[redacted]

Case No.

1557

Application, Transcript,
Small Exhibits, Etc.

CASE 1557: Hearing January 14, 1959
Cities Service Oil Co. application for hearing de novo for oil-oil dual of State "P" #3 Well.

LIFT COST COMPARISON DUALS VERSUS SINGLES

	No. Wells In Group	Depth Wells	Age Wells	Avg. Mo. Bbls. Fluid	Avg. Mo. Gross Oil	Avg. Mo. Expenses	Lift Cost/ Bbl. Fluid	Lift Cost/ Bbl. Oil
Group I	9	4200 to 6200	6-19 months	15,767	14,243	$ 627.00	4.0	4.4
Group II	7	4200 to 6200	6-19 months	13,009	9,975	821.00	6.3	8.2
Group III	9	4200 to 4800	17-148 months	8,429	7,899	956.00	11.4	12.2

Group I — Both zones flowing - equipped for dual zone pumps

Group II — Both zones pumping with dual zone equipment

Group III — Single zone pumping

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WESTERN UNION
TELEGRAM

W. P. MARSHALL, PRESIDENT

1220 (R 11-54)

SYMBOLS
DL = Day Letter
NL = Night Letter
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The filing time shown in the date line on domestic telegrams is STANDARD TIME at point of origin. Time of receipt is STANDARD TIME at point of destination.

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=OIL CONSERVATION COMMISSION, MABRY HALL,
STATE CAPITOL= SANTA FE NMEX=

:RE APPLICATION OF CITIES SERVICE OIL COMPANY TO DUALLY COMPLETE ITS STATE "P" NO. 3 WELL, BY THE INSTALLATION OF DUAL ZONE PUMP EQUIPMENT, TERRY BLINEBRY OIL POOL AND AN UNDESIGNATED OIL POOL IN THE GLORIETA SAND, LEA COUNTY, NEW MEXICO. / CASE NO. 1557/ MAGNOLIA PETROLEUM COMPANY AS AN OPERATOR IN THE TERRY BLINEBRY FIELD, HEREBY SUPPORTS CITIES SERVICE OIL COMPANY IN ITS APPLICATION FOR PERMIT TO INSTALL DUAL ZONE PUMPING EQUIPMENT TO EFFECT A DUAL COMPLETION OF ITS STATE "P" NO. 3 WELL BETWEEN THE TERRY BLINEBRY OIL POOL AND AN UNDESIGNATED GLORIETA OIL POOL, LEA COUNTY, NEW MEXICO

D V CARTER MAG PET CO==

"P" 3 1557 "P" 3=

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WESTERN UNION
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NEW MEXICO OIL CONSERVATION COMMISSION=

ATTN A L PORTER JR SANTA FE NMEX=

IN RE REHEARING JANUARY 14, 1959 ON CASE 1557 APPLICATION OF CITIES SERVICE OIL COMPANY FOR PERMIT TO OPERATE A TWO ZONE PUMP ON SINGLE ROD STRING WITH CROSSOVER EQUIPMENT AND TWO PARALLEL TUBING STRINGS AT ITS STATE "P" WELL NO. 3 IN THE BLINEBRY AND GLORIETA POOLS. THIS TYPE INSTALLATION HAS BEEN USED BY PHILLIPS PETROLEUM COMPANY ON MORE THAN TEN WELLS IN TEXAS, OKLAHOMA AND KANSAS FOR EIGHT YEARS AND IS GIVING SATISFACTORY SERVICE. THIS OPERATION CREATES NO MORE DANGER OF COMMINGLING BETWEEN ZONES THAN WITH TWO ZONES FLOWING OR WITH TWO PUMPING UNITS. INDUSTRY INGENUITY IN DEVELOPING THIS COST-SAVING DEVICE SHOULD NOT BE THWARTED. PHILLIPS PETROLEUM COMPANY URGES THAT THE COMMISSION RECONSIDER ITS DECISION AND APPROVE THIS INSTALLATION=

PHILLIPS PETRO CO L E FITZJARRALD==

14 1959 1557 P 3=.

THE COMPANY WILL APPRECIATE SUGGESTIONS FROM ITS PATRONS CONCERNING ITS SERVICE

BEFORE THE
OIL CONSERVATION COMMISSION
SANTA FE, NEW MEXICO

IN THE MATTER OF:

Case No. 1557

TRANSCRIPT OF HEARING

JANUARY 14, 1959

DEARNLEY - MEIER & ASSOCIATES
GENERAL LAW REPORTERS
ALBUQUERQUE, NEW MEXICO
Phone CHapel 3-6691

BEFORE THE
OIL CONSERVATION COMMISSION
SANTA FE, NEW MEXICO

IN THE MATTER OF:

Case 1557 Application of Cities Service Oil Company for a hearing de novo before the Commission on its application for a dual completion. Applicant, in the above-styled cause, seeks an order authorizing it to dually complete its State "P" No. 3 Well located 990 feet from the South and West lines of Section 32, Township 22 South, Range 38 East, Lea County, New Mexico, in such a manner as to permit the production of oil from the Blinebry Oil Pool and from an undesignated Glorieta oil pool through parallel strings of tubing.

Mabry Hall
Santa Fe, New Mexico
January 14, 1959

BEFORE:

A. L. Porter
Murray Morgan
John Burroughs

TRANSCRIPT OF HEARING

MR. PORTER: The meeting will come to order, please. We will take up Case 1557.

MR. PAYNE: Case 1557, "Application of Cities Service Oil Company for a hearing de novo before the Commission on its application for a dual completion."

MR. KELLAHIN: If the Commission please, Jason Kellahin of Kellahin and Fox, Santa Fe, New Mexico, appearing on behalf of the applicant, Cities Service Oil Company.

Prior to opening our case, I would like to briefly state

that this case is before the Commission as a hearing De Novo under the proper statute providing for such hearings having previously been heard before the Commission's examiner.

The application in this case is simply stated, an application for a dual completion, which in most of its elements is a routine application similar to those which have heretofore been approved by the Commission, the difference in this case being simply that it is proposed in this installation to pump two separate horizons with a single string of rods on a pumping unit. That is simply the difference in this and other applications which have been approved by the Commission.

Now, in making this type of installation, it is necessary to use a slightly different type of equipment, which we will display to the Commission at some length, the Commission willing. In the presentation of our testimony, we propose to show to the Commission that this type of completion is as practical as two pumping units actuated by two rods through two strings of tubing, but has numerous advantages over the conventional type of installation and it will protect the two separate producing horizons completely and adequately to meet the requirements which may be set by the Commission. That is what we hope to show by our testimony and we will have three witnesses, Mr. Galian, Mr. St. John and Mr. Motter.

MR. PORTER: Mr. Kellahin, we will have the witnesses sworn in a moment; in the meantime, I will ask if there are other

appearances in the case? Anyone else desire to make an appearance in Case 1557?

We have some telegram communications from other operators which will be read and entered into the record.

Will the witnesses stand and be sworn?

(Witnesses sworn in).

MR. KELLAHIN: We will call as our first witness, Mr. Motter.

E. F. MOTTER

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

DIRECT EXAMINATION

BY MR. KELLAHIN:

Q Will you state your name, please?

A E. F. Motter.

Q By whom are you employed, Mr. Motter?

A Cities Service Oil Company.

Q Mr. Motter, have you ever testified before this Commission as an expert engineer and have your qualifications been accepted?

A Not before this Commission; I have appeared many times before the examiners.

MR. KELLAHIN: Does the Commission wish to have the witness qualified?

MR. PORTER: Just one moment, Mr. Kellahin. The witness'

qualifications are accepted.

MR. KELLAHIN: Perhaps you didn't hear the question, Mr. Porter. The witness has never testified before the Commission, only before the examiners. Now, if you wish that he qualify --

MR. PORTER: It won't be necessary, his qualifications are a matter of record, unless someone cares to questions the witness' qualifications.

Q (By Mr. Kellahin) Mr. Motter, in what position are you employed?

A Assistant Division Engineer, Hobbs, New Mexico.

Q Are you familiar with the application in this case?

A Yes sir, I filed the application.

Q Is the area involved within your division?

A Yes, sir.

Q The division under which you have supervision?

A It is.

Q Now, briefly state what is proposed by this application?

A We propose to dually complete our State "P" Number 3 Well, which is in the Blinebry Pool and an undesignated pool with production from the Glorieta by means of two strings of tubing with two pumps actuated on one rod string by one pumping unit.

Q Have you prepared a plat showing the area involved in this application?

A Yes sir, I have.

MR. KELLAHIN: Will you mark that as Exhibit Number One, please?

A We have some exhibits up over here and I plan to make some marks on them, so maybe we ought to use these.

(Whereupon, the document was marked as Exhibit Number One for identification).

Q (By Mr. Kellahin) Referring to what has been marked as Exhibit Number One, will you state what that is designed to show?

A Yes sir, this is a map of the area surrounding our State "P" Lease. The lease itself is marked in yellow, the subject well is the State "P" Number 3, which I will circle in red, and is located 990 feet from the south, 990 from the west line, Section 32, 22, 38, Lea County, New Mexico. This well has been completed in the--I should say is now in the Glorieta formation. I would like to give some of the producing characteristics of some of the wells around this well. The Pan American State "T" Number 2, which is the direct east offset, is a Glorieta producer. The most recent test on that well was in August of 1958. That well produced 58.6 barrels of oil, 30 barrels of water, GOR was 350 to 1 with a gravity of 36 degrees. The Gulf Andrews Number 3 is completed in the Glorieta. It is located 1980 from the south line and 1980 from the east line of Section 32, Range 38 East, Township 22 South. That well, on a test--the most recent test on this well produced 43 oil, 4/10 barrels of water --

Q 43 oil, what do you mean by that?

A 43 barrels of oil, 4/10 barrels of water in six hours through a 15/64 choke. That well is producing top allowable, gravity of that oil os 36 degrees. The Blinebry production is from our State "P" Number 2, which is located 1980 from the south line, 660 from the west line of Section 32. One of the most recent tests on that well produced 31 barrels of oil and 6 barrels of water in 24 hours on a pump. The GOR was 3795 to 1, the gravity is 40 degrees and 60 degrees. Pan American's State "S" Number 3, which is located 1980 from the north line, 660 from the west line of Section 32, is currently flowing from the Blinebry with an extremely high GOR, 15,713 to 1. It has a penalized allowable and the gravity on that well was 39 degrees. I would like to pount out that the GOR limit in the Blinebry pool is 6,000 to 1. The State "P" 3 Well, as I previously stated, has been completed since our previous hearing. We have 7-inch casing set at 59--pardon me--5809, it was cemented with 100 sacks of cement and one-third cubic feet of stratocreate per cubic foot. The cement--the top of the cement was at the surface at 3695. The Blinebry was perforated at intervals from 5763 to 65, 5772 to 76, 5648 to 61, 5666 to 74 and these zones were acidized, and this zone was swabbed at a rate of 45.6 barrels of oil per day. We set a Baker Model "D" production packer at 5600 feet and we are now producing from the Glorieta. The perforations of that zone are 5187 to 92, 5168 to 71. 24-hour potention on this zone was

360 barrels of oil and 6 barrels of water in 24 hours through a 20/64 choke with a flowing tubing pressure of 75 pounds. GOR is 280 to 1 and the gravity is 33.4 API. It is now producing top allowable, 46 barrels per day.

Q Are we to understand then that the Glorieta is presently flowing in that well?

A Yes, sir. We do not believe that it will flow for any length of time.

Q Is that the reason for this application then, to pump that zone as well as the Blinebry?

A Yes sir, it is. We have reason to believe that we will perhaps increase the water production in the Glorieta zone, which will necessitate pumping equipment.

Q Mr. Motter --

MR. PORTER: Mr. Motter, pardon me just a minute. What did you say the gravity was, the gravity of the Blinebry oil was?

A Mr. Porter, I don't believe I gave you the gravity of the Blinebry production in our well because we tested that for only a short interval and it was acidized water. We do have the gravity of two offset wells, which was 40 and 39.

MR. PORTER: Thank you.

Q (By Mr. Kellahin) In connection with that gravity, Mr. Motter, I believe in the previous hearing in this case, you testified that the difference in the gravities between the two zones of the Glorieta and the Blinebry was approximately two

degrees, is that correct?

A That's what we expected from production of offset wells. Now that we have tested and produced the Glorieta for some time, we found that the gravity is 33.4, so apparently there would be a considerable difference in the surface gravities of the two zones.

Q Approximately 6 degrees then?

A That's correct.

Q Now, in your opinion, is that a sufficient difference in the gravities that would enable you to detect the commingling of the fluids, in the event such an event occurred?

A It certainly is.

Q How would that show up?

A Well, in the first place, any tanks that are run are gauged in by the pipe line for gravities run on them, which we get a record of. Our own switchers take gravity tests periodically, and in the case of dually completed wells, more often than in single completed wells, so any leakage would show up at the surface as a matter of change in gravity of fluid.

Q Now, are you familiar with the lease ownership in the areas involved in this case?

A Yes, sir.

Q Is the lease ownership common?

A Yes, it is.

Q And is the royalty ownership common?

A It is.

Q Now, Mr. Motter, you have prepared a schematic diagram of the proposed completion?

A Yes sir, I have.

MR. KELLAHIN: Will you mark that as Exhibit Number Two?

(Whereupon, the document was marked as Exhibit Number Two for identification).

Q (By Mr. Kellahin) Referring to what has been marked as Exhibit Number Two, will you describe the operation of that completion?

A Yes sir, I will explain the schematic diagram. We have a Baker Model "DA"--I believe I testified before that it was a Model "D"--"DA" Packer set at 5600 feet. We propose to run two-inch tubing with the crossover assembly set at approximately 5500 feet in this well. A second string of tubing will be set in the cross over assembly. We will then run two rods on a single rod string in the long string of tubing, this will be actuated with a single pumping unit. Production in this setup from the bottom zone enters the perforated production tubing. The production is picked up by the lower zone pump, pumped to the crossover assembly and crossed over to the short string of tubing and from there to the surface and into the tankage. The upper zone production enters the crossover assembly, is picked up by the upper pump, pumped from there to the surface and into tankage. We have a gas vent line around the bottom pump to prevent that

pump from gas locking. I would like to point out that we have a standing valve in our tubing below the bottom pump and also a standing valve below the upper pump. Those valves are placed so that if the two pumps are pulled from the well for any type of workover, that there will not be any communication of fluid between the two producing zones. While those pumps are out of the hole, the only fluid that can enter is if the bottom zone would happen to have a higher pressure than the upper zone, then the tubing will fill up to the point where the upper standing valve would check the fluid and stop it from entry into that zone and vice versa, if the upper zone has a higher pressure, it can only enter and fill some one hundred feet of tubing and then it will be checked by the lower standing valve.

Q Then all the production from the well would be through tubing, is that correct?

A That's correct.

Q Now, have you had any personal experience with this type of installation before, Mr. Motter?

A Yes sir, we have some of this type of production equipment installed in Texas. Our Odessa Division has quite a few of these, similar installations that are being quite successful.

Q On the basis of your experience, have you found it possible to do any necessary workovers or treat the separate horizons as may be required through this type of installation?

A Well, this is just about as simple to treat as any other single completion. The upper zone, of course, can be treated down the annulus; however, to acidize it or kill it or anything, to treat it in the bottom zone, it would be necessary to pull the rods--excuse me, the pumps and rods from the hole and treat down the long string and treat through the long string.

Q That would be no different than any other type of dual completion, would it?

A No sir, it's actually a little simpler because we could, if necessary, and we anticipated a higher pressure in treating the lower zone, we could merely pull the short string in the crossover assembly and treat down the string of tubing, which would give us somewhat less pressure on the casing head, which in a pumping installation is normally a low pressure head. This way we would get a somewhat higher pressure through the string of tubing and when we got through treating below, we would merely reset the stinger in the crossover assembly and we would go back to production.

Q Now, with this type of installation, will it be possible for you to keep track of the production from the two separate horizons?

A Yes, they will be tanked and gauged separately.

Q Now, with the single pumping unit, how would you control production should one zone or the other become over-produced?

A Well, there are four means of controlling production with this type of installation. The first one and the most practical means is by sizing the two pumps. We know approximately what our allowables will be and we will size those pumps so as to produce that production. In case one zone would get ahead of the other and it would be necessary to shut in or stop production from the zone that is ahead of the other, there are numerous ways we can do that. If the upper zone has been produced, its allowable has been produced, then we would merely cycle the oil from the flow stream back into the casing of the upper zone and this would not allow any production from the upper zone to be tanked. Another means of doing this is by means of a traveling overload valve, which means loading the traveling valve in the pumps so that if production on one zone exceeds the other, we close the valve and by pressuring up the fluid in that particular tubing string, this spring-loaded valve will be overcome and fluid by-passed so that no fluid is pumped with that pump. One other means of controlling fluid production is in case the bottom zone has produced its allowable before the upper zone, we will space the two pumps in such a manner that the bottom pump will unseat before the upper pump, therefore we can go out there and we can go and pick up the bottom pump some fifteen feet and it will not pump because it is not seated in the tubing.

Q Now, you mentioned some water production in connection with your discussion of the wells in this area. What type of

water is found in this area?

A Well, Actually, we don't have too much information right in this area. I do believe that we will get some water production but we do not anticipate an active water drive. If there were an active water drive, I believe these zones would flow much longer than I have shown.

Q Is the water production from the Glorieta and the Blinebry comparable?

A In volume?

Q In volume, yes.

A Well, these tests indicate that perhaps the Glorieta would produce a little bit more water than the Blinebry.

Q But in your opinion, this is not water-drive water?

A I don't think it would be an active water drive, no sir. I don't think we will have any abnormal volumes of fluid.

Q Well, getting to this point, Mr. Motter, would there have to be a portion of this fluid lifted from the two separate zones in the operation of this type of installation in order to reach the allowable assigned to each zone?

A Yes sir, I believe there would be.

Q So your problem in controlling the production from one zone or the other would be minimized?

A Yes, sir.

Q Now, in discussing Exhibit Number Two, you mentioned some of the safety factors which were designed to prevent the

commingling of fluids. Did you cover all of those, Mr.Motter?

A I believe I have covered most of them. I believe our other two witnesses will be able to go over that in more detail, the means of preventing commingling. I might point out at this time that we believe this type of installation is more safe in a case of rod failure where it becomes a necessity to fish in the well. If we had rods in both zones and one rod string broke and maybe hit the lower tubing on one particular string and parted it we would have some difficulties in fishing those rods and tubing out of the hole. By means of this type of arrangement, in case our rods parted or anything, we could pull the string of tubing which has no rods and then very easily go over the other tubing string and pull it from the hole through the crossover assembly.

Q Now, have you made any study of a completion of this type of installation as compared to other types?

A Yes sir, I have, on this type of installation.

MR. KELLAHIN: Would you mark that as Exhibit Number Three, please?

(Whereupon, the document was marked as Exhibit Number Three for identification).

A Exhibit Number Three is the economics of a two-zone pump versus two pumps with individual pumping units. I have these broken down, I don't believe it will be necessary to run all the way through it, but by using only one pumping unit, we can realize a savings of $13,533.00 on this particular installation.

Q Mr. Motter, would that have any significance in the ultimate recovery of oil from either or both of the zones?

A Yes, it would mean that we would probably pay for the well much sooner and could probably produce a well longer to get more oil from the zones.

Q In the operation of the unit, would that have any significance on the ultimate savings?

(Whereupon, the document was marked for identification as Exhibit Number Four).

A Yes sir, we have prepared Exhibit Number Four, which shows some economics of pumping with two-zone pumps as compared to two single zone pumping units. I would like to point out that I have these wells in groups. Group one and group two are wells producing from 4200 to 6200. All these wells are in the Odessa production area. All the wells, upon completion, have been equipped with crossover equipment identical to what we propose. When these wells cease to flow, it is merely a small matter of running the single rod string with two pumps in the well to continue to produce the wells. These wells vary in age from 6 to 19 months in group one and are wells that are equipped for dual zone pumping but both zones are still flowing. I would like to point out that the lift cost on these wells is four cents per barrel of fluid or 4.4 cents per barrel of oil. On the wells where it has been necessary to go ahead and complete with artificial lift equipment, the same production zones, the same

age wells, this cost has been increased for each barrel of fluid to 6.3 cents, for each barrel of oil, 8.2 cents with the selected --

Q On that group two, is that referring to the group in which both zones are pumping with dual zone equipment?

A Identical to this, yes sir.

Q Identical to this?

A We have selected some wells that were single completed to compare to these wells and I might state that the reason for selecting these group three wells, which there were nine of them, at no time did we have to pull the rods and tubing from any of these wells that are using dual zone pumping equipment in group two, so we selected these wells that had no pulling expense during a two-year period, or approximately eighteen-month period to use as a comparison. Some of these wells are several years old, but they are--in general, most of them, I think, with the exception of two, they are all producing top allowable and very little water. I might also point out that the average figures that we used in this case for group one and group two are average figures for the entire life of the well. Since some of the wells in group three have a much longer life, we used only one year as an average. I would like to point out that these are single completions and since we do not have as much fluid as on the duals and the lift cost was 11.4 per barrel of fluid and 12.2 per barrel of oil lifted.

I believe that this shows that we can safely predict that

we can deplete a reservoir much further with dual zone equipment on a dually completed well because of lower costs. I admit that as production declines, these costs will go up but they will not advance on a dually completed well using dual zone equipment fast enough but what we can deplete the reservoir further. I would like to try to make that a little more plainer. In other words, if we had reached a decline stage to where one zone was only pumping, say one barrel of oil per day, which in a normal single zone completion we would have to abandon it, if the other zone in a dually equipped well for dual pumping was producing as much as five or six barrels a day where it would still be economical, that one barrel a day would be getting a free ride and we would actually be able to deplete the reservoir that much further. I have made some estimates, or tried to, on several different formations, and I believe that in these cases, we can deplete the reservoir several thousand barrels further with this type of equipment on dual units than we could if we had single pumping units on each well.

Q Is it your opinion that it would be in the interests of conservation and prevention of waste?

A Yes, it certainly is.

Q Now, have you any method worked out whereby you can determine whether packer leakage is occurring?

A Yes sir, I wouldn't say that we can determine specifically if there is packer leakage, but we feel that we can

determine whether there is any leakage in any of the equipment. To show whether the packer is leaking or any other type of cross-over --

Q You are referring to a diagram.

MR. KELLAHIN: Would you mark that as Exhibit Number Five, please?

(Whereupon, the document was marked as Exhibit Number Five for identification).

A The diagram, Exhibit Number Five, shows a means of determining fluid levels. In other words, we all know that we have a leak in this equipment, we shut the well down for any time and the fluid level would all tend to seek the same level. We can run a bomb in the tubing string that does not have rods in it to determine that fluid level; we can use an acoustic well sounder to determine the fluid level in the upper zone. This is one means of checking the whole installation for any type of leaks. Of course, if we run bottomhole pressure to determine whether there is any pressure across the packer, we will pull the two rods on a single rod string, pull the bottom standing valve, run a bottomhole pressure on the bottom zone, and we will run a PSI straight through to where this packoff assembly is in place and run a bomb down to check the bottom pressure. The pressure, the upper pressure, we can run through a straight PSI tool and run a PSI to the bottom above and we can check the pressure on the upper zone. I might point out that the way we have

this particular well set up that we can run our bomb within one hundred feet from the perforations on these entire intervals, which I do not think is enough difference that we can safely extract fluid and accurately determine pressure on either side of the packer.

Q In your opinion, then the pressures can accurately be determined on each side of the packer?

A Yes, sir.

Q And would that reflect whether packer leakage was occurring or not?

A That's correct.

Q Now, have you compared this type of installation with similar installations which have been approved by this Commission?

A Yes, I have read of the approvals by this Commission. I think in New Mexico there have been approximately fifty wells dually--have been authorized for dualling. I don't have the exact figure, but I think it's in the twenties, of the wells that have actually been dualled. Many of these wells have been dualled where a zone is depleted or not currently shown on the allowable schedule, but one zone is producing. I have found eight wells where one zone is being artificially lifted and I know of two installations where there are two pumping units lifting fluid from two separate zones.

Q Have you made a schematic diagram comparing different types of completions with this completion?

A Yes sir, that will be Exhibit Number Six.

(Whereupon, the document was marked as Exhibit Number Six for identification).

Q (By Mr. Kellahin) Referring to what has been marked as Exhibit Number Six, would you discuss that?

A Exhibit Number Six shows two types of assemblies that are now in common use in New Mexico, gas gas duals or gas over oil duals. These are known as the Otis Sidebar and the Garrett Sliding Shelf. I prepared this exhibit to show that the same type of packing element is used in the Oilmaster crossover assembly as is in use in this other sidedoor assembly, the only difference we have is the packing that is around the polish rod that travels through the crossover packing assembly. That is the only difference that we can see where there is possible chance for leakage other than what has been discussed previously. I might point out--I said the only other, the stinger that is used in the other zone has identical packing to what is used in this type of equipment that we propose.

Q Now, you referred to the polish rod. That element through which it runs, I believe in the previous case you referred to it as a stuffing box. Would you discuss that?

A Yes sir, I have been corrected by some of the people that make this equipment that I have erroneously referred to it as a stuffing box, that is the lower seal assembly. And I would like to point out for the members of the Commission that both of

these drawings are exagerrated drawings. This was done for means of simplicity in showing the equipment. In actual use, we would not find the sharp bend in this tubing below the crossover assembly like I show it in both of these diagrams. I think that that can be shown by the models which we have and I believe one of the other gentlemen will discuss that.

Q Now, in regard to this definition you have given to what we normally call the stuffing box, is that in any sense a stuffing box in the sense that that term is used on surface pumping equipment?

A No sir, it is not.

Q Is the construction comparable to that type of a box?

A No sir, it is much finer manufacturing. The specifications are much closer in tolerance than stuffing boxes that we normally refer to at the surface. These stuffing boxes that we normally refer to at the surface are adjusted by means of tightening the packing to prevent leakage of oil. There is no such thing in this type of a crossover assembly. This can be done by two different means, by the use of Chevron Tevlon packing, or by a straight metal to metal seal. I would like to show that we have means of testing the packing in this crossover assembly. I will draw some --

Q You are referring again to Exhibit Number Five?

A Exhibit Number Five, if we want to test this packover-- crossover assembly packing at the surface, we can put a pressure

gauge in either zone and close the valve in the flow line. If this packing element is not leaking, this pressure gauge should build up immediately. If we do not get a buildup in pressure at the pressure gauge, then we check for production from the other zone into the tankage and if we do not get an increase in production, we will assume then that we either have a standing valve or a traveling valve in the lower pump leaking and it will then be necessary to pull it from the well, which is common with any type of pumping equipment, it happens quite often. In the same manner, we can get the flow line of the upper string, put a pressure gauge, close the valve and pressure this zone up. And if we get no pressure immediately, we know that we should get a pressure increase, and say we got an increase in production from our bottom zone, then we would probably believe, and safely believe, that we have a leak in our crossover assembly.

Q What action would be taken?

A Well, in that case, the two pumps, of course, would be pulled from the well, the crossover assembly would be repacked and run back in the well. I might point out, while we are talking about that, that any normal pumping installation is going to have pump trouble and will be pulled from the well periodically, I think it averages somewhere between twelve and eighteen months to pull a pump from a well. Each time that those rod strings are pulled from the well, this packing assembly comes out and is inspected. Should we find any sign of wear or damage to the

packing in this assembly, it will be immediately replaced and run back in the well with any other necessary repairs that need to be made to the pumps.

Q Now, if it becomes necessary to do that, then you don't use the production from both zones during that period of time, is that correct?

A Yes sir, that's correct.

Q How does that compare to conventional dual completions with both zones pumping through two pumping units?

A Well, if the pumps need to be pulled on a situation such as you described, one zone can continue to pump for perhaps some short period, until a pulling unit was moved to location, then it would have to be shut down while the other zone was repaired and after the repairs, both zones could be put back to pumping.

Q So in that sense, there is very minor difference between the two types of completions?

A Yes sir, as I say, upon finding any leaks, it would be a matter of just maybe--whatever it takes to get a pulling unit to the location.

Q Now, are you familiar with the installation of dual zone pumping units of this type in other States?

A Yes sir, I have prepared an exhibit to show the installations in other States.

MR. KELLAHIN: Would you mark that as Exhibit Number

peaking in this assembly, it will be immediately replaced and
sent back in the mail with all other necessary reports that need
to be made to the pump.

Now, it is necessary, is it not, that when you
don't use the production from both zones during that period of
time, is that correct?

A Yes sir, that's

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Seven, please?

(Whereupon, the document was marked as Exhibit Number Seven for identification).

Q (By Mr. Kellahin) Referring to Exhibit Number Seven, would you state briefly what that is designed to show?

A Exhibit Number Seven indicates the number of installations, of dual zone pumping installations, made in the year 1957 and until September 1st, 1958. This does not necessarily mean that both pumps are actuated in the well, this means that dual zone equipment was run in the wells in preparation for dual zone pumping. The wells may still be flowing, we don't have any record on those. In Alabama there was one in 1957, none in '58; in Kansas in '57 there were four installations, 3 in '58; in Louisiana, three in '57, none in '58; in Mississippi, three in '57, two in '58; in Oklahoma, 27 in '57, 14 in '58, and in Texas, 110 in '57 and 137 in 1958.

Prior to January, 1957, there were between seven and eight hundred dual zone pumping equipment manufactured but we do not know if all of that is still in use. Prior to 1957, there were probably five hundred of those still in use, so that means that today we probably have somewhere in the neighborhood of eight or nine hundred installations in use. In addition, dual zone pumps are operating in foreign countries such as Canada, Columbia, Venezuela and Germany.

Q Mr. Motter, on the basis of your experience and your examination of this type of equipment, is this a practical means

o" completing a well?

A Yes, it is. There may be a few technicalities above a single completed well, or I should say a dually completed well with two single pumps and separate rod strings, but considering the whole, I see no additional trouble that we may have over some of the other installations.

Q Does it afford adequate protection, in your opinion, to the two producing horizons in regard to the danger of communication?

A Yes. As I have pointed out previously, I see no possible means for communication that we cannot check at the surface and which we cannot evidence immediately, and also we think we have installed enough safety devices by the use of the standing valves that will not allow commingling of fluid should there be a leak in the crossover assembly.

Q Does this type of installation permit you to make all the required tests and such other tests as may be required by this Commission to determine if there is packer leakage or to see if communication has occurred?

A I would say that we can make more tests than can be made in a dually completed well involving two rod strings and two strings of tubing.

Q You can make more tests?

A Yes, sir.

Q Now, the Commission in the previous hearing and an order

issued thereon, made a finding 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. Assuming that that finding is based upon a comparison to a conventional dual completion that has two pumping units, and without taking issue with the Commission's finding, have you any comment on that finding?

A Yes, I do not--well, I do not believe that there are any abnormal chances of commingling between the two zones as long as we have the two standing valves which I pointed out on both Exhibit Two and Exhibit Five in place. I do not believe there is any chance of commingling, any abnormal chance of commingling, I'll put it that way.

Q Now, is this type of completion as practical as two pumping units actuated through two strings of tubing, in your opinion?

A Yes, and it's much more economical.

Q You referred to the tests which could be made with this type of completion. Are you willing to make any and all tests which may be required by this Commission?

A Yes, we will be willing to make any type of tests so designated by the Commission. I see no reason why we wouldn't.

Q Mr. Motter, in view of the fact that the Commission, as a result of the hearing before, the Commission examiner determined that in their opinion, there--or the opinion of the examiner,

there would be some danger of communication, would your company be willing to accept an order approving this unit for a temporary period of time and make tests that may be required by the Commission and present the results of those tests to the Commission, either at a hearing or to the Commission staff?

A Yes, I believe we would. I might point that as far as our company goes, we are sold on the equipment. We have enough installed in other areas where we think it's pretty satisfactory, but we have none in operation in New Mexico at this time. We would be happy to go along with a, say three to six month test period if they so desire to properly evaluate this type of equipment.

Q Now, Mr. Motter, were Exhibits One through Seven inclusive prepared by you or under your direction or supervision?

A Yes, they were.

MR. KELLAHIN: At this time, we would like to offer in evidence Exhibits One through Seven.

MR. PORTER: Without objection, the exhibits will be admitted.

Q (By Mr. Kellahin) Do you have anything else to offer, Mr. Motter?

A Yes, in the previous hearing I read some exerpts from the proceedings of the Fifth Annual West Texas Oil Lifting Course, Texas Tech College, Lubbock, Texas, which was held April 17th and 18th. I again would like to refer to an article that was written

by Mr. W. W. Whitaker and H. P. Lieb, Gulf Oil Corporation. The title of that article is Dual Zone Pumping with Two Rods Actuated by One Rod String. In their discussion and conclusions, they state, and I'll quote, "Our experience with Tandem pumps indicates that as a general rule, this equipment will give satisfactory service. The newer design should limit or minimize some objectionable features of earlier models. Most dual zone pumping equipment problems have occurred during installation and immediately thereafter."

Some of the advantages and disadvantages which they give, the advantages are, and again I quote, "Number one, smaller initial cost in comparison with other methods. Number two, compactibility in casing design in most wells. Number three, limitation of upkeep of two pumping units. The disadvantages are, number one, lack of simplicity as compared to other methods. Number two, inability of equipment to handle suspended sand as well as other methods. Number three, loss of production from both zones due to surfacing of downhole equipment for one zone. Number four, pumping depth and quantity of production limited by the strength of rods. Number five, lack of flexibility."

Q Now, on their list of disadvantages, do they list the danger of--increased danger of communication?

A No sir, they do not, and I also have some objections to their disadvantages.

Q I will ask you then if you have any comment on the

disadvantages which they do list there, insofar as they apply to this well?

A Yes sir, I have. Taking the disadvantages in order, number one, lack of simplicity, and I will grant that there is perhaps a little more equipment which could fail in this type of installation. Number two, inability of equipment to handle suspended sand. I can see no reason why this type of equipment can't handle it and we have found in other areas no objectionable properties of the equipment to handle suspended sand over conventional single zone pumping units.

Q In this area, have you encountered any problem of suspended sand?

A No sir, we have no fracing in this area, which is normally where suspended sand comes from. Loss of production from both zones while servicing downhole equipment, well, we just went over that a few minutes ago. I don't feel that the loss of time would be any more than the length of time from which the failure occurred that it took us to get a pulling unit to the location to correct any trouble were having. Number four, they have as a disadvantage, pumping depth and quantity of production. We have a record of one installation such as this that the bottom pump is pumping from 12,300 feet. I don't believe that the pumping depth would be objectionable when we can pump from that depth with this type of equipment.

Q What is the maximum depth that you are pumping from in this

well?

A Approximately 5600 feet.

Q Does this type of installation have any advantages over two long strings of tubing installed in five and a half inch casing?

A Yes sir, it certainly has. When we use five and a half inch casing, we are limited on the size of two strings of tubing that normally are used. I think the biggest tubing that can be used is 2 1/16 inch Hydrill and that is quite costly, and we are limited by the size of pumps which we can use on the 2 1/16 inch Hydrill. Even though this can be run in five and a half inch casing, it's a very close tolerance and in case of failure of equipment, we would have trouble in fishing any failed equipment from the hole.

Q Do you know whether that type of installation has been approved by the Commission in New Mexico?

A Not with dual zone pumping equipment. I know of some installations where they have approved 2 1/16 inch tubing to be used where one zone is being artificially lifted. This, of course, is in case of five and a half inch casing.

MR. KELLAHIN: That's all the questions we have, sir.

MR. PORTER: Did you offer your exhibits, sir?

MR. KELLAHIN: Yes sir, I did.

MR. PORTER: Thank you. Mr. Motter, one question. In your experience with this type of installation, would you say

there is greater or less danger of communication than there would be using the installation which has been allowed by the Commission or any of the installations?

A Mr. Porter, I would like to ask you, do you mean communication between zones or communication between produced fluid?

MR. PORTER: Between the zones.

A No sir, I don't.

MR. PORTER: That's what I had in mind. And you say that you would expect to produce each zone to a greater ultimate completion?

A Yes, sir.

MR. PORTER: Because of the difference in cost?

A Yes, sir.

MR. PORTER: Anyone else have a question of the witness?

MR. FISCHER: Yes, sir.

MR. PORTER: Mr. Fischer?

MR. FISCHER: Mr. Motter, would you please go over again your method of treating, what you have to go through to treat your bottom zone, the Blinebry?

A I will refer to Exhibit Five, it's a larger exhibit. If we want to treat the bottom zone, it will be necessary to pull the rod string and the two pumps from the well, retrieve the standing valve with wire line equipment and then treat the well. We have a standing valve on the well and we have PSI straight

through tubing so that we could pump from the Blinebry formation without any fluid entering into the upper zone.

Q Your PSI tubing would set where?

A It would set in the same interval that the crossover packoff assembly sets.

MR. FISCHER: On your Exhibit Number Five, the vent tubing --

A Yes, sir.

MR. FISCHER: Coming in your packer, the bottom zone, the ball there in your vent tubing, does it set in an upright position?

A No sir, it sets down by gravity. It's merely a standard standing valve inside of one-inch tubing.

MR. FISCHER: It does not set, it goes up, it won't shut off against flow through that tubing, into your tubing, is that right?

A No sir, it's built like any standard standing valve.

MR. FISCHER: That's all, thank you.

MR. PORTER: Mr. Payne?

MR. PAYNE: Mr. Motter, is this relatively new equipment?

A This equipment was manufactured first in 1947. It has been in use since that time.

MR. PAYNE: Well now, in view of the fact that you achieve a considerable saving, according to your testimony, by the installation of these dual zone pumps, to what do you attribute the fact that the installation of this type pump has decreased

in 1958 as opposed to 1957 in every State except Texas?

A Mr. Payne, I can point out a couple of reasons. First thing, 1958 was only eight months, I believe it's eight months, it's up to the 1st of September, it is not a full year. And one definite reason for the decrease in Oklahoma is because they are allowing them to commingle fluid and assign one allowable to wells up there, which is probably the reason for the decrease in Oklahoma. For the other States, it's just a matter of a decrease of one or two wells, I don't know for what reason.

MR. PAYNE: Now, to the best of your knowledge, Louisiana, the Louisiana Commission has not entered any order denying the use of this dual zone pump.

A No sir, I don't know of any.

MR. PAYNE: Thank you, that's all.

MR. PORTER: Mr. Fischer?

MR. FISCHER: Mr. Motter, which one of these zones, if either or both should go to water totally, which one do you think would go first?

A I would say the Glorieta, because referring to Exhibit Number One, the Glorieta was tested in the Gulf Scarborough Number 3, which is located 1980 from the south line and 660 from the east line in Section 31, and it tested at a hundred per cent water in the Glorieta.

MR. FISCHER: If it went to--your upper zone, which is the Glorieta, if it went to a hundred per cent water, would you then,

I assume, change your whole installation, is that correct?

A We would just use the single pumping installation.

MR. FISCHER: Thank you.

MR. PORTER: Mr. Nutter?

CROSS EXAMINATION

BY MR. NUTTER:

Q Mr. Motter, on your Exhibit Number One, you gave some of the test data on certain of these wells. Did you give the test date for Gulf's Number 3 "P" in Section 32?

A The test date that I have is the potential on January 12, 1958. At that time, it produced 43 oil, 4/10 barrel of water in six hours, which would give a 24-hour potential of somewhere in the neighborhood of 160 barrels. The last time I checked with Gulf, the well was flowing top allowable. The pressure has dropped somewhat, the ratio has declined from 430 at the time of the potential to 212 to 1 in November.

Q Now, Pan American State "T" Number 2 had a GOR of 350 to 1 in August, is that correct?

A That's right.

Q Did you give the GOR on your Glorieta formation in your Number 3 Well?

A Yes sir, 280 to 1. I may have missed it, but that is our GOR.

Q And do you have a GOR in the Blinebry in that well?

A That well was swabbed for a short time after we recovered

load acid and naturally, by swabbing, we cannot run GOR's.

Q All you got is the swabbing in the Blinebry?

A That's correct.

Q What are the characteristics of the fluid produced from each zone, has either one of them a high sulphur content?

A Not that we know of. There is sour, but we have had no indication in either of our other installations down there if any abnormal corrosion in the downhole equipment.

Q Is the Blinebry sour?

A Yes sir, I believe it is.

Q Is the Glorieta sour?

A Yes sir, to some extent.

Q I see. The machine is setting over there, and I notice it has two black rubber-like packers on it. What do those packers do to protect the metal surface on the tubing of the machine?

A Mr. Nutter, we have a witness that will go through the complete installation of this and will explain everything in detail.

Q You can't answer it?

A Yes sir, I can.

Q What type of packing do you have there?

A Are these the packers that you are referring to?

Q Yes.

A Those are identical packers to what we use here. The packers right here are identical packers to what we use on the

Otis sidedoor assembly.

Q Now, the metal tubing in which those packers are set, do you know the type of metal that is used in the construction of that tubing?

A We can buy that in any material, any alloy that we so desire. We can get Monnel or any corrosion resistant material. I have been told recently that they have even made this particular piece of equipment where the packing sets, that they have made that in bronze.

Q Is it your intent or do you propose to purchase corrosion resistant tubing for this pump?

A Not this particular tubing, but the polish rod that travels through the packing will be corrosion resistant.

Q In other words, the packings that are outside there don't move?

A No, sir.

Q And the polish rod which would move would be a corrosion resistant material?

A That's correct.

Q Mr. Motter, have you ever calculated what the hydrostatic head of a column of fluid in the Glorieta tubing would be? That is, the amount of pressure due to the column of fluid which will be exerted on the top of the lower stuffing box?

A No, I have never calculated it. It wouldn't take very long,if you will give me a minute, sir.

Q Would you give us an approximation of what that pressure would be?

A If it was in mud and not clearly on the surface, I calculate it would be approximately 1900 pounds. That is considering it's all oil.

Q Yes. On your Exhibit Six, you have depicted three different types of installations here, the Otis Sidedoor on the far side and you have the Oilmaster crossover assembly and the Garrett. Do you know what I am talking about here?

A Yes sir, this is it right here.

Q This is the only one of the three that has any constant moving parts in it, is it not?

A Yes sir, and I have indicated by red the packing that separates the fluids around the moving parts on the inside of this packing.

Q So you are comparing a machine that has all moving parts to a machine that doesn't have constant moving parts?

A Mr. Nutter, I think you missed what I was trying to show here. Our packing in this assembly right here where it sets is identical to that non-moving packing, identical to what we are using in these other types of installations.

Q I see. Now, what is the distance from the tubing crossover assembly to the lower zone pump housing?

A From here to here?

Q Well, on Exhibit Two, I see the tubing crossover assembly

approximately midway of the drawing there.

A Well, it would be a hundred feet from the packer to the crossover assembly, so the pump would be in between there. I would say from the crossover assembly to the top of the tubing would be somewhere in the neighborhood of sixty feet.

Q This would be from the point more or less labeled on this exhibit as the one-inch gas vent line in the lower assembly?

A Yes.

Q To the tubing crossover assembly which is above that --

A That's correct.

Q --would be sixty feet?

A Approximately sixty feet. I might point out that with this type of assembly and this particular gas vent line, we can actually pump below the packer in this type of assembly should we so desire, but we do not feel that it will be necessary. In that case, it would be some little but further up in the crossover assembly.

Q Mr. Motter, you suggested that one of the means by which you could stop the bottom zone from producing in the event it met its allowable would be to raise the rod strings, is that correct?

A That's correct.

Q And unseat the lower pump?

A Unseat the lower pump.

Q Is there any danger to upset the lower stuffing box in the upper pump?

A No sir, we would probably unseat the pump--the bottom pump would be unseated some, oh, twenty to thirty feet before the upper pump would be unseated. The lower stuffing box would have to fall in between those two and it would probably be unseated approximately twenty feet after the lower pump was unseated.

Q So that if you unseated the lower pump, all of the movement at the top of the rod string would be through the side of the lower stuffing box and the lower stuffing box would not move?

A That's correct.

Q Mr. Motter, do you believe that there is any appreciable amount of whip or side motion to a rod string as it pumps the well?

A No sir, not if it has a full fluid load, I don't believe there is any appreciable whip.

Q In other words, you would have to size your pump very exactly, and if you had the pump sized exactly and had a full fluid load on it, you would have a very straight and rigid rod string all the time?

A That's correct, normally we have no flipping, or I think you are referring to what is commonly called pounding, where the well is pumping fluid and then you get your rods to whipping your tubing string.

Q In your economic analysis of the lift cost comparing these various types of installations, Mr. Motter, I believe you

stated that group two, which is the both zones pumping with dual zone equipment category, there are no rod jobs, is that correct?

A No, sir.

Q Had there been any rod jobs in group three?

A No, we particularly chose these with no rod jobs in the interval in which we took the monthly expenses.

Q And in rod jobs, you are including pump jobs, too?

A Yes, sir.

Q So that in either of these groups, there have been no pumps pulled or rods pulled?

A No, sir. I might explain one thing: In group two, we had one well which watered out completely and we pulled the crossover equipment out of the well and ran single completion equipment. I did not include that expense in this category.

Q In group two, did you include the additional expense that may be necessary to go out and recycle the upper zone in the event it met its allowable or to pull the--or unseat the lower pump in the event it met its allowable or any such inherent additional cost that may be associated with the use of the dual zone pump?

A No sir, that has not been necessary. We have apparently been fortunate in selecting these wells and we have produced our allowable in both zones at the end of the month.

Q I see. I note that group three as a whole is a lower allowable group, or at least a shallower zone group. Do you think

that the fact that it only produced 8,429 average barrels per month as compared to 13,000 might not have an effect on the determination of the average lifting cost per barrel of fluid?

A Well, it might but I think maybe you are missing the point that I made. You see, we are lifting approximately twice as much fluid through the dual zone than we would be with a single, and therefore, naturally our expense will be somewhat less. In other words, when you look at the average expense column in group two and group three, there is approximately a hundred and thirty dollars difference but we lifted much more fluid with the group two wells than we did with group three wells. We had no wells singly completed at that particular depth of 6200 feet. I might say that the 42 to 4800 wells were primarily Queen and San Andres production.

Q You didn't have a representative sample of single zone wells to compare with dual zone?

A No sir, not in this area where all duals have been installed. The only single completion we have is the one that I told you went to water and that was the bottom zone.

Q Considering that certain costs related to pumping wells are affected, it would have brought the cost per barrel of fluid lifted down if you had had available to you a group of wells which would have produced approximately the same amount of fluid that the two zones produced, would it not?

A No, I can't agree to that. Our costs are fixed already

and I think that is borne out by group two and group three because we have no pulling expense. These fixed costs are mainly pumper's expenses, treating and minor repairs on the lease.

Q Well, those expenses would have been spread out over a larger number of barrels if you lifted more fluid and be lower per barrel, would they not?

A If we had lifted more fluid then it would have taken more pumping units for the particular depth. In other words, we just wouldn't lift any more fluid per well.

Q What I am driving at is that you didn't have a depth category comparable to the group two category which you could compare?

A My point on this thing here is that group one and group two are all Texas wells where we have had a little bit less allowable there than we have had in New Mexico for the same depth, and there is then more allowable, more production to be taken from this shallower zone because in group three most of them were New Mexico wells, I think in fact that whole number of wells with the exception of four.

Q Even with those higher allowables, they still produced less fluid there, didn't they?

A That's correct.

Q You made several references to the desirability of using this installation where you have five and a half inch casing. This isn't the point in this particular case, is it?

A No sir, this is seven-inch casing where we can run two strings of two-inch in the dually completed well.

Q You wouldn't have to run that expensive 2 1/16 inch Hydrill that you were referring to in this particular well?

A No, that's correct.

Q Have you already made your preliminary calculations as to the length of stroke that is going to be necessary and strokes per minute and so forth?

A Oh no, we haven't done that. We calculated the size of pumping unit we would need and that would be 228, 228-thousand inch pounds of tork. Those things usually have a stroke of I think eighty-four inches.

Q Would you give me an estimate as to what you expect the stroke of the pumping unit to be?

A Well, to begin with, considering that we are making nearly all oil, we will probably run this unit rather slow at, say ten strokes a minute. And it would take me ten or fifteen minutes to determine actually the size of stroke.

Q I don't want it exact, just approximately.

A Roughly, I would say fifty-four inches, in that neighborhood.

Q Ten 54-inch strokes per minute?

A Yes sir, and that would vary with the size of pumps which we run in this installation to get our fluid.

Q Well, I realize that, but if you had to use 54-inch

strokes and you used ten strokes per minute, that would be 540 strokes per minute, would that not be correct?

A That's correct.

Q And assuming there are 1440 minutes per day, how many inches of travel would you have through that packer in the hole, Mr. Motter?

A That would be quite a few inches, Mr. Nutter, but I might point out one thing: I don't think you could have it better lubricated due to the fact that you've got oil on both sides of the seal.

Q Is that oil corrosive, Mr. Motter?

A No.

Q Mr. Motter, in the event that the Commission should approve the installation, would Cities Service be willing to take pressure tests such as you described, would it be possible on the well, say a period of every thirty days?

A We would be glad to take tests, say every thirty days for a period of three or six months, whatever you decide, and we will also be glad to check the gravity of this particular fluid at the same time and also check to see that there is no commingling being done.

Q Would you be willing to pull the pumps after a period of say six months and make an inspection of them at the surface?

A I would see no reason why we would object to that.

MR. NUTTER: I believe that's all, thank you.

MR. PORTER: Anyone else have a question?

MR. FISCHER: Mr. Motter, I will be satisifed with a few questions here. Mr. Motter, what is the allowable of each zone at the present time?

A Well, the Glorieta is 46 barrels and the Blinebry would probably be the same amount because it is in same depth bracket.

MR. FISCHER: And if you went to pumping both these zones you could design your--or would your pumping unit be an electric motor or gas engine?

A It would be a gas engine.

MR. FISCHER: Thank you.

MR. PORTER: Mr. Utz?

CROSS EXAMINATION

BY MR. UTZ:

Q Mr. Motter, referring to Exhibit Number Seven, do you have knowledge of the total number of dual completions in these various States?

A No sir, my source of information for those dual installations was from the two manufacturers that have placed this equipment, so I do not know the number of actual duals that were allowed for flowing wells or any other type of dual completion.

Q Would it be safe to say that there are many more dual completions of all types than there are of this particular type

that you have recommended here?

A I just don't believe I can answer that question, sir.

Q What type of equipment do you intend to use in this completion, the --

A We propose to use the metal to metal seal in this particular installation. That's one thing I might point out, this seal assembly seems to be somewhat a point of interest. That is made in complements of three feet and we can put as many of those seal assemblys together as the Commission thought might be necessary to stop any commingling that might occur. I might point out that from the experience of one of these companies, they have started manufacturing this equipment with a 36-inch seal at the reduced 2 3/4 inch. That is in case of using Tevlon. I think that perhaps that was brought about more by the introduction of Tevlon over a lesser grade of sealing material that they had.

Q I take it that you feel that metal to metal is better than Tevlon, or is that your decision because of cost?

A No, cost has very little to do with it, that has been my opinion. I think that a metal to metal seal would hold a very close tolerance and that would be in the neighborhood of plus or minus 2/1000.

Q By using longer seals, in your opinion, would it decrease the possibility of commingling?

A No, I don't think that, I think the three-foot metal to metal seal is standard and adequate. In case we found that we

did have some leaks, we could always add more sealing area.

Q In your opinion, by adding say two standing valves in each instance, would that decrease your possibility of commingling?

A Well yes, it certainly would. I would say that two of anything would be better than one.

Q Would you be willing to do that?

A Well, I just don't think it's necessary, Mr. Utz.

MR. UTZ: That's all I have.

MR. PORTER: Anyone else have a question?

MR. PAYNE: Mr. Commissioner, I would like to ask Mr. Kellahin if he has any objection to introducing the entire article from which Mr. Motter quoted into evidence in view of the fact that he only quoted a portion.

MR. KELLAHIN: We would have no objection, certainly not.

MR. PAYNE: Would you do that, please?

A Yes, sir.

MR. PAYNE: Thank you.

MR. KELLAHIN: I have a couple of questions on redirect if the cross examination is completed.

MR. PORTER: Depends on your redirect, I suppose.

REDIRECT EXAMINATION

BY MR. KELLAHIN:

Q Mr.Motter, is there any--what is the pressure in between the two zones that you propose to produce in this well,

approximately?

A Well, Mr. Kellahin, we have very little bottomhole pressure information available. The only bottomhole pressure information I have in the Glorieta is the drill stem test that was run on the State "P" 2, which is the north offset well, and a 30-minute shut-in gave 1700 pounds. I would assume that that is probably a little bit low. The Blinebry on further north up in the pool was tested for bottomhole pressure and I think that it ran safely over 2,000 pounds in this immediate area. I don't have those pressures, I did not think that they would be necessary since this a pumping well and you don't need to run bottomhole pressure in this installation.

Q In this type of installation between the two zones, will it be a matter to be considered, communication between the two zones?

A Well, it's always a matter to be considered, but I don't think there's any possibility of that. The equipment that we have proposed will safely handle any pressure and any pressure differential.

Q In your opinion, this equipment is adequate to handle any pressure differential that might exist?

A The same Baker Model "DA" packer has been approved previously and I don't feel we have a large enough pressure differential to affect any of the equipment.

Q You testified, I believe, that this type of equipment

has the same safeguards as two long strings of tubing with separate pumping units?

A Well, I would say it has more safeguards than the two pumping unit installation.

Q In regard to the problem of whipping of the pumping rod, does that occur in most pumping wells?

A It does, as I explained to Mr. Nutter, whenever you have what we normally term pounding or there is not adequate fluid entering the well bore to keep the tubing full of oil.

Q Now, has that created a problem to you in the installations which you have operated in other States?

A No sir, it has not.

MR. KELLAHIN: That's all I have.

MR. PORTER: Any further questions?

The witness may be excused.

(Witness excused).

MR. KELLAHIN: Our next witness, Mr. Gallian.

J. E. GALLIAN

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

DIRECT EXAMINATION

BY MR. KELLAHIN:

Q Would you state your name, please?

A J. E. Gallian.

Q By whom are you employed, Mr. Gallian?

A Continental Emsco Company.

Q In what business is Continental Emsco Company engaged in?

A We are engaged in the manufacturing and distribution of oil field equipment throughout the world.

Q Now, Mr. Gallian, have you previously testfied before this Commission as an expert on the dual zone equipment, which is the subject matter of this hearing?

A Not before the Commission, but before the Commission's examiners.

MR. KELLAHIN: Would the Commission care to hear the witness' qualifications?

MR. PORTER: I believe his qualifications are complete in this transcript of the previous record, Mr. Kellahin. Unless someone has a question of his qualifications, they are accepted.

Q (By Mr. Kellahin) Mr. Gallian, is your company one of the companies that manufactures this type of equipment?

A Yes, we were one of the first to manufacture this.

Q Would you briefly outline your experience with this type of equipment?

A It initially began with out pump company working with Otis Engineering Company in the development of this tool. That was in 1947; subsequently, our pump company, which at that time was the D & B Division of the Emsco Manufacturing Company, took over the patent rights of the dual pumping equipment from Otis

Engineering and began manufacturing the full line of equipment and I entered into some discussion with Otis in '47, and in '51 when our company, or our subsidiary company, undertook the complete manufacture, I assisted in that work, and in '51, came into the infield operation to a rather full extent.

Q Now, does your company keep any type of record on the success or failure of the operation of its equipment?

A We do during a test period, and after it has proven to be satisfactory, those records are discontinued. As in the case of our two-zone pumping equipment, we maintained early records, but they have been discontinued and we no longer keep records of installations. As such, we do not have a complete record of all dual pumping equipment that we have installed.

Q Was the discontinuance of that because of the fact you had no difficulties with this type of installation?

A Yes, it was found to be satisfactory and therefore, there was no further requirement or anything, just to see how many tools were in operation.

Q Do you have some pictures of this equipment?

A We have a picture of the lower packoff and seal element which was taken of this model that I have with me. The purpose of this is to indicate how the packing is held in place and how it is placed around the reciprocating rod, which is the moving part of the crossover assembly.

MR. KELLAHIN: If the Commission please, those will be

marked as Exhibit Number Eight and Exhibit Number Nine.

MR. PORTER: Which is Eight and which is Nine?

MR. KELLAHIN: The large one showing the packing assembly would be Exhibit Number Eight and then the --

A I believe you have both the same, Mr. Porter. Mr. Morgan has one of the --

MR. KELLAHIN: And then the picture of the entire tool, the length of the tool, would be Exhibit Number Nine.

A Sorry there were not sufficient photographs brought to furnish each member with one.

(Whereupon, the documents were marked for identification as Exhibits Number Eight and Nine).

Q (By Mr. Kellahin) Exhibits Eight and Nine, are these photographs of the tool which you have in your hand, Mr. Gallian?

A They are actual photographs of this piece of equipment.

Q Referring to the model which you have in your hand, will you explain the operation of that tool to the Commission, please?

A This is actually only a portion of the complete cross-over as depicted by Exhibit Five and Exhibit Four of Mr. Motter's. This shows only the lower packoff and seal assembly, which seem to be of great interest in that this is the element which packs off the two zones of fluid. Now, in operation, this lower seal nipple is screwed below the crossover and made a part of the crossover. The element that is projecting through that is carried

on the sucker rod string down through the crossover by means of this lower release assembly, which is a spring-loaded release assembly that latches into a recess on the packoff and seal assembly. That is carried through and is landed in the spring collet which is depicted as the large spring fingers at the lower part of the seal nipple. As that is landed mechanically, it must be pulled mechanically. It cannot be pushed out by pressure because of the square shoulders in both of these elements and they are of extreme hardness. If I am not mistaken, these two elements are of rock seal hardness, which is about as hard as you can harden steel without it becoming too brittle for practical useage. That locates this packing assembly in such a position that complete zone separation is maintained while the rod is reciprocating through and while the assembly is in use in the well.

Q That packing assembly has been referred to as the stuffing box. Is that the correct term?

A Not in the common connotation of a stuffing box. Generally speaking, a stuffing box is exposed to air and packs off a fluid from coming out into the air. This is actually a seal assembly, it is surrounded by a lubricating fluid at all times and has pressure above and pressure below. Generally speaking, a stuffing box has pressure operating only at one end of it in the common oil field usage. And further, a surface stuffing box, as we commonly see on top of the wellhead, is exposed at the top of atmospheric conditions and it is at the whim

of the pumper as to how tight he should make his packing. In this, it's a fixed, prescribed packing held at a very close tolerance with pressure above and below and is completely surrounded by lubricating fluid. So actually it is not a stuffing box in that connotation, but a seal assembly.

Q Is that type of equipment sufficient to prevent commingling between two different producing horizons?

A Our experience has been that it is ample.

Q Have you made any pressure tests on this type of equipment?

A Our laboratory ran a test one time in an effort to determine the Tevlon seal, as to how much pressure could be maintained on that and the equipment was capable of 15,000 pounds. We did not detect leakage while the rod was reciprocating at 15,000 pounds pressure; therefore, we felt that it would be adequate and conducted no further tests, to my knowledge.

Q Now, in reference to the entire assembly, in your opinion, is that adequate to prevent commingling of fluid between the two producing horizons?

A It has proven to be adequate in the many installations we have made. In my opinion, it is thoroughly adequate.

Q In some of the exhibits, particularly in Exhibit Five, it would appear that there is an offset in the crossover shoe offsetting the rods that operate the pumping unit. Will that cause any undue wear in the downhole seal assembly?

A As Mr. Motter, explained, those drawings in Exhibit Four and Five are quite exagerrated. The offset is only --

Q You mean Exhibits Two and Five, do you not, sir?

A Two, I beg your pardon, Exhibits Two and Five, that offset is only one half of your tubing or approximately slightly over an inch in offset. Now, in general practice, in running this type tool that is proposed in the Cities Service well, the parallel flow tube in the Baker Model "D" Packer is latched in the tubing and then pulled in tension intended to give us a perfectly straight tubing column above the crossover. Now, the rods traveling above the crossover are directly in line with this seal assembly, which incidentally, is held rigidly in place and latched, both top and bottom, and made a portion of this long assembly so that we have no side play or side thrust at this point in the crossover. Now, should we get fluid pound, as Mr. Motter explained, it would be possible to rattle the rods in the tubing column, but with proper sizing of equipment, that is minimized, if not completely ruled out of the picture.

Q Now, what are some of the advantages of this type of installation, Mr. Gallian?

A Well, in use of single string actuated dual pumping equipment, we are not limited as much as to rod size as we would be in parallel string. Obviously, even in seven-inch, two-inch tubing is our maximum size tubing that can be run in that safely. Therefore, the maximum size sucker rod that can be introduced

through two-inch tubing is 7/8 sucker rods. The maximum size pump that can be run through that is 1 3/4 inch tubing pump. With this equipment, even in 5 1/2, it is possible to run 2 1/2 inch tubing, which would permit the use of larger pumps, would permit the use of one inch or an inch and an eighth sucker rod, and therefore handle greater volumes of fluid with greater safety to your rod string.

Then the other factor that enters in mind at this moment, should we have a rod part in this equipment, there is room within the tubing, sizes that could be used to fish the sucker rod from the well. Then when you use particularly the smaller size parallel tubing strings, there are no fishing tools with adequate strength to fish a 3/4 inch sucker rod from the small inch and a half or 2 1/16 tubing to do a thoroughly good job. So if you should have a tubing part, there is room to fish one string of tubing, where if you had two strings of tubing in the well and one string should part, then the other becomes quite difficult to get out until you can go in and fish the parted string. Does that answer your question, Mr. Kellahin?

Q Yes, sir. Now, you heard Mr. Motter's testimony in regard to the procedure for testing the two separate zones. Are you in agreement with that testimony?

A Yes, very much.

Q Have you anything to add to it in regard to testing procedures which may be followed?

A We have felt that the most successful tests of the lower packoff and seal assembly are those described by Mr. Motter as closing off one zone and detecting a pressure build-up, a fluid increase in the other zone, that is the quickest and most effective. The other, on checking of the gravities of the oil, should we find an increase in a low gravity, we would naturally suspect that it came from the zone which had a higher gravity and we would immediately investigate to determine if we had commingling of fluid in the well bore. Those are the two chief methods used and that is what we recommend highly.

Q Now, with this type of equipment, is it possible to treat the two zones as may be needed?

A Yes, it is. As Mr. Motter explained, the lower zone can be--lower zone pump can be unseated without disturbing any of the other elements and treating fluid can be introduced around the pump into that. The upper zone can be treated down the annular space. In the case of parallel string, the treating fluid for the lower zone would be introduced down the short string past through the crossover, by-pass the pump and enter into the well. Now, with the bottom ball and seat, it would be necessary to adapt to the lower pump a retrieving mechanism which could easily be done to pull it and allow treating at that point to go through there. The upper zone fluid, as I say, or the upper zone, could be treated through the casing annulus and out into the formation without disturbing the upper pump or packoff

elements.

Q Now, does your company manufacture equipment for use in the conventional dual completion units through two long strings of tubing?

A Yes sir, our company manufactures tubing, pumping units, sucker rods and pumps, as well as gas engines and electric motors, so we are equipped to handle both the conventional two-string, two pumping unit installations or the single unit, single string dual pumping installation.

Q The two-string unit installation is more costly, is it not?

A Quite a bit, yes sir.

MR. KELLAHIN: At this time, we would like to offer in evidence Exhibits Eight and Nine as being the photographs of the model which has been used and demonstrated by the testimony of Mr. Gallian.

MR. PORTER: You're not going to leave the model?

Is there objection to Counsel's motion for admission of the exhibits?

They will be admitted.

MR. KELLAHIN: In connection with Mr. Payne's request for the full article, a portion of which was read by Mr. Motter, I would request the Commission for permission to offer this as Exhibit Number Ten and submit a copy of the complete article, subject to the Commission's approval.

MR. PORTER: Does that meet with your approval, Mr. Payne?

MR. PAYNE: Yes, sir.

(Whereupon, the document was marked as Exhibit Number Ten for identification.)

MR. PORTER: Then it will be entered as an exhibit.

Q (By Mr. Kellahin) Do you have anything to add to your testimony, Mr. Motter--I mean, Mr. Gallian?

A Nothing that I don't believe Mr. Motter has covered very thoroughly.

MR. KELLAHIN: That's all the questions I have.

MR. PORTER: Anyone else have a question?

MR. NUTTER: Yes, sir.

MR. PORTER: Mr. Nutter?

CROSS EXAMINATION

BY MR. NUTTER:

Q Mr. Gallian, just what portion of that device is it that Mr. Motter mentioned could be extended by adding 36-inch complements or segments?

A In this particular model, Mr. Nutter, we are showing the Tevlon seal, which is actually 5 3/4 packing element. This portion right here can be extended by adding other packing housings with the packing placed in it to an indefinite length as determined by the customer.

Q On the Tevlon packing type as well as the metal to metal

packing type?

A As well as the metal to metal. Now, both of the manufacturers here represented today make either the Tevlon or the metal to metal, as preferred by the customer, and they both may be extended to any length decided by the customer.

Q I see. Mr. Gallian, you sell ordinary single zone pumps as well as this type of pump, do you not?

A Yes, sir.

Q Have you noticed any peculiarities in connection with the use of these pumps that you haven't encountered with the normal single zone type of pumps?

A In peculiarities, I would interpret that to mean --

Q Unusual performance or anything that you haven't encountered in the single zone pump?

A There have been a few instances that we seem to have had more difficulties in putting this equipment into actual operational use than we have had with single zones, but in each instance, Mr. Nutter, we have found upon investigating that there was some basic element of the well that was improper or incorrect and would have given us undoubtedly the same trouble if we had been using single zone equipment. So in reality, I must say that we have encountered no problems in this that are to any great extent different from those that we might expect and do encounter in single zone installations.

Q Does your company offer an engineer's service whereby

you can help the operator install this equipment in place properly?

A We install each and everyone of this type of equipment for the operator.

Q Do you know of your own personal knowledge whether the other manufacturer that is represented here furnishes the same service?

A They do.

Q I see. Now, would it be possible for you to pressure test one of these sealing assemblies while it was in motion? That is, while the reciprocating rod was in motion, at the present time?

A The pressure test I mentioned was done with the reciprocating rod in motion.

Q Are you still in a position to test that device, Mr. Gallian?

A Yes, sir.

Q Would you be in a position to test the machine in the same manner say six months after it had been in use?

A Yes, sir.

Q Yes?

A It would have to be taken back to our laboratory where facilities are available for that.

Q I see.

A It could not be done on the well in the field.

MR. NUTTER: I see. Thank you very much.

MR. PORTER: Anyone else have a question of Mr. Gallian? You may be excused.

(Witness excused).

MR. KELLAHIN: We will call at this time, Mr. St. John. Off the record.

(Discussion off the record).

J. A. ST. JOHN

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

DIRECT EXAMINATION

BY MR. KELLAHIN:

Q Would you state your name, please?

A J. A. St. John,

Q By whom are you employed?

A By Fluidpack Pump Company.

Q In what position?

A I am Manager of the Technical Service Division.

Q Now, Mr. St. John, what education and experience have you had in mechanical or petroleum engineering?

A Well, I have a--I have a high school education and my experience with technical service has been calculated from experience.

Q Would you outline briefly what that experience has been?

A Well, I worked in production for seventeen years, since

1934 until 1950, when I went to work for Fluidpack Company.

Q When you say you worked in production, what do you mean?

A I started from roustabout, what they call a roustabout, and worked on up to superintendent of one oil company.

Q Will you state what oil company that was and what period of time?

A From 1947 to 1950, I was superintendent for the Street Investment Company, which was an independent oil company of Graham, Texas.

Q Where did you work then?

A I lived there. In and around Abilene, Texas.

Q Now, have you had any experience with dual zone pumping equipment?

A Yes sir, that's all I've done for the last four years, five years.

Q And what connection have you had with this type of equipment?

A Well, I have helped design part of the equipment and install this equipment regularly.

Q Have you personally supervised the installation of this type of equipment?

A Yes, sir.

Q Have you kept track of it after your installation?

A We make an installation report. In other words, when we

install an installation, we make an installation report which will show who the operator is, what is in the well, and what position, where it is located.

Q And is that installation under your personal supervision?

A It is when I make the installation, I make a report of that well, and when one of the other boys makes an installation, he takes care of his own installation report.

MR. KELLAHIN: Are the witness' qualifications acceptable?

MR. PORTER: Yes sir, they are.

Q (By Mr. Kellahin) Now, Mr. St. John, do you have a diagram of the type of equipment which your company manufactures?

A No, I don't have one with me except--do you have one of those? This diagram right here, I thought I came up here and didn't bring it. We didn't know exactly what we were going to need for this equipment.

Q Now, you have been handed a diagram, which we will request to be marked as Exhibit Number Eleven.

(Whereupon, the document was marked as Exhibit Number Eleven for identification.)

Q (By Mr. Kellahin) Referring to Exhibit Number Eleven, Mr. St. John, does that depict the type of equipment your company manufactures?

A Yes, sir.

Q The dual zone installation?

A Yes, sir.

Q Referring to that diagram, did you bring a cut-away model of that type of equipment --

A Yes, sir.

Q --with you?

A Yes, sir.

Q Referring to the cut-away model, will you briefly demonstrate to the Commission--and attempt to avoid any repetition of prior testimony--the operation of your equipment?

A Okay, sir. In other words, you would like for me to show how the equipment is installed? In other words, what procedure we go through to install it?

Q Yes, and I would like, during the course of your testimony, if you please, for you to outline the safety factors built into the equipment to prevent commingling of fluid between the two producing horizons.

A Okay, sir. In other words, this is what we call our tubing assembly in dual zone equipment. This is life-size; in other words, this is the size that we would actually use in running this equipment. Of course, you have your Baker Model "D" Packer located somewhere below this equipment. In other words, we can run this any distance above a Baker Model "D" but ordinarily run them around a hundred feet. Above your Baker Model "D" Packer you still have your packing sealing element with a standing valve below it. Then we have the lower pump setting shoe, which comes just above the locater and there is the Baker

Model "D" Packer, and then we run the tubing up until we get ready to put the crossover shoe and when you put the crossover shoe, you run it into the hole until the tubing has latched your Baker Model "D." And then your wellhead is--you make your wellhead spacing just like you would on an installation where you are using a packer in the hole. Then we pick up our parallel string, which we attempt to use two-inch tubing, and it is run in by the side of your long string of tubing and when it gets to here, there is no place for it to go so it goes into this hole right here and is landed. In other words, this is locked in here and it is for us who are running the tubing to know when it is landed. When it is landed, it takes 1500 pounds to pull it and about 500 pounds to push it in. In other words, you can put pressure on it as much as you want to and it doesn't have an unseating force because you are pulling down as much as you are pushing up.

Then I will talk about the safety factors. Over here to prevent commingling, you have your standing valve which is to keep the upper zone fluid from going into the lower zone. And these standing valves here are just regular API and some people call these check valves. The lower zone, fluid from the lower zone, comes up the tubing to here and it can't get by the check valves. In other words, the only place it can go is up your tubing string and the only possible chance for commingling would be across the seals right here, which are --

Q The seal is on what portion of that?

A This is your landing spear, what you call your landing spear. These seals were made, designed and made first by Baker Oil and Tool Company, which they used Baker Model "D" Packers and they wanted some kind of base so they put these two deep lines with tolerance which we use in making this seal. These seal rings here have been tested and we used one ring here and one here and they were tested at 12,000 pounds. And the reason we run five on each side is in case when you run it in the hole one gets nicked, why if you just had one it wouldn't hold, but we haven't had failure and so forth.

Q Is that the same type of packer as your Baker Model "D" Packer?

A These seal rings here are the same material used in the Baker Model "D," which I believe the Commission Board has approved for New Mexico. Then the rod string, when your tubing strings are landed and then placed, then you have your rod string to run in your lower pump. Your rods from this top pump will run down and screw to your lower pump. In other words, where one rod string actuates both pumps. In other words, when you move your top plunger, you are moving your bottom plunger. This is the seal assembly. On ours we prefer mostly to use metal to metal. In other words, that is what we use in nearly all of our installations, it's metal to metal with a three-foot metal seal. This rod is plunged in the hole and is honed to 2/1000

and inside it fits just exactly like a barrel in a plunger in a regular pump. So when you run your lower pump, you pick up your upper pump. In other words, our equipment is on a regular rod string. This upper pump is just a regular pump like you run in any well, the only difference is that it has a seal assembly attached to it and the lower pump is just a --

Q In regard to the seal assembly, you say that you prefer a metal to metal seal. Have you found that adequate to prevent communication between the producing horizons with the pump in operation?

A Yes sir, we sure have. In other words, if we are ever in doubt, we close the valve on the parallel string and whenever you close the valve on the parallel string, you are testing this seal, this seal, and your tubing strings and also this seal that is right here and this is your lower pump pressure. Then you go up and shut your well down and if they are holding, your pressure stays, then you know that you have all your seals in place and your seal assembly isn't leaking because if you get an assembly leaking here, you will build no pressure in your long string of tubing. These are locked up, this is a positive lock. In other words, you have to lock the top of this on the head so we have a positive lock when we run these in and it is closed. It really doesn't have to be that close, but you have to close it to get through here. Ordinarily, if that was setting unlocked, the weight of your hand would push it through. It goes in place,

these strings are locked, this is a positive lock, and when it does, it throws your seals across this hole here, you have a set of seals here and a set of seals here. Your lower zone fluid is pumped up your tubing until it reaches this sealing element in this packing in this hole right here, it's just below this packing.

Q You are referring to the hole --

A This hole here.

Q The area that is painted red?

A Yes sir, this hole right here is where your lower fluid comes out of your tubing into your crossover shoe and it goes into the parallel string across where these holes are right here.

Q And what happens to the other zone then?

A Then your upper zone, you know, comes in here where this yellow mark is, the upper zone enters these balls and sets and comes up into your upper zone pump. In other words, it's above this sealing element in here and this set of seals. Your fluid goes in here and this set of seals is to keep your fluid from your tubing, it goes back into your pump. In other words, it's just circulating just like on a regular pump. This would be from the sealing up just like a regular pump. In other words, if you were leaking, your seals would leak right back and your fluid would just circulate. So in other words, it goes into your upper pump, which this plunger ties on this rod on the bottom of the

upper plunger. This would produce your fluid on your upper long string just like a regular pump.

Q Now, in this type of installation, Mr. St. John, is it possible to make what tests may be necessary or treat the separate horizons?

A Yes, sir. In this type of installation, our tests might work a little different than in the other installation. In other words, Mr. Motter said that we can pull this pump equipment out if we want to test the lower--treat the lower zone. We can pull the pump out and get a positive seal by running a through tubing, that is, a PSI through tubing blanking plug, which I believe the Commission has approved in New Mexico. In other words, when this is seated, we run a collar right here on your crossover shoe and the pump is in here. This is the blanking plug in here and when it is in place and the lock is up on the joint of tubing, it can't blow it out of the hole so these seals are above this intake, your upper zone intake, and these seals here are below this outlet into your parallel string where it has the hole through it. So your lower zone fluid comes through right up in here and that actually locks the lower zone tubing. That is a positive shut-off from the upper zone, there is no doubt. Then if you want to test your upper zone for any reason, you have to shut your bottom zone out of your tubing. This little plug, it's solid, it's just a blanket plug, and when it's in place, the seals are below this intake here and your lower

zone fluid comes up here and it is isolated into your parallel string, then your upper zone fluid can go on up your tubing. Or you can put it right down there, put a complete blank on the bottom clear over, you can put that plug solid on your seal here and completely isolate your lower zone at any time. That is just running a wire line plug.

Q Now, Mr. St. John, in your opinion, is this type of installation adequate to protect the zones against communication?

A Yes sir, we found them so.

Q You heard the testimony of Mr. Gallian and Mr. Motter in regard to the advantages of this type of equipment. Do you have anything to add to that?

A Well, this type of equipment, it's--in other words, it's more economical to produce a dual zone well than it is to run two pumping units and two strings. Just like if we were manufacturers of pumping units, well, we wouldn't--we'd rather see a man run two pumping units.

Q Now, can the two zones be produced as efficiently as with two pumping units?

A Yes sir, they sure can because actually, we don't have anything in our equipment that's not standard PSI pump. In other words, your upper pump is just like the conventional pump that you run in any well, your lower pump is just like a conventional pump that you run in any well. All the difference is, as I said before, there is a seal assembly that separates your two

zones.

Q I believe you testified that Exhibit Number Eleven was a diagramatic sketch of the equipment which you have been demonstrating here, is that correct?

A Yes sir, it sure is.

MR. KELLAHIN: At this time, we would like to offer Exhibit Number Eleven.

MR. PORTER: Without objection, Exhibit Number Eleven will be admitted in the record.

Any questions of the witness?

CROSS EXAMINATION

BY MR. NUTTER:

Q Mr. St. John, have you noticed any peculiarities in the installation or operation of this type of equipment that are not present in the installation and operation of single zone pumping equipment?

A No sir, I don't think you'd find anything different from any other types of installations because in other words, your pumps are the same, and the only difference would be your seal assembly. You run in your tubing string just like in other words, just like it was another joint of tubing.

Q What provision is made for venting the lower zone?

A Venting the lower zone, we have it vented just like Mr. Motter brought up on this drawing over here. You can bring that fluid gas vent line up to be tied in with your bottom tubing

string. In other words, you're by-passing your pump. You have a ball and set check valve on that just like you would on what we have right in here. And it has been proven to work because we have actually run it on wells that they could not pump the lower zone on account of gas and we have installed this equipment in those wells and actually pumped, produced them.

Q Is your laboratory or shop equipped so that you can pressure test one of these machines while it is in operation?

A Well yes, I am sure it is. We usually test this on location, in other words, with your pumping unit. In other words, we close the valve that is going to your well and close this valve and just let the pump build that pressure. Sometimes it may take a little while for it to compress the fluid. In other words, if you have a foamy gas, it may take a little while to compress, but if you got solid water, you don't want to go too far away from the clutch on that unit because that pump will actually build up a hundred pounds or more on each stroke.

Q You could test it in your laboratory prior to installation and say six months after installation --

A Yes, sir, that's right.

Q --where you know you wouldn't have any gas or anything else that might effect the pressure?

A That's right, or you can go to a well and do it after it has been installed.

MR. NUTTER: Thank you.

MR. PORTER: Mr. Utz?

CROSS EXAMINATION

BY MR. UTZ:

Q Mr. St. John, in reference to the metal to metal seal unit, what is your clearance around your sucker rod?

A 1/1000, we try to make it 1/1000 but it varies just a little bit one way or the other, but we try to make it at 1/1000.

Q Have you pressure tested this unit to see how much fluid will be passed through at so much pressure?

A No, we haven't, but on the metal to metal seal, as you understand it, they will always usually just have a slight fluid passage on pressures. That metal to metal seal is not a positive seal is what I mean, but actually, when this rod is working, you get a better sealing than you would with it standing still, because when you have a piece of metal working, you get a better seal than if it was not moving.

Q You have some by-pass fluid or water, right?

A That's right, you couldn't have a positive metal to metal seal if you wouldn't get any lubrication at all. Just like on these pump manufacturers that manufacture barrels and plungers with a metal to metal seal, you do have to have a clearance to get lubrication.

Q But you don't have any idea how much pressure you could get say at forty degrees gravity and so forth?

A No, we don't have any record of how much it would pass

through. No sir, we don't, but you could tell at the surface by pumping and pressuring up your parallel string. Maybe it's a half a barrel or a barrel that passes through in a day's time because you do have a differential in pressure, you have a pressure on top in the seal and you have a pressure under it. I'll grant that the pressure will be practically the same because you have your hydrostatic head up there and you have your hydrostatic head on your upper zone on top of it, so there wouldn't be much differential in the pressure.

Q Has your company had the same experience as Mr. Gallian's in reference to pressure testing the Tevlon seal?

A I don't believe that we have ever tested that in our plant; in fact, we have only used Tevlon packing in one installation that I know of.

Q On your new units, what type of --

A On our new units?

Q On your new units that you have regularly installed, have you used Tevlon?

A We don't make the Tevlon packing unless a customer requests it, we make all metal to metal seals. We have had one customer request the Tevlon packing, which was Tidewater Oil Company at East Texas.

Q What I am trying to find out is, is there any fluid passage through the Tevlon seal at all?

A I couldn't tell you that, sir.

MR. UTZ: That's all I have.

MR. PORTER: Any further questions?

MR. JOHNSTON: Yes, sir.

MR.PORTER: Mr. Johnston?

MR. JOHNSTON: We might have to get Mr. Gallian to answer this, but leaving out personal preferences that one individial or company might have, has the Tevlon seal withstood the same tests as the metal to metal?

A Well now, I couldn't answer that. Mr. Gillian might have the answer to that because as I said, we only had one customer that wanted to try the Tevlon seal, which was Tidewater in East Texas.

MR. PORTER: Anyone else have a question?

MR. KELLAHIN: I would like to ask just one question.

REDIRECT EXAMINATION

BY MR. KELLAHIN:

Q Mr. St. John, assuming there is no pressure differential of any appreciable amount between the two zones, would there be any appreciable passage of fluid through the metal to metal seal?

A No sir, there sure would not.

Q In this installation in this particular well, do you know whether there would be any pressure differential or not?

A Well, in this particular well, Mr. Motter could more or less answer that. I think the only--in other words, our

pressures on the hydrostatic head would be the only difference in the pressures that I would think of.

MR. KELLAHIN: That's all I have.

MR. PORTER: Any further questions?

The witness may be excused.

(Witness excused.)

MR. KELLAHIN: I would like to recall Mr. Motter briefly to discuss the question.

MR. PORTER: You may.

MR. MOTTER: I would just like to make a point here that I think we are missing on this matter of differential across this packing seal element. The only differential we'll have is whatever length of seal we have, since this column of fluid and this column of fluid would be the same, and we might have a little bit of differential in case there is a different gravity of fluid, but that would be very minor in the differential across the packing element.

MR. KELLAHIN: That's all.

MR. PORTER: Any further questions?

MR. UTZ: By minor, what magnitude do you mean?

MR. MOTTER: Well, Mr. Utz, it would be minor depending upon the gravity of the fluid. If one would be 38 and the other 36, there might be--I am assuming without calculating it--it might be twenty pounds or something like that, but what I am getting at is, that the hydrostatic heads are almost, for practical purposes,

the same across the seal element.

MR. PORTER: Is that all the questions you have?

MR. UTZ: Yes.

MR. KELLAHIN: That completes our presentation.

MR. PORTER: The witness may be excused.

(Witness excused.)

MR. PORTER: Does anyone else have any testimony or exhibits to --

MR. JOHNSTON: Could we recall Mr. Gallian and clear up that point about whether or not the Tevlon has withstood the same tests as the metal to metal seal?

MR. PAYNE: Mr. Johnston, does Gackle have a residence Counsel here?

MR. JOHNSTON: That was a question for myself, and if necessary--off the record.

(Discussion off the record).

MR. PAYNE: Mr. Gallian, in your opinion, will it withstand the same pressure?

MR. GALLIAN: In my opinion, Mr. Payne, the metal to metal seal would serve as adequately as the Tevlon. Frankly, the only reason for using Tevlon was for the economy of space and the fact that it was giving adequate results at a very economical cost.

MR. PAYNE: There is no increase in efficiency in the metal to metal?

MR. GALLIAN: Yes sir, as far as I know, there is no appreciable difference in efficiency between the two.

MR. PAYNE: Thank you.

MR. PORTER: Any other questions?

Anybody have any statements to offer in the case?

MR. PAYNE: I have two that we received.

MR. PORTER: Telegrams?

MR. PAYNE: Yes, sir.

MR. PORTER: Read them into the record.

MR. PAYNE: "In regard to the hearing January 14, 1959 on Case 1557, application of Cities Service Oil Company for permit to operate a two zone pump on single rod string with crossover equipment and two parallel tubing strings at its State "P" Well Number 3 in the Blinebry and Glorieta Pools, this type installation has been used by Phillips Petroleum Company on more than ten wells in Texas, Oklahoma and Kansas for eight years and is giving satisfactory service. This operation creates no more danger of commingling between zones than with two zones flowing or with two pumping units. Industry ingenuity in developing this cost-saving device should not be thwarted. Phillips Petroleum Company urges that the Commission reconsider its decision and approve this installation." Signed --

MR. PORTER: Did you say statement or telegram?

MR. PAYNE: Signed, L. E. Fitzjarrald.

"In regard to application of Cities Service Oil Company

to dually complete its State "P" Number 3 well, by the installation of dual zone pump equipment, Terry Blinebry Oil Pool and an undesignated oil pool in the Glorieta Sand, Lea County, New Mexico, Case Number 1557. Magnolia Petroleum Company as an operator in the Terry Blinebry field, hereby supports Cities Service Oil Company in its application for permit to install dual zone pumping equipment to effect a dual completion of its State "P" Number 3 Well between the Terry Blinebry Oil Pool and an undesignated Glorieta Oil Pool, Lea County, New Mexico."

Signed, D. V. Carter of Magnolia Petroleum Company.

MR. KELLAHIN: I would like to make a very brief closing statement, if I might. I would like to make this observation, and I think it was brought out to some extent on the material just quoted: There are from time to time new developments in the oil field operations, as this Commission well knows, and we feel that we have presented an adequate case to show that the danger of commingling of reservoir fluid is at a minimum and certainly no greater than in the conventional types of dual completion which have heretofore been approved by the Commission.

So with a new Commissioner present, we feel that we have belabored the point in our presentation. If we have bored the Commission, we apologize, but we did feel that in view of all of these circumstances and this being a new type of installation in the State of New Mexico, we so attempted to give the Commission all of the information which would be pertinent to this

type of completion.

I think we have shown that the zones will be adequately protected, I think we have shown that this type of installation is in the interests of conservation and the prevention of waste in that it will result in the greatest ultimate recovery of oil from the two zones involved here. It is a type of installation that we feel the Commission should approve, and in connection with our presentation, I would like to make the observation that there has been no testimony offered against this type of completion. There has been no testimony or evidence offered to show where any excessive danger of commingling or other damage to the reservoir or to the creation of underground waste might exist. I think all of the testimony has been to the contrary, and we submit that the Commission should seriously consider approval of this type of installation in New Mexico.

MR. PORTER: Anyone have anything further to offer in Case 1557?

We will take the case under advisement and proceed to case 1581.

STATE OF NEW MEXICO)
: ss
COUNTY OF BERNALILLO)

I, JERRY MARTINEZ, Notary Public in and for the County of Bernalillo, State of New Mexico, do hereby certify that the foregoing and attached Transcript of Hearing was reported by me in Stenotype and that the same was reduced to typewritten transcript by me and contains a true and correct record of said hearing, to the best of my knowledge, skill and ability.

DATED this 18th day of January,1959, in the City of Albuquerque, County of Bernalillo, State of New Mexico.

Notary Public

My Commission Expires:
January 24, 1962

Dual-Zone Pumping with Two Pumps Actuated by One Rod String

By W. W. WHITAKER and H. F. TIEB
Gulf Oil Corp.

Exhibit #10

ABSTRACT

This paper reviews our experience, dating from 1953, with dually completed wells equipped with tandem pumps (two pumps actuated by one rod string). In this span of time newer designs in dual-zone equipment and packer-tubing combinations have antiquated the initial installation. Subsurface schematic drawings depict seven deviations in equipment installed in various wells, which encompass most of the major techniques and assemblies. Commentaries on each method, which include installational and operational problems and production results from specific wells, give an insight into the applications and limitations of each assembly.

INTRODUCTION

The installation and operation of artificial lift equipment in dually completed wells often involve many problems not necessarily associated with single-zone producers. Many of these problems can be minimized or avoided if the operator will give some thought during initial completion to the type and size of future pumping equipment to install after one or both producing zones have ceased to flow. Sometimes one may find that it is feasible to equip a well in such a manner that dual-zone pumping equipment can be installed at a later date without disturbing the tubing. This fact may be especially true if the flowing life of one or both pays is anticipated to be rather short.

Perhaps the most important single item affecting dual-zone pumping, for consideration during the initial completion of a well, is the design of a casing program that will permit adequate clearance for passage and hanging of future tubing strings. Sometimes, however, the reverse may occur, and the casing in a well may limit the type and size of artificial lift equipment. This condition could prevent the installation of equipment best suited for the depth, productivity, corrosiveness, and other operating conditions prevailing in a well, thereby causing inefficiencies by increasing installation costs and/or operating costs and possibly by reducing production.

Casing Design

Currently, Gulf's West Texas District installs 7-inch OD production strings swaged to 7 5/8-inch OD casing near the surface in order to give more clearance for tubing hangers. This casing design is compatible with most artificial lift methods, and permits considerable flexibility in the selection of future dual-zone artificial lift equipment.

Our experience with tandem pumps began more than four years ago in 1953. Considerable improvements in equipment and methods have occurred in this span of time. This evolution has been chiefly in the direction of improved flexibility and simplicity. Several installations cover most of the major changes that have taken place. Currently, fourteen wells have some form of equipment for this type of pumping. Operational and production histories, supported with schematic subsurface drawings from some of these dually pumped wells, reflect the applications and limitations of seven major deviations in equipment.

DOUBLE-PACKERS, SINGLE-STRING

Fig. 1 schematically shows a dual-zone pumping system that represents our first endeavor to produce

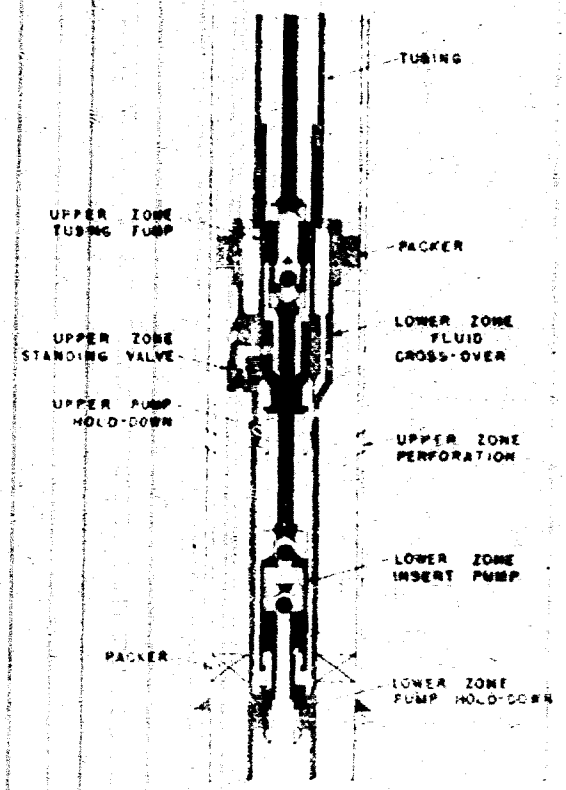


FIG. 1 DOUBLE-PACKERS, SINGLE STRING DUAL-ZONE PUMP INSTALLATION WITH TUBING PUMP AND INSERT PUMP

Production Tests - Table 1

Pay	Depth - Feet	Date	Hours Tested	Production - Bbls. Oil	Water	GOR	Pump Efficiency - Percent
5600'	5447	11-10-53	24	47	1	3745	23.1
Clearfork	6235	10-28-53	24	68	0	294	40.5

both zones of a dually completed well with tandem pumps. This equipment was installed in Well A in October, 1953. Only one string of 2-inch tubing was run. A retainer-type packer was set in the casing between the two producing zones in order to prevent commingling of their fluids around the tubing, and a hook-wall packer was set above the upper zone. A conventional insert pump and a tubing pump were used to produce the respective lower and upper zones. The upper-pump standing valve, composed of three API balls and seats recessed in the crossover shoe, was run as an integral part of the tubing string. The lower rod string and pump were actuated by a polished rod attached to the plunger of the upper pump that stroked through a pack-off assembly below the upper pump. The upper-zone fluid was taken into the pump suction at the crossover shoe and was pumped up the tubing. The lower-zone fluid was conducted through a jacket around the upper pump and was discharged above the upper packer into the annulus between the tubing and casing.

Locking Device

During the installation of this equipment the locking device on the pack-off assembly between the two pumps proved troublesome to latch. This device was held in an upward position until the pumps had been lowered to the desired position in the well. Then, jarring of the rod string was supposed to dislodge the positive lock permitting it to fall downward and lock the pack-off assembly into place in the tubing string. Three round trips with the rods and pumps were required to accomplish this.

Typical tests using this equipment are listed in Table 1.

New designs, in pumps adaptable to dual-zone pumping and in other dual equipment, were perfected and made available to the oil producer subsequent to this installation. A 2 1/2-inch model dual-zone pump was developed that was superior to the 2-inch model installed in Well A. It eliminated the troublesome and difficult method for latching the 2-inch model in place in the tubing and permitted the use of two insert pumps, instead of one tubing pump and one insert pump. About the same time a two-stage pump was designed. This pump is basically a stationary-barrel, bottom-anchor pump with a hollow, perforated, polished rod substituted for a pull rod and with a second traveling valve, which supports the fluid column during all or part of the downstroke. There is an annular chamber above the plunger into which all or part, depending upon the pump efficiency, of the fluid swept from the suction chamber by the plunger is displaced on the downstroke.

This two-stage pump is almost impossible to gas lock, and should continue to pump although any one of its three valves has failed. If the upper traveling valve should fail, it would revert to a conventional pump; if either the intermediate traveling valve or the bottom standing valve should fail, it should continue to pump with reduced efficiencies. The new 2 1/2-inch model equipped with a two-stage pump alleviates to some extent two major problems inherent in the pumping equipment shown as Fig. 1: (1) all produced gas from both zones must pass through the pumps, (2) the recovery of the working barrel and standing valve for the upper pump for repairs requires a tubing job.

Conventional Pumps

In March 1954, the equipment in Well A was converted to the newer 2 1/2-inch model shown as Fig. 2, except conventional pumps instead of two-stage pumps were

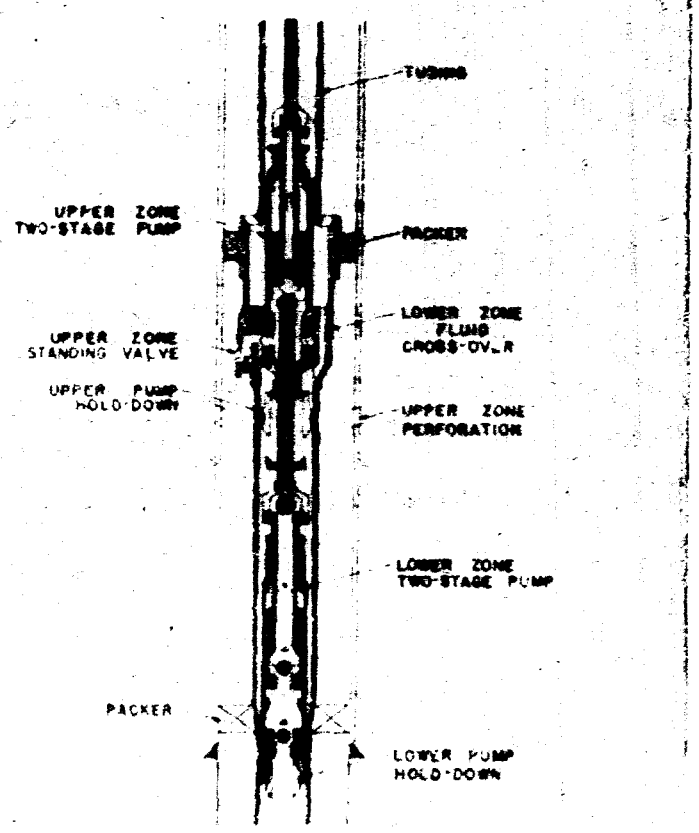


FIG. 2 DOUBLE-PACKERS, SINGLE STRING DUAL-ZONE PUMP INSTALLATION WITH TWO TWO-STAGE PUMPS

Production Tests - Table 2

Well No.	Pay	Depth Feet	Date	Hours Tested	Production - Bbls. Oil	Water	GOR	Pump Efficiency Percent	Remarks
A	5600	5447	8-25-54	24	21.2	0.4	3726	10.1	Unvented
	5600	5447	1-17-55	24	21.9	0	6257	20.2	Unvented
	5600	5447	7-26-57	18	23.2	0	1897	23.1	Unvented
	Clearfork	6235	7-21-55	24	19.4	0	14423	6.7	Unvented
	Clearfork	6235	3-9-57	24	8.9	0	33208	5.7	Unvented
B	5600	5317	1-12-55	24	13.6	0	3382	12.5	Unvented
	5600	5317	7-30-57	12	6.1	0	5410	11.2	Unvented
	Clearfork	6339	11-26-54	24	19.0	0	1684	15.8	Unvented
	Clearfork	6339	9-11-57	10	8.0	0	1625	15.1	Unvented

used. Following this installation production from both zones was lower than had been anticipated. The 5600' pay (upper zone) produced a daily average of 22 barrels of clean oil with a gas-oil ratio of 2200 to 1, and the Clearfork pay (lower zone) produced a daily average of 10 barrels of clean oil with a gas-oil ratio of 5000 to 1. Due to the high gas-oil ratios, gas locking of the pumps appeared to be a possible cause for the low production. In May 1954, the conventional insert pumps were replaced with two-stage pumps in an attempt to alleviate this condition. After stabilization of production, the 5600' pay produced a daily average of 45 barrels of clean oil, and the Clearfork pay produced a daily average of 26 barrels of clean oil. This is an increase in production, attributed to the installation of two-stage pumps, amounting to 205 and 260 percent from the respective 5600' and Clearfork pays.

Similar equipment to that shown in Fig. 2 was also installed in Well B in August, 1954. Representative tests using this combination of pumping equipment are shown in Table 2.

Both wells pump off, which accounts for the low pump efficiencies. Production is generally comparable to the yield of nearby single-zone producers.

The pumps in Well A have been pulled a total of four times since installation of the converted equipment in March, 1954. Each of these pulling jobs was necessary for annual bottom hole pressure measurements of the upper 5600' pay according to the Railroad Commission orders; the pumps were serviced at these times. In order to obtain a true bottom hole pressure of the upper zone, a wireline retrievable plug is set in the lower-pump shoe, thereby blanking off lower-zone fluid.

Operation in Well B

In Well B during the first 1-1/2 months of operation the sucker rods and pumps only were pulled three times, and the tubing, sucker rods, and pumps were pulled one time. Debris from jet shots, swab rubbers, packer rubbers, lost circulation materials, and cuttings plugged the pumps and the tubing crossover. Since the well was cleaned of this debris approximately 3-1/2 years ago the pumps have not required servicing. The pumps were pulled three times for annual bottom hole pressure measurements and once when the sucker rods unscrewed.

The dual-zone pumping equipment in both wells has given excellent service since removal from the well bores of debris deposited during initial completion and during the flowing life of the wells. Possibly, production would have been slightly improved if both zones could have been vented. However, the relative displacement of the pumps, compared with the fluid yield from the pay zones, is great enough that considerable pump displacement can be sacrificed to the production of gas without a loss in oil production. The large volume of the tubing-casing annulus, which serves as a conduit to transmit lower-zone fluid to the surface, proves somewhat troublesome. Since lower-zone production has been 19 barrels or less per day and the tubing-casing annulus will hold approximately 150 barrels, it is sometimes difficult to determine whether the lower-zone pump is functioning properly or not.

The two-packer combination, which currently can be obtained in the newer model in both the 2-inch and 2 1/2-inch sizes, still is applicable for some wells. For instance, it usually results in the smallest initial investment since it only requires one tubing string. This equipment can also be run in small-bore casing, which may prevent the installation of some other methods.

This subsurface hook-up imposes a number of restrictions on each zone due to its lack of flexibility. For example, neither zone can be treated with hot oil, corrosion inhibitor, or paraffin solvent, nor can fluid be circulated, gas be vented, or fluid level measurements be taken from either zone.

SINGLE-PACKER, DOUBLE-CLAMPED-STRINGS

A dual-zone pumping installation of the type schematically illustrated in Fig. 3 was installed in Well C in October, 1954. This installation differed from the double-packer, single string method in that parallel strings of 2 1/2-inch and 1 1/4-inch tubing were clamped together and run in place of a 2 1/2-inch tubing string and packer. The remainder of the equipment was identical. Fluid from the lower zone is produced up the 1 1/4-inch tubing, thereby leaving the tubing-casing annulus available as a gas vent for the upper zone.

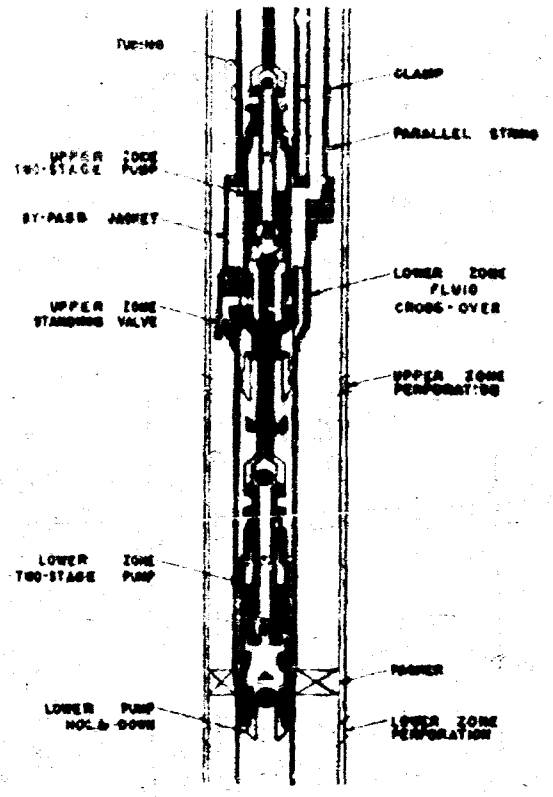


FIG. 3 SINGLE-PACKER DUAL-ZONE-PUMP INSTALLATION WITH DOUBLE-CLAMPED-STRINGS

These parallel tubing strings were preferred rather than the double-packer, single-string method, in order to provide a means for control of severe paraffin deposition from the lower-zone fluid. Hot oil is injected periodically into the casing, with paraffin accumulations from the interior of the tubing being successfully removed by the heat transfer. With this method of hot-oil treatment the pumping equipment is not shut-down, since its operation is desirable during treatment in order to remove melted paraffin.

Sand, suspended in the produced fluid from the lower pay, caused trouble immediately upon completion of this installation. The sand stuck the lower two-stage pump, which is not designed for sand production. A three-tube pump was run for a short time to clean up lower-zone production.

Representative tests from this well are listed in Table 3.

The decline in production during these tests was caused by a similar decline in the productivity of the pay zones. The production rates are very similar to those of nearby single producers.

The dual-zone equipment in Well C has undergone a total of 20 malfunctions in 38 months of operation, which is an average of 1.9 months operation for each service job. Operation of the dual equipment has therefore been extremely expensive. There have been 12 rod jobs to service the pumps, 4 fishing jobs to recover parted rods, and 4 stripping jobs to recover stuck dual-zone equipment. Eighty-five percent of these service jobs occurred during the first 16 months of operation with 15 percent occurring during the next 22 months. Produced sand seems to have been the main source of trouble causing worn pumps, stuck pumps, and stripping jobs. The dual-zone equipment has five locks or seals exposed to well fluids (three to the lower-zone fluid and two to the upper-zone fluid). The rod-string failures were possibly caused by its over stress during attempts to loosen stuck equipment and by over pumping of one or both zones.

When the equipment in Well C was converted in March, 1957, to the popular, independent-string method of dual-zone pumping, the clamps were still firmly attached to the tubing. Clamped-parallel-string installations, however, are hazardous since the buckling of the tubing by pump action could cause the clamps to loosen, fall, and stick the tubing.

SINGLE-PACKER, DOUBLE-UNCLAMPED-STRINGS

Fig. 4 shows a typical schematic drawing of this type of installation. In this subsurface combination only one packer is used to separate the two pay zones. The long string is run and latched into the retainer-type packer. This string is set with sufficient tension to avoid excessive tubing buckling and attendant sucker-rod abrasion during pump action. The short macaroni string, with beveled coupling edges, is then run and landed in the parallel-string landing head integral with the long string of tubing. Two insert pumps are used as in the other installations, with fluid from the lower pump passing up the macaroni string and fluid from the upper pump passing up the long string. This equipment is available in both the 2 1/2-inch and

Production Tests - Table 3

Pay	Depth Feet	Date	Hours Tested	Production - Bbls. Oil	Production - Bbls. Water	GOR	Pump Efficiency Percent	Remarks
Glorieta	4570	3-27-56	24	51.1	1.4	391	31.6	Vented
Glorieta	4570	1-13-56	22.6	56.1	16.6	446	51.6	Vented
Glorieta	4570	1-8-57	24	20.3	1.8	935	11.5	Vented
Fusselman	7574	10-20-54	24	92.5	5.5	714	50.5	Unvented
Fusselman	7574	10-18-56	24	24.9	5.5	803	22.5	Unvented
Fusselman	7574	10-9-57	24	16.4	0.2	433	14.2	Unvented

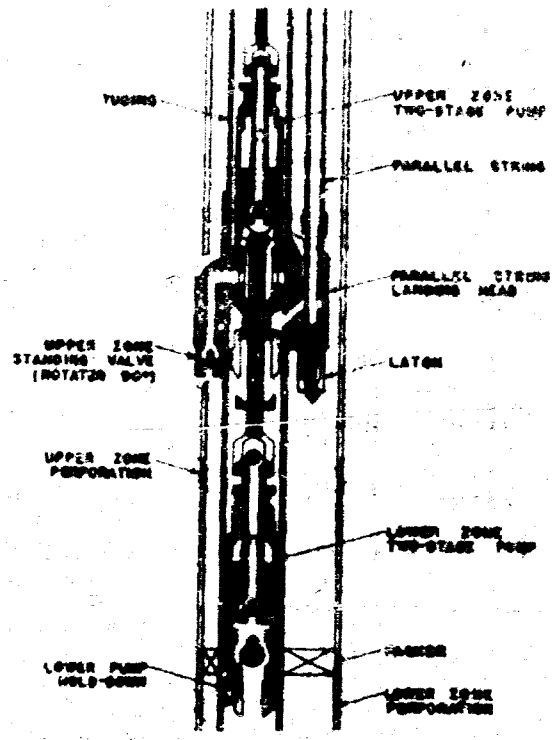


FIG 4 SINGLE-PACKER DUAL-ZONE-PUMP INSTALLATION WITH DOUBLE-UNCLAMPED-STRINGS—BOTH ZONES PUMPING

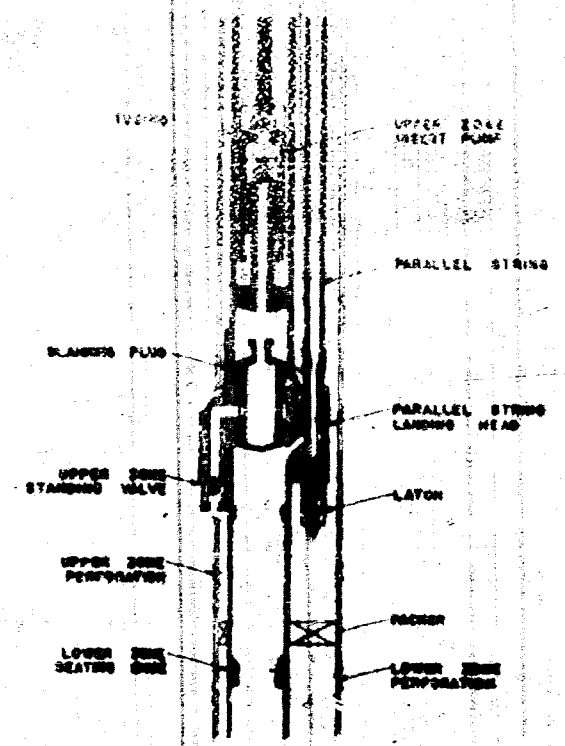


FIG 5 SINGLE-PACKER DUAL-ZONE PUMP INSTALLATION WITH DOUBLE-UNCLAMPED-STRINGS—UPPER ZONE PUMPING, LOWER ZONE FLOWING

2-inch models.

This arrangement of subsurface dual-zone pumping equipment was first installed in Well D in April, 1956. The inadvertent installation of a 5 1/2-inch landing head in 7-inch OD casing caused trouble during installation. The clearance between the landing head and the casing permitted the landing sub on the 1-inch macaroni string to miss the landing head and to wedge between the anchor and the casing. Shoulders were welded on the landing head to correct this condition. Before satisfactory operation of this equipment was obtained the rods, pump, and both tubing strings were round tripped once; the macaroni string alone was round tripped once; and the rods and pumps alone were round tripped twice. Since this installation was completed satisfactorily, it has given nearly 2 years of maintenance-free operation.

A similar installation was performed in Well E in July, 1956. This installation was completed without any trouble whatsoever. It has currently given 1-1/2 years of satisfactory service without a single shutdown to service the subsurface equipment.

Most Economical Approach

Many times the most efficient and economical approach to dual-zone pumping is the installation of separately-landed, parallel-tubing strings with appropriate dual-zone equipment during initial well completion. This procedure eliminates the expenditure to kill and re-enter the well at a later date when one or both zones have ceased to flow. The additional investment required at well completion is especially justifiable and profitable if the flowing lives of the two zones are anticipated to be rather short. Fig. 5 is a subsurface hook-up of an installation of this type. It permits both zones to flow or one zone to pump and the other zone to flow merely by the installation of the proper wireline tool in the crossover shoe. During installation of this equipment, an accurate measurement of the distance between the lower and upper pump shoes must be made and kept available for future reference when tandem pumps are run.

Gulf has six installations of this type. In one well both zones are now pumping; in four wells the upper zone is pumping, and the lower zone is flowing; and in one well the upper zone is flowing, and the lower zone is pumping. Both zones have pumped in Well F since July, 1957. The rods and pumps have been pulled twice to permit servicing of the pumps and packing between the pumps. On one occasion steel shavings damaged the upper pump, and in another instance the metal-to-metal packing between the pumps froze. In wells where only one zone is pumping, the troubles encountered have been common to that of nearby single-zone wells.

Compiled in Table 4 are results from tests on three wells equipped with the single-packer, double-string method of dual-zone pumping.

These single-packer, double-unclamped-string methods are rather versatile and trouble-free because (1) the need for clamps is eliminated, thereby speeding up rig time and removing the hazards associated with clamps, (2) the upper zone can be vented, (3) hot oil, paraffin solvents, and corrosion inhibitors may be injected into the casing, (4) sonic fluid level measurements can be taken for the upper zone, (5) the tubing strings may be run in and pulled out independently, but only in

Production Tests - Table 4

Well No.	Pay	Depth Feet	Date	Hours Tested	Production - Bbls. Oil	Water	GOR	Pump Efficiency Percent	Remarks
D	5600	5750	8-1-56	24	69.8	5.4	3074	39.1	Vented
	5600	5750	9-27-57	8	9.5	0	2000	55.0	Vented
	Clearfork	6239	8-1-56	16	22.1	0	1312	24.3	Unvented
	Clearfork	6239	8-1-57	12	9.7	2.0	2062	16.1	Unvented
E	5600	5683	9-27-56	24	23.1	0	5195	17.4	Vented
	5600	5683	9-28-57	5	9.7	0	2062	35.1	Vented
	Clearfork	6246	9-8-56	24	13.2	0.6	5303	9.9	Unvented
	Clearfork	6246	7-26-57	24	5.5	0	11455	3.9	Unvented
F	Tubb	4900	9-11-57	24	80.1	21.3	325	66.1	Vented
	Tubb	4900	12-5-57	24	79.7	28.0	289	70.0	Vented
	Wolfcamp	6300	9-11-57	24	63.4	12.0	804	46.6	Unvented
	Wolfcamp	6300	12-6-57	24	51.2	34.1	645	52.7	Unvented

a certain order: the long string must be run first, while the short string must be pulled first, and (6) one or both zones may be allowed to flow and may be placed on pump at a later date without disturbing the tubing.

SINGLE-PACKER, DOUBLE-UNCLAMPED-STRINGS WITH DOUBLE-BY PASSES

This unique installation is shown schematically as Fig. 6 and was installed in Well G in August, 1956. When this equipment was installed, considerable doubt existed as to whether it would perform satisfactorily; however, the design appeared sound from an engineering standpoint. This design is an adaptation of the usual dual-zone equipment, which permits the shoe for the upper-zone pump to pass into a 5-inch OD (18#) liner in order to attain complete depletion of the upper zone.

This subsurface arrangement utilizes a double by-pass, 550 feet of hollow sucker rods, one retainer-type packer, and two unclamped tubing strings. The hollow sucker rods act as a conduit for upper-zone fluid to a point just above the 5-inch OD liner where a cross-over directs the production into a 1-inch macaroni string. The lower-zone fluid produces through the 2-inch tubing for the entire distance from the pump to the surface, except that it must traverse two bypass shoes.

The only source of trouble during this installation occurred when the macaroni string, which originally was set in tension, became unlatched. This string was reset and left in compression.

This equipment has not required any repairs since its installation 1-1/2 years ago. Table 5 shows some representative production tests from this well.

The production from Well G is comparable to the production from nearby single-zone producers.

This type of installation would rarely have an application. It is shown merely to illustrate how standard dual-zone equipment can be deviated to suit any unusual conditions existing in a particular well. The principle

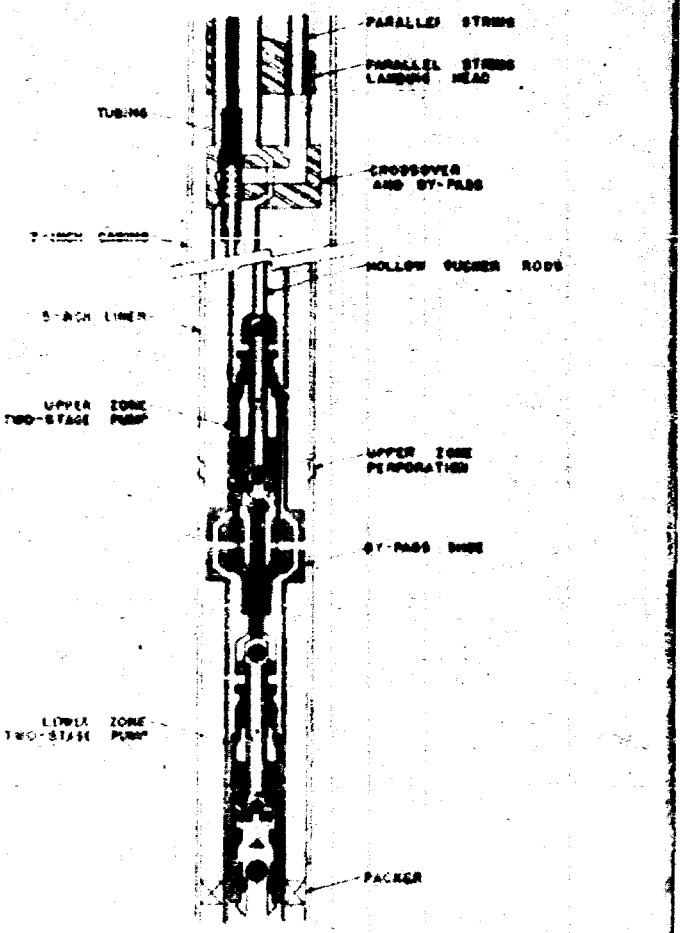


FIG. 6 SINGLE-PACKER, DUAL-ZONE-PUMP INSTALLATION WITH DOUBLE-UNCLAMPED-STRINGS, DOUBLE BY-PASS, AND HOLLOW SUCKER RODS

Production Tests - Table 5

Pay	Depth Feet	Date	Hours Tested	Production - Bbls. Oil	Water	GOR	Pump Efficiency Percent	Remarks
5600'	5810	2-15-57	24	46.1	0	3471	65.0	Vented
5600'	5810	8-2-57	24	6.8	0	19118	9.6	Vented
Clearfork	6050	3-5-57	24	15.2	0	4934	15.2	Unvented
Clearfork	6050	7-19-57	17	11.3	0	2568	16.0	Unvented

application of this hook-up would likely be in a well, similar to the one shown, containing a small-bore liner. The "double bypass" arrangement might prove applicable where it is desirable for the lower zone to produce up the long string and for the upper-zone production to divert into the parallel string.

SINGLE-PACKER, TRIPLE-STRING

Fig. 7 is a schematic drawing depicting the latest dual-zone tubing assembly installed in two wells during initial completion. The upper zone is equipped to pump, while the lower zone is flowed. When the lower zone ceases to flow, a second pump will be run and seated in a shoe provided in the tubing string.

This arrangement consists of the standard dual-zone equipment and two parallel strings of 2-inch tubing with 1-inch vent tubing extending beneath the shorter string downward through the packer. The crossover shoe with landing head is run on the long string and a landing sub is run on the bottom of the short string. A ball-and-seat arrangement with a fishing neck attached is installed in a seat on top of the 1-inch vent tubing. This valve remains closed except when the pressure buildup below it exceeds the fluid head. At a later date, should the lower-zone pump gas lock, the ball-and-seat arrangement can be pulled and a 3/4-inch vent string can be substituted inside the shorter tubing string.

In this system the long string conducts upper-zone fluid to the surface. The parallel string conducts the lower-zone fluid from the crossover shoe to the surface, while the 3/4-inch concentric string, when installed, will conduct the lower-zone gas from below the packer to the surface. The casing serves as a vent for the upper zone.

Landing Sub Leaked

In both installations of this type the landing sub on the bottom of the short string leaked. There was considerable money expended to locate the leak in each well and to pull and rerun the short string. The cause of these leaks was apparently not due to faulty equipment but to insufficient weight being set on the short string. This was the only trouble experienced with one installation. In the other installation, however, the sealing elements in the retainer-type packer also leaked. A successful completion of this well was obtained after several months had expired, in which large expenditures were incurred in testing and service work.

Since the single-packer, triple-string method requires an extra string of 2-inch tubing, it is usually more expensive than any of the other methods mentioned. Otherwise this installation has all the advantages of the single-packer, double-string model, plus some additional ones. The advantages of the single-packer, triple-string assembly over all other methods are made possible by the 3/4-inch vent string. This vent string (1) provides a means for venting lower-zone gas, (2) can serve as a conduit for corrosion inhibitor injection to the lower-zone pump when it is not used to vent gas, and (3) permits circulation of lower-zone production if such action is desirable to avoid overproduction.

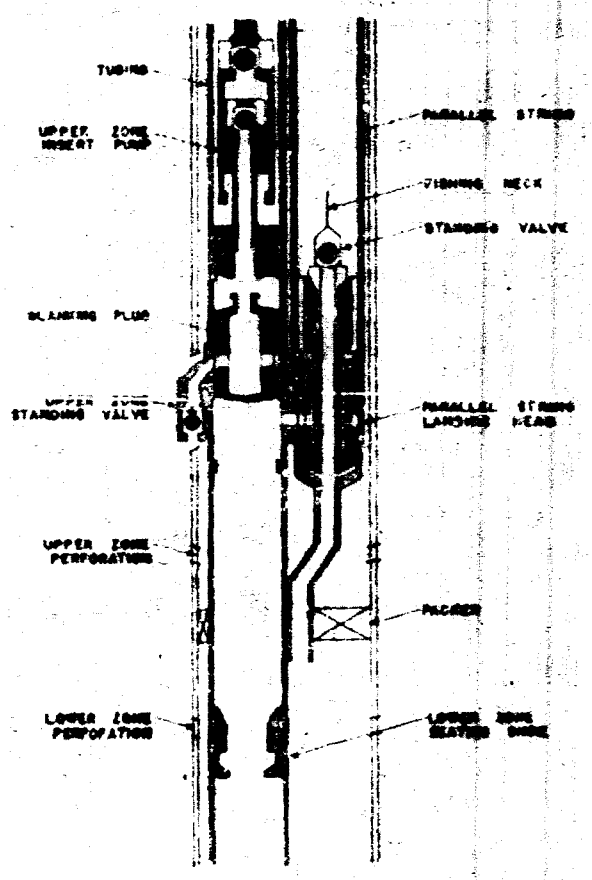


FIG. 7 SINGLE-PACKER DUAL-ZONE-PUMP INSTALLATION WITH TRIPLE-UNCLAMPED-STRINGS — UPPER ZONE PUMPING, LOWER ZONE FLOWING

DISCUSSION AND CONCLUSIONS

Our experience with tandem pumps indicates that as a general rule this equipment will give satisfactory service. The newer designs should eliminate or minimize some objectionable features of earlier models. However, problems and difficulties are usually inherent qualities of dually completed wells with out without pumping equipment. Dual-zone pumping certainly involves more problems than single-zone pumping.

Most dual-zone pumping equipment problems have occurred during installation or immediately thereafter. In some wells the installation was made without mishap. In other wells random difficulties developed, usually attributable to failure of a latch to lock into place or a seal to hold. Possibly the greatest overall source of trouble was caused by the plugging and sticking action of debris and sand during the cleaning-up period immediately following a dual-zone installation. Thorough circulation of the well bore prior to the installation of dual-zone pumps might minimize this difficulty.

In one well, in which the lower zone and possibly the upper zone produce fluids that contain small amounts of suspended solids, the operational costs have been extremely high. The equipment malfunctions experienced in the operation of dual equipment in this well, and the difficulties resulting from the production of solids during and immediately following the completion of other installations, suggest that a concerted effort should be made to keep the production of sand and debris at a minimum. Newer designs in tubing assemblies and associated equipment have reduced the number of seals exposed to well fluids, which should decrease to a small extent the possibility that sedimentation of solids might stick the pumping equipment.

Subsurface Repairs

Disregarding the aforementioned well in which the production of sand caused excessive repairs, the remaining six wells equipped with tandem pumps have suffered very little downtime for subsurface equipment repairs. These installations, following a short clean-up period, have operated a total of 150 months with only three pulling jobs that were solely the result of equipment malfunctions. Unscrewed rods caused one of these service jobs. These installations, therefore, have averaged 50 months of operation for each pulling job. The rods in two wells, however, were pulled several times for annual bottom hole pressure measurements, and the pumps were serviced on these occasions.

The two-stage pump has proved its value in the production of foamy or gassy fluid. This feature is particularly advantageous when all produced gas must pass through the pump (pumping from beneath a packer). Since the two-stage pump will usually operate with a faulty standing valve, it is also very useful as an upper-zone pump where it may minimize or eliminate the need for a standing valve integral with the tubing string. This pump, however, should not be used in wells where the produced fluid contains suspended sand.

The most logical conclusion regarding pump efficiencies is that tandem pumps will yield efficiencies comparable to single-zone pumps operating under similar conditions. With one exception the wells utilizing tandem pumps have been low producers in which the productivity of each zone has been considerably less than the pump's displacement. Under these conditions the productivity of each zone, and not the pump, usually governs the pump efficiency, accounting for most of the low efficiencies.

Advantages and Disadvantages.

Dual-zone pumping using tandem pumps has distinct advantages and disadvantages. Some advantages are: (1) smaller initial cost in comparison with other methods, (2) compatibility with casing designs in most wells, and (3) elimination of upkeep of two pumping units. The main disadvantages are: (1) lack of simplicity compared to some methods, (2) inability of equipment to handle suspended sand as well as some other methods, (3) loss of production from both zones due to the servicing of down-hole equipment for one zone, (4) pumping depth and quantity of production limited by strength of rods, and (5) lack of flexibility even in the most advanced models.

The flexibility has improved considerably in the last few years mainly through deviations in tubing assemblies; however, the pumping speed, pumping time, and length of stroke are by nature of this equipment still the same for both zones. This condition sometimes makes difficult the regulation of production from the two zones, since one zone may overproduce while the other zone is underproduced. Some means for varying the production from one zone are: (1) changing the pump size, (2) circulating production, (3) unseating pump (applies only to the lower pump), and (4) allowing the pump to pump through itself by use of a traveling overload valve on the pump.

The tandem pumping method has demonstrated its value as a means for producing dually completed wells. Like any type of oilfield equipment, however, it has its limitations, and should be thoroughly engineered to suit conditions existing in each specific well.

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

COPY

March 20, 1959

Cities Service Oil Company
P. O. Box 97
Hobbs, New Mexico

Attention: Mr. E. F. Motter

Gentlemen:

Reference is made to Commission Order No. R-1298-A, entered by the Commission February 2, 1959, which authorized Cities Service Oil Company to dually complete its State "P" Well No. 3, located in the SW/4 SW/4, Section 32, Township 22 South, Range 38 East, Lea County, New Mexico, in the Blinebry Oil Pool and in an undesignated Glorieta oil pool, and to produce said pools by means of dual-zone type pumping equipment.

Order R-1298-A further provides that the operator of the well shall make such tests as the Secretary-Director may prescribe from time to time.

Cities Service Oil Company is hereby directed to conduct pressure tests, immediately upon installation of the dual zone pumping equipment and at least once each month thereafter, to insure that leakage and communication between the separate pools is not occurring in the dual zone equipment. These pressure tests shall be conducted in accordance with the instructions enclosed herewith.

Very truly yours,

A. L. PORTER, Jr.,
Secretary-Director

ALP/DSN/ir

cc: Oil Conservation Commission - Hobbs, New Mexico

INSTRUCTIONS FOR PRESSURE TESTS, DUAL ZONE PUMPING EQUIPMENT

1. Upon installation of the dual-zone pumping equipment, there shall be installed in the flow-line leading from each zone of the dual completion one valve and one pressure gauge located up-stream from said valve.
2. Operator shall close the valve on the lower zone flow-line and leaving the other valve open, run the pumping unit until the pressure on the closed-in flow line reaches a minimum of 350 psig.
3. The pumping unit shall then be shut-down and the valve on the upper zone flow-line closed immediately.
4. Both valves shall remain closed a minimum of 30 minutes. Pressure readings on both gauges shall be taken and recorded every 10 minutes.
5. Following conclusion of the first test, the same procedure shall be repeated, with the exception that the test shall commence with the valve on the upper zone flow-line closed and the lower zone valve open.
6. Operator shall notify the Oil Conservation Commission, Hobbs, New Mexico, at least 24 hours prior to commencement of pressure tests. Pressure tests may be witnessed by Commission representatives at their discretion. Results of pressure tests, including all recorded pressures, shall be filed with the Commission's Hobbs office within five days after completion of the tests.

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

February 2, 1959

COPY

Mr. Jason Kellahin
Kellahin & Fox
P.O. Box 1713
Santa Fe, New Mexico

Dear Mr. Kellahin:

On behalf of your clients, we enclose two copies of each of the following orders issued February 2, 1959, by the Oil Conservation Commission:

Order R-1298-A in Case 1557
Order R-1328 in Case 1585
Order R-1329 in Case 1583

Very truly yours,

A. L. Porter, Jr.
Secretary - Director

bp
Encls.

BEFORE THE

OIL CONSERVATION COMMISSION OF

THE STATE OF NEW MEXICO

IN THE MATTER OF THE APPLICATION OF CITIES SERVICE OIL COMPANY FOR PERMISSION TO DUALLY COMPLETE ITS STATE "P" WELL NO. 3 FOR PRODUCTION OF OIL FROM THE BLINEBRY OIL POOL, AND THE PRODUCTION OF OIL FROM AN UNDESIGNATED GLORIETA OIL POOL, LEA COUNTY, NEW MEXICO.

Case No. 1557

APPLICATION FOR DE NOVO HEARING

Comes now Cities Service Oil Company, and pursuant to the provisions of New Mexico Oil Conservation Commission Rule 1120, and as provided by Section 65-3-11.1, New Mexico Statutes Annotated, 1957 Supplement, applies for a hearing de novo before the Commission in the above captioned matter, and in support thereof would show:

1. That by application filed October 28, 1958, Cities Service Oil Company sought approval for the dual completion of its State "P" Well No. 3, located 990 feet from the South line and 990 feet from the West line of Section 32, Township 22 South, Range 38 East, N.M.P.M., Lea County, New Mexico, for the production of oil from the Blinebry formation in the Blinebry Oil Pool, and for the production of oil from the Glorieta formation in an undesignated oil pool.

2. That said application was heard as Case No. 1557 on the Commission's Docket, before Elvis A. Utz, Examiner, on November 19, 1958.

3. That by Order No. R-1290, entered November 28, 1958, the Commission denied said application.

4. That by its application, Cities Service Oil Company proposes to dually complete the said State "P" Well No. 3 in such a manner as to permit the production of oil from the Blinebry Oil Pool and the production of oil from an undesignated Glorieta oil pool through parallel strings of 2-inch tubing utilizing a dual-zone pump operated by a single rod string.

5. That such proposal is in the interests of conservation and the prevention of waste, and should be approved.

Wherefore applicant prays that this matter be set for de novo hearing before the Commission as provided by law and the rules and regulations of the Commission, and after notice and hearing as provided by law, said application be approved.

Respectfully submitted,

CITIES SERVICE OIL COMPANY

Kellahin and Fox
Santa Fe, New Mexico

Attorneys for Applicant

By: Jason W. Kellahin

— Pan Payne - Falls
— Nutter — Brough
— Fisher
— Lutz

FOREMOST IN THE INDUSTRY

oilmaster

dual zone pumps

. . . a compilation of selection charts, rod and tubing assemblies, schematic drawings and pack-off sub-assemblies designed to assist in the proper design of your Oilmaster Dual Zone Installation

FLUID PACKED PUMP CO. • • Los Nietos, California

BULLETIN — 5702

SELECTION OF DUAL ZONE PUMPS

There are numerous considerations influencing the selection of Dual Zone Pumping Equipment. The following information and the selection chart on the next page are submitted as a guide to assist in selecting the optimum Oilmaster Equipment based on the specific requirements of the well under consideration:

The first selection is usually between the single packer and double packer installation.

A. The double packer single string is the least expensive installation since it uses the annulus between the tubing and casing to conduct the lower zone production to the surface.

B. The single packer double string installation is more versatile since it permits venting gas from the upper zone at the casing head, it permits treating the upper zone with inhibitor or other additives, it permits returning a portion of the production where upper zone allowable is exceeded, and it permits hot oil application down the casing for paraffin control in either string.

C. The single packer triple string model offers all the advantages of the single packer double string model, plus complete control of the lower zone as well.

The second selection is the casing size. Equipment for each type of installation is available for 5-1/2 in., but in the double and triple string models there are definite limitations that in many instances permit design of better equipment for 7 in. casing.

The third selection is the tubing size. Where volumes are within the capacity of insert pumps in 2 in. tubing, and calculated rod loads are within the limits of a tapered string of 7/8 in. and 3/4 in. rods, 2 in. tubing is the most economical and provides the greatest choice of Dual Zone Equipment. Where fluid volumes or rod loads are high, 2-1/2 in. tubing will be required. Unfortunately, because the larger tubing uses more of the available space in the casing, certain models possible with 2 in. cannot be designed for use with 2-1/2 in. tubing.

Once a type of installation compatible with the casing program and the tubing size is selected, the proper upper zone pump may then be selected based on stroke length of the unit and volume required. Most upper zone pumps are available in either Conventional or Ratio-Compound designs. In most cases, the Ratio-Compound is desirable because this design normally operates at a higher efficiency and eliminates the hazard of fluid pound.

DUAL ZONE PRODUCTION EQUIPMENT CHART
for selection of TUBING ASSEMBLY,
ROD ASSEMBLY and UPPER ZONE PUMP

TYPE OF INSTALLATION	CASING SIZE	TUBING ASSEMBLY	MAX. STROKE	INTERCHANGEABLE UPPER ZONE PUMPS: PUMP BORE	BORE FACTOR	CONVENTIONAL ROD ASSEMBLY	RATIO-COMPOUND ROD ASSEMBLY
			2" TUBING				
DOUBLE PACKER SINGLE STRING	5-1/2" *	DZT20201-6	110"	1-1/4	.093	DZR2026-6	--
				1-1/2	.173	DZR2033-6	DZR2033-6LRC
		DZT20201-10	182"	1-1/4	.093	DZR2026-10	--
				1-1/2	.173	DZR2033-10	DZR2033-10LRC
SINGLE PACKER DOUBLE STRING	5-1/2"	DZT2092-55	73"	1-1/4	.093	DZR2090-26124	--
				1-1/2	.173	DZR2090-33124	DZR2090-312
	7"	DZT2092-70	109"	1-1/4	.093	DZR2090-26165	--
				1-1/2	.173	DZR2090-33165	DZR2090-316
SINGLE PACKER TRIPLE STRING	5-1/2" *	DZT2090	181"	1-1/4	.093	DZR2090-26225	--
	7"	DZT2093-70		1-1/2	.173	DZR2090-33225	DZR2090-322
			2-1/2" TUBING				
DOUBLE PACKER SINGLE STRING	5-1/2" *	DZT25201-6	108"	1-1/2	.173	DZR2536-6	DZR2536-6LRC
				1-3/4	.268	DZR2546-6	DZR2546-6LRC
				2	.378	DZR2553-6	DZR2553-6LRC
		DZT25201-10	180"	1-1/2	.173	DZR2536-10	DZR2536-10LRC
				1-3/4	.268	DZR2546-10	DZR2546-10LRC
				2	.378	DZR2553-10	DZR2553-10LRC
SINGLE PACKER DOUBLE STRING	7"	DZT2592-70	74"	1-1/2	.173	DZR2592-36124	DZR2592-312
				1-3/4	.268	DZR2592-46124	DZR2592-412
				2	.378	DZR2592-53124	DZR2592-512
			109"	1-1/2	.173	DZR2592-36165	DZR2592-316
				1-3/4	.268	DZR2592-46165	DZR2592-416
				2	.378	DZR2592-53165	DZR2592-516
			181"	1-1/2	.173	DZR2592-36225	DZR2592-322
				1-3/4	.268	DZR2592-46225	DZR2592-422
				2	.378	DZR2592-53225	DZR2592-522

* Or larger

CHART for selection of LOWER ZONE PUMP

TUBING ASSEMBLY	PUMP BORE	TYPE PUMP	BORE FACTOR
DZT20201-6 DZT20201-10 DZT2090 DZT2092-55 DZT2092-70 DZT2093-70 DZT25201-6 DZT25201-10	1-1/16"	INSERT	.132
	1-1/4"	INSERT	.182
	1-1/2"	INSERT	.262
	1-3/4"	TUBING	.357
DZT2592-70	1-1/16"	INSERT	.132
	1-1/4"	INSERT	.182
	1-1/2"	INSERT	.262
	1-3/4"	INSERT	.357
	2"	INSERT	.466
	2-1/4"	TUBING	.590

** Any of the DZR2090 Rod Assemblies may be installed in the DZT2090, DZT2092, and DZT2093 Tubing Assemblies.

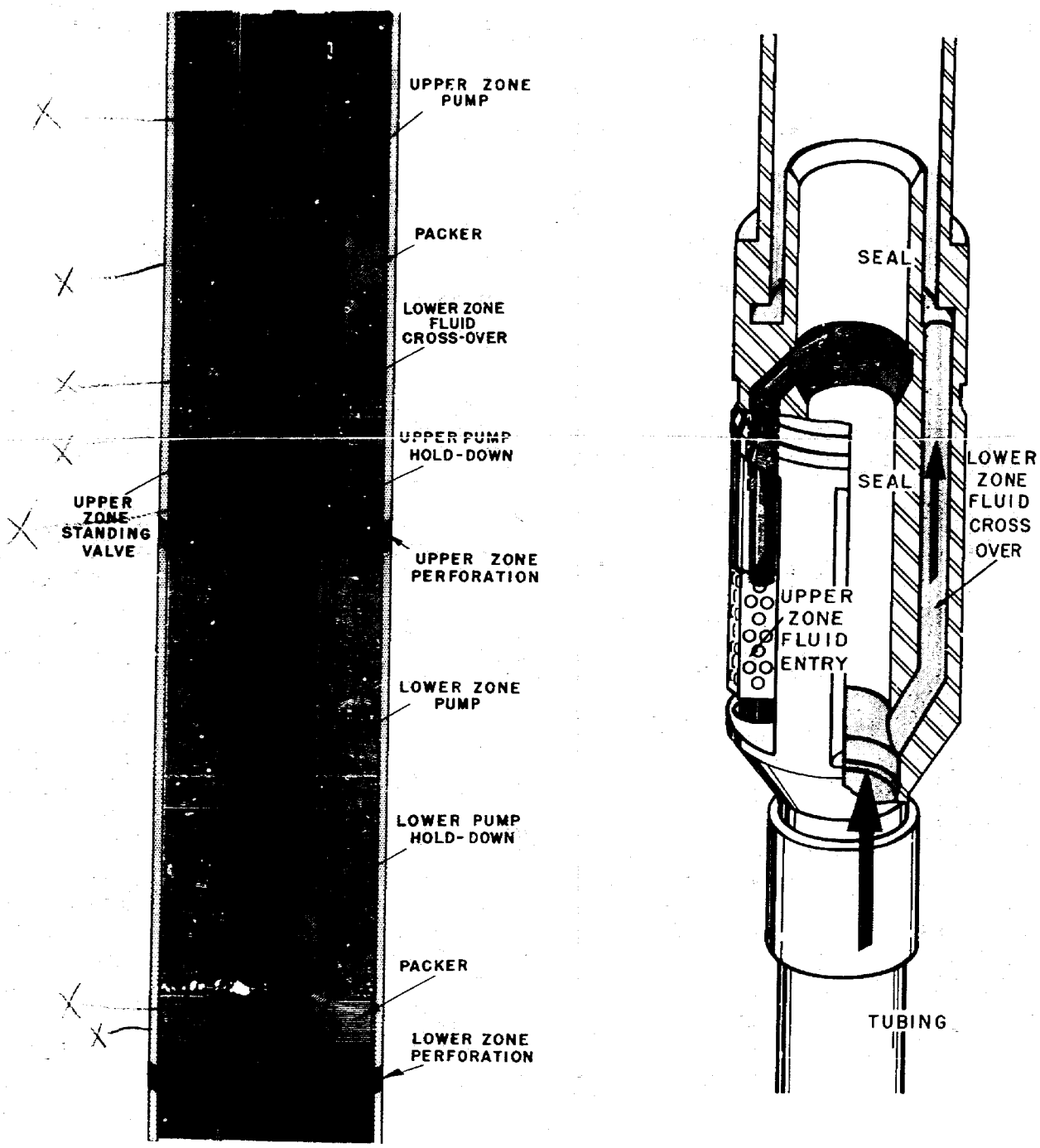
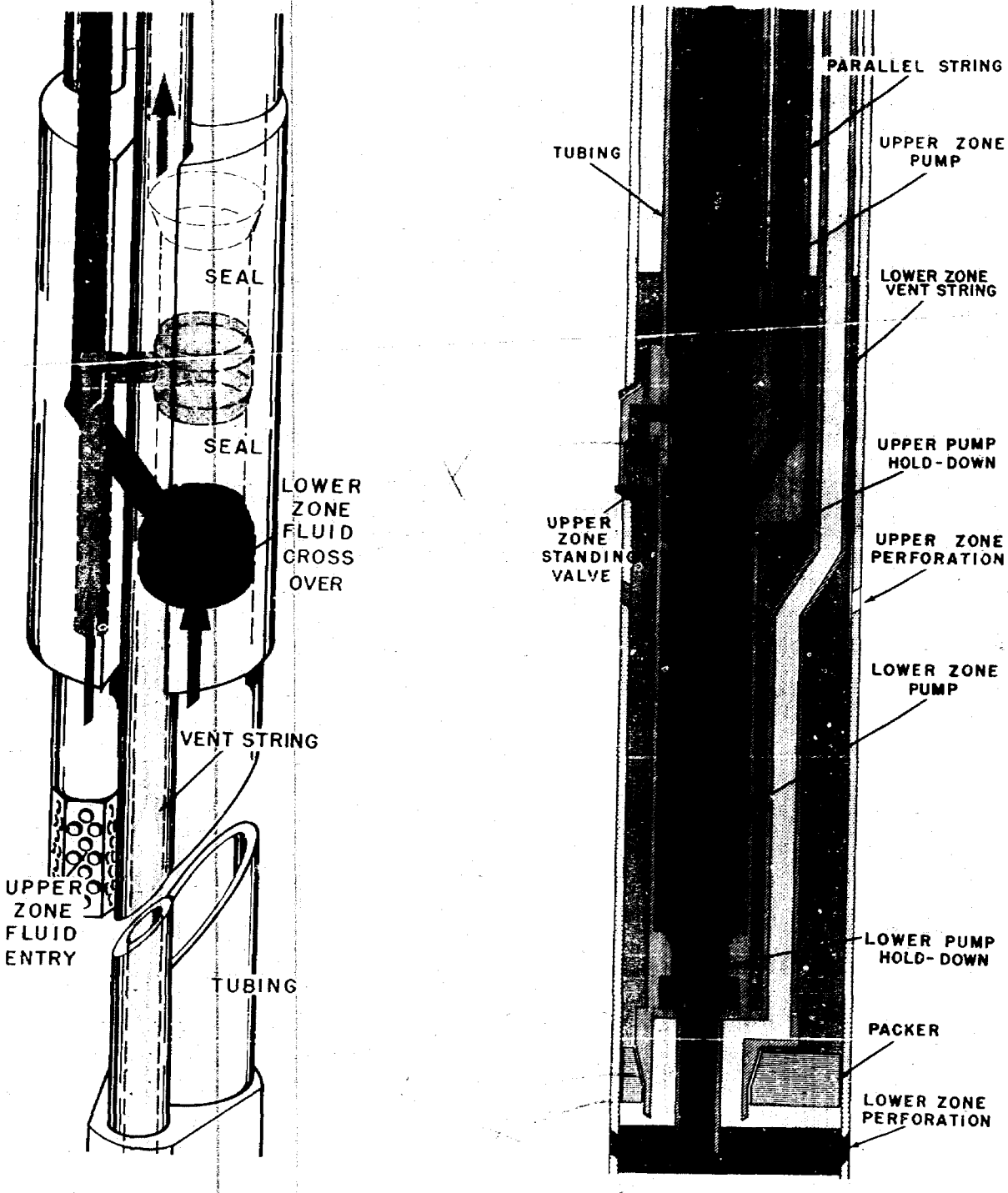


FIG. 1
DOUBLE PACKER SINGLE STRING
Installation Typical of
DZT20201-6 **DZT25201-6**
DZT20201-10 **DZT25201-10**

In the **DZ20201** and **DZ25201**, the lower packer separates the perforated intervals of the upper and lower zone, while the upper packer is set above the upper zone perforations. Both upper and lower zone pumps are positioned in a single string of tubing and are run in, operated, and pulled with a single string of rods. Lower zone production is directed into the annulus above the upper packer and is conducted through this annulus to the surface. Upper zone production is drawn into the upper pump below this packer and is conducted to the surface by the tubing string. No gas is vented from either zone.



In the **DZ2090** installation a packer separates the perforated intervals of the upper and lower zone. Both upper and lower zone pumps are positioned in the long string of tubing and are run in, operated, and pulled with a single string of rods. The long string conducts the upper zone production to the surface, a second string of tubing conducts the lower zone gas from below the packer to the surface, and a third string conducts the lower zone fluid from the crossover shoe to the surface. Gas from the upper zone is vented up the casing. The two shorter strings are clamped onto the long string and they are run into the well together. The vent string passes the crossover shoe in a slot provided for this purpose. The **DZ2090** is designed to run in 5½ in. casing.

FIG. 2
SINGLE PACKER TRIPLE STRING
Installation Typical of
DZT2090

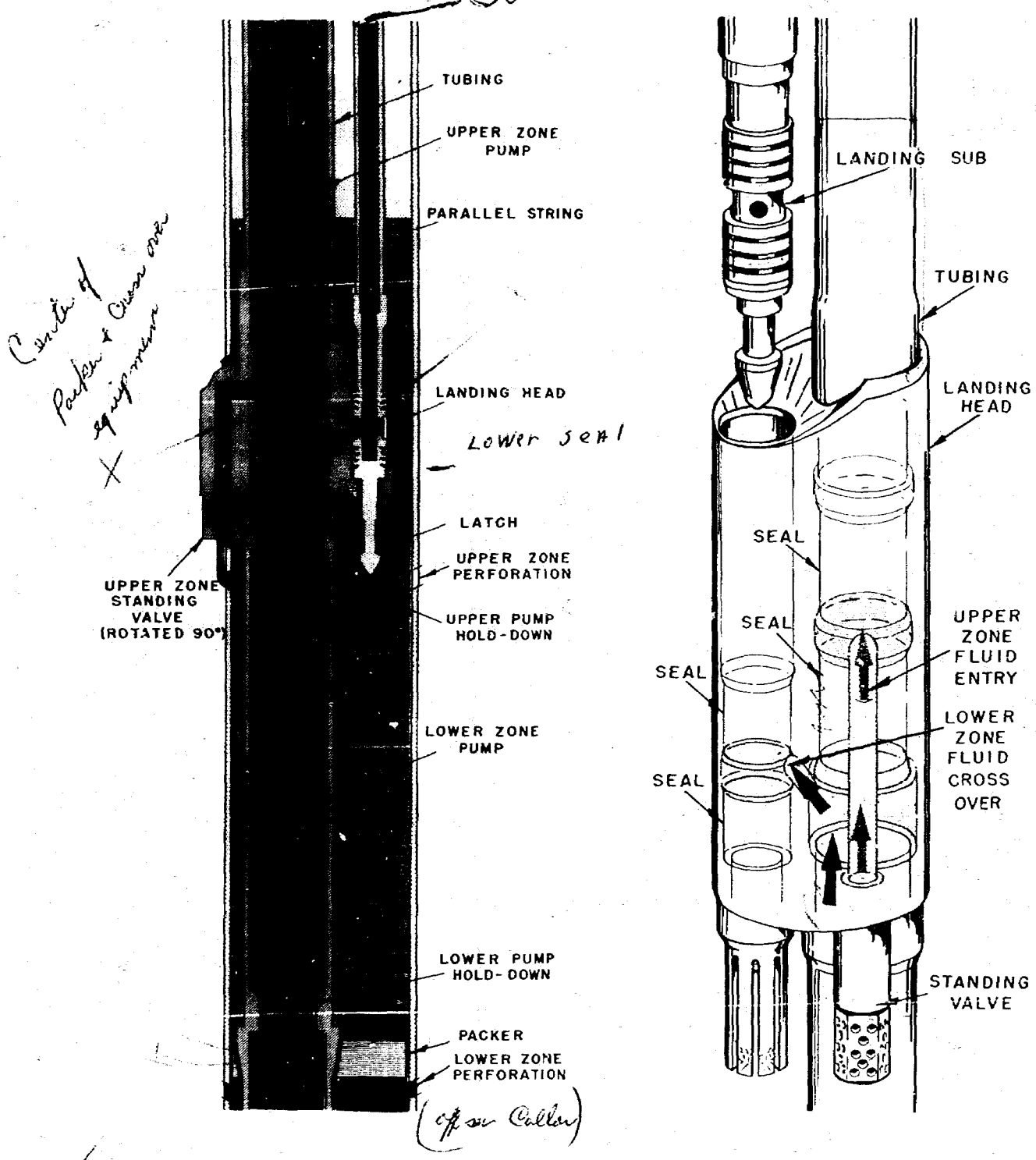
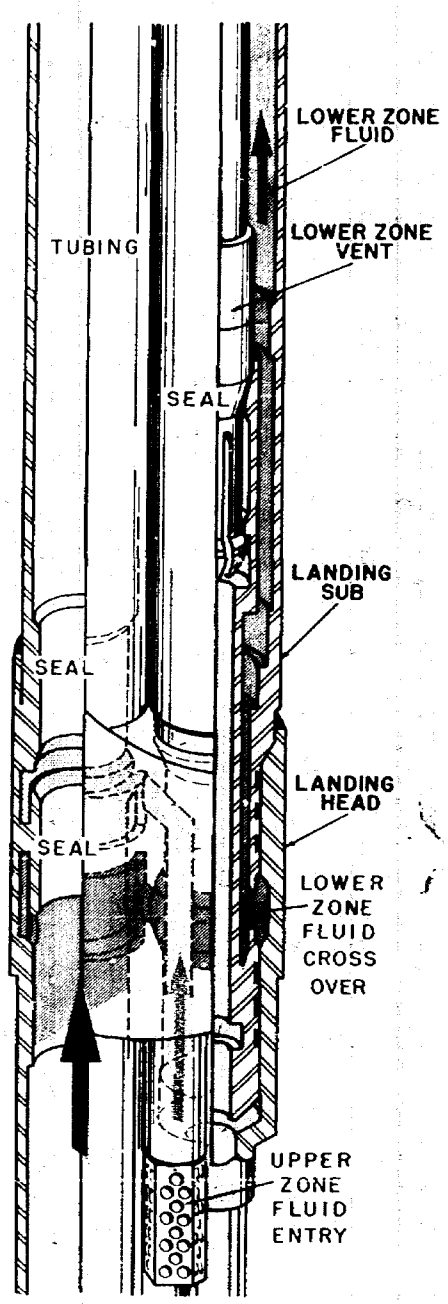
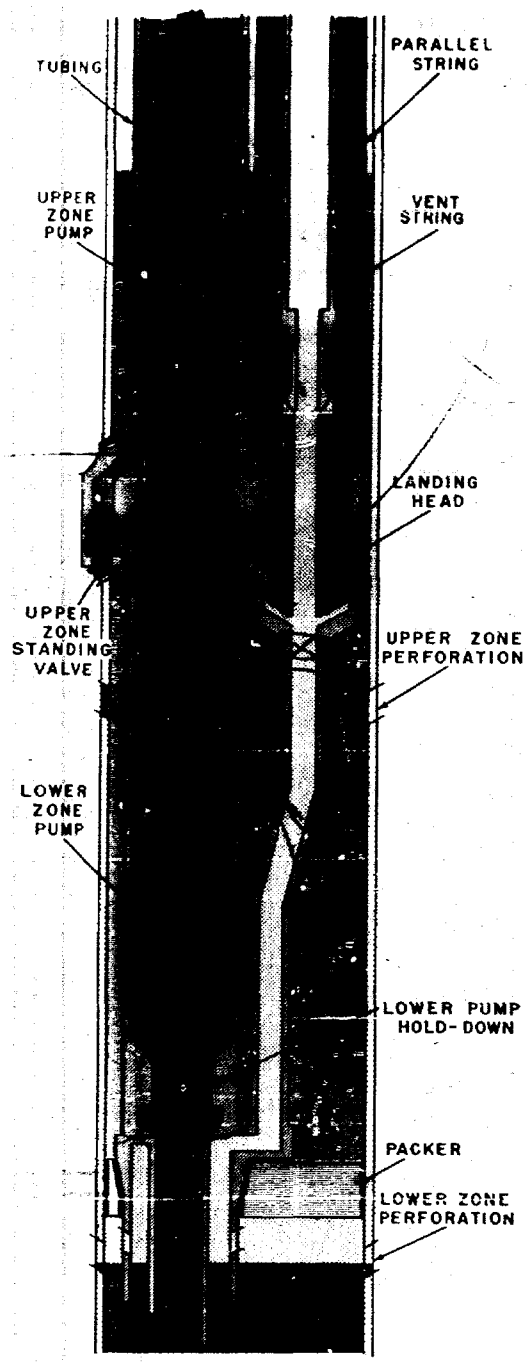


FIG. 3
SINGLE PACKER DOUBLE STRING
Installation Typical of
DZT2092-55 **DZT2092-70**
DZT2592-70

In the **DZ2092** and **DZ2592** installations, a packer separates the perforated intervals of the upper and lower zone. Both upper and lower zone pumps are positioned in the long string of tubing, and are run in, operated, and pulled with a single string of rods. The long string conducts the upper zone production while a second string of tubing conducts the lower zone production to the surface. No gas is vented from the lower zone, but gas from the upper zone is vented up the casing. The two tubing strings are run independently. The crossover shoe with integral landing head is run in on the long string. A landing spear is run on the bottom of the short string. This spear is automatically guided into place by the landing head and the seal elements are properly positioned by a no-go ring and latch.





In the **DZ2093** installation, a packer separates the perforated intervals of the upper and lower zone. Both upper and lower zone pumps are positioned in the long string of tubing, and are run in, operated, and pulled with a single string of rods. The long string conducts the upper zone production to the surface, a second parallel string conducts lower zone fluid from the crossover shoe to the surface, and a third concentric string run inside the second string conducts the lower zone gas from below the packer to the surface. Gas from the upper zone is vented up the casing. All strings are separately run. The crossover shoe with integral landing head is run in on the long string, which is 2⅜ in. EUE tubing. A landing spear is run on the bottom of the second string which is also 2⅜ in. EUE tubing. This is landed in the receptacle in the crossover shoe. The third smaller string is run and landed in a shoe inside the short string of 2⅜ in. The **DZ2093** cannot be run in casing smaller than 7 in.

FIG. 4
SINGLE PACKER TRIPLE STRING
Installation Typical of
DZT2093-70

DUAL ZONE ROD ASSEMBLIES, for use with
DOUBLE PACKER SINGLE STRING, DUAL ZONE TUBING ASSEMBLIES
WITH RATIO COMPOUND UPPER ZONE PUMPS

DESCRIPTION	NO. REQ.	PART NUMBERS			
		2" TUBING	2-1/2" TUBING		
		1-1/2"	1-1/2"	1-3/4"	2"
ROD ASSEMBLY COMPLETE WITH 108" MAXIMUM STROKE WITH 180" MAXIMUM STROKE		DZR2033-6LRC DZR2033-10LRC	DZR2536-6LRC DZR2536-10LRC	DZR2546-6LRC DZR2546-10LRC	DZR2553-6LRC DZR2553-10LRC
TRAVELING ASSEMBLY					
CAGE, TOP, 1-1/16" PIN	1	4000-2	4000-2	4000-2	4000-2
SEAT AND BALL, CARBIDE	1	40170A	40170A	40170A	40170A
ADAPTER, CAGE TO HOLLOW ROD	1	05652	15651	15651	15651
HOLLOW POLISHED ROD, PARCO - 6 LENGTH -10 LENGTH	1	 05261-178 05261-250	 15261-196 15261-268	 15261-196 15261-268	 15261-196 15261-268
ADAPTER, HOLLOW ROD	1	05303	15652	15653	15654
PLUNGER, CHROME PLATE	1	3X25-5	3X25-5	4X25-5	5X25-5
PLUNGER, COMPOSITE, ALT.		DZ3X28-5	DZ3X28-5	DZ4X28-5	DZ5X28-5
CAGE, PLUNGER BLIND	1	3X70	3X70	4X70	5X70
SEAT AND BALL, CARBIDE	1	30170A	30170A	40170A	50170A
ADAPTER, POLISHED ROD	1	DZ3X27C	DZ3X27C	DZ4X27C	DZ5X27C
POLISHED ROD, LOWER SEAL - 6 LENGTH -10 LENGTH	1	 DZ2026-186 DZ2026-258	 DZ2026-186 DZ2026-258	 DZ2026-186 DZ2026-258	 DZ2026-186 DZ2026-258
SOCKET, LOCK PULLER	1	DZ2029	DZ2029	DZ2029	DZ2029
STATIONARY ASSEMBLY					
ASSEMBLY, LRC PACKOFF	1	LRC059	LRC159	LRC159	LRC159
ADAPTER, PACKOFF	1	DZ2056	DZ2558	DZ2558	DZ2558
ASSEMBLY, PUMP TOP SEAL	1	DZ20548C	DZ2554	DZ2554	DZ2554
ADAPTER, UPPER BARREL SEAL	1	3030	-	-	DZ5355
EXTENSION, UPPER BARREL - 6 LENGTH -10 LENGTH	1	 - -	 3610-1 3610-2	 4610-1 4610-2	 - -
BARREL, UPPER PUMP - 6 LENGTH -10 LENGTH	1	 3305H-16 3305H-22	 3607H-15 3607H-20	 4607H-15 4607H-20	 5305H-16 5305H-22
EXTENSION, LOWER BARREL	1	-	361016-6	461015-6	-
ADAPTER, LOWER SEAL	1	DZ3355	DZ5361	DZ5361	DZ5361
ASSEMBLY, PUMP LOWER SEAL	1	DZ2040C	DZ2040C	DZ2040C	DZ2040C
ASSEMBLY, CROSSOVER SEAL	1	DZ20549C	DZ20549C	DZ20549C	DZ20549C
PACKOFF, DZ POLISHED ROD	1	DZ20391	DZ20391	DZ20391	DZ20391
LOCK	1	DZ2048	DZ2048	DZ2048	DZ2048

SINGLE PACKER MODELS -- DUAL ZONE TUBING ASSEMBLIES

TRIPLE STRING MODEL for 5½ in. or larger casing. Small Strings for Lower Zone Gas Vent and Lower Zone Production are clamped to a Long String of 2 in. Upset Tubing

DESCRIPTION	NO. REQ.	PART NUMBERS
COMPLETE TUBING ASSEMBLY		DZT2090
SHOE, CROSSOVER	1	DZ20901
ADAPTER, SHOE TO JACKET	1	DZ20902
JACKET, BY PASS	1	DZ2008-41
COLLAR, ANCHOR SHOE	1	DZ20094
ANCHOR RING	1	DZ20112
SHELL, UNIVERSAL SHOE	1	20-9052-1
CAGE, STANDING VALVE	1	3X20
SEAT AND BALL, CARBIDE	1	30170A
PLUG, STRAINER SEAT	1	DZ20904

DOUBLE STRING MODELS WITH INTEGRAL LANDING RECEPTICLE

for Separately run PARALLEL STRING.

DESCRIPTION	NO. REQ.	PART NUMBERS TUBING AND CASING SIZE		
		2" x 5-1/2"	2" x 7"	2-1/2" x 7"
COMPLETE TUBING ASSEMBLY		DZT2092-55	DZT2092-70	DZT2592-70
SHOE, CROSSOVER	1	DZ20921-55	DZ20921-70	DZ25921-70
LOCK, LANDING SPEAR	1	DZ20922	DZ20922	DZ20922
ADAPTER, SHOE TO JACKET	1	DZ20923	DZ20923	-
JACKET, BY PASS	1	DZ2008-35	DZ2008-35	DZ2508-42
COLLAR, ANCHOR SHOE	1	DZ2009-A	DZ2009-A	DZ25092
ANCHOR RING	1	DZ20112	DZ20112	DZ25091C
SHELL, UNIVERSAL SHOE	1	20-9052-1	20-9052-1	25-9052-1
CAGE, STANDING VALVE	2	2X20C	2X20C	3X20C
SEAT AND BALL, CARBIDE	2	20170A	20170A	30170A
STRAINER, SEAT PLUG	2	DZ2005	DZ2005	DZ20904

PARALLEL STRING LANDING SPEAR

with 1½ in. O.D. PRESSURE BALANCED SEALS. SPRING TYPE LOCK for use with Models DZT2092-55, DZT2092-70 and DZT2592-70

DESCRIPTION	NO. REQ.	PART NUMBERS
LANDING SPEAR ASSEMBLY COMPLETE		DZ1034
ADAPTER	1	DZ10341
EXTENSION	1	DZ10342
MANDREL	1	DZ10343
NOSE	1	DZ10344
END RING, CONVEX	2	DZ10345
END RING, CONCAVE	2	DZ10346
SPACER RING	8	DZ10347
SEAL RING	10	DZ10348

DUAL ZONE ROD ASSEMBLIES, for use with SINGLE PACKER, DOUBLE and TRIPLE STRING DUAL ZONE TUBING ASSEMBLIES

WITH RATIO COMPOUND UPPER ZONE PUMPS

DESCRIPTION	NO. REQ.	PART NUMBERS			
		2" TUBING	2-1/2" TUBING		
		1-1/2"	1-1/2"	1-3/4"	2"
ROD ASSEMBLY COMPLETE					
WITH 12 FT. PUMP, MAX. STROKE 73"		DZR2090-312	DZR2590-312	DZR2590-412	DZR2590-512
WITH 16 FT. PUMP, MAX. STROKE 109"		DZR2090-316	DZR2590-316	DZR2590-416	DZR2590-516
WITH 22 FT. PUMP, MAX. STROKE 181"		DZR2090-322	DZR2590-322	DZR2590-422	DZR2590-522
TRAVELING ASSEMBLY					
ROD GUIDE	1	20-61-2	25-61-2	25-61-2	25-61-2
TOP CAGE, 1-1/16" PIN	1	1000-2	4000-2	6000-2	6000-2
SEAT AND BALL, CARBIDE	1	4017CA	40170A	60170A	60170A
ADAPTER, POLISHED ROD TO TOP CAGE	1	15651	15651	25651	25651
HOLLOW POLISHED ROD, PARCO	1				
12 FT. PUMP		15261-160	15261-160	25261-160	25261-160
16 FT. PUMP		15261-196	15261-196	25261-196	25261-196
22 FT. PUMP		15261-268	15261-268	25261-268	25261-268
ADAPTER, POLISHED ROD TO PLUNGER	1	15652	15652	25653	25654
PLUNGER, CHROME PLATE	1				
12 FT. PUMP		3X25-4	3X25-4	4X25-4	5X25-4
16 FT. OR 22 FT. PUMP		3X25-5	3X25-5	4X25-5	5X25-5
PLUNGER, COMPOSITE, ALT.					
12 FT. PUMP		DZ3X28-4	DZ3X28-4	DZ4X28-4	DZ5X28-4
16 FT. OR 22 FT. PUMP		DZ3X28-5	DZ3X28-5	DZ4X28-5	DZ5X28-5
CAGE, PLUNGER BLIND	1	3X70	3X70	4X70	5X70
SEAT AND BALL, CARBIDE	1	30170A	30170A	40170A	50170A
ADAPTER, PLUNGER TO POLISHED ROD	1	DZ3X27C	DZ3X27C	DZ4X27C	DZ5X27C
POLISHED ROD, LOWER SEAL	1				
12 FT. PUMP		DZ2026-150	DZ2026-150	DZ2026-150	DZ2026-150
16 FT. PUMP		DZ2026-186	DZ2026-186	DZ2026-186	DZ2026-186
22 FT. PUMP		DZ2026-258	DZ2026-258	DZ2026-258	DZ2026-258
SOCKET, LOCK PULLER	1	DZ2029	DZ2529	DZ2529	DZ2529
STATIONARY ASSEMBLY					
PACKOFF, LRC POLISHED ROD	1	LRC15	LRC15	LRC25	LRC25
ADAPTER	1	-	DZ2562	DZ2562	DZ2562
EXTENSION, UPPER BARREL	1				
12 FT. OR 22 FT. PUMP		-	36101-1	46101-1	-
16 FT. PUMP		-	361015-7	461015-7	-
BARREL 12 FT. PUMP	1	3305H-12	3607H-10	4607H-10	5305H-12
16 FT. PUMP		3305H-16	3607H-15	4607H-15	5305H-16
22 FT. PUMP		3305H-22	3607H-20	4607H-20	5305H-22
EXTENSION, LOWER BARREL	1				
12 FT. OR 22 FT. PUMP		-	36101-1	46101-1	-
16 FT. PUMP		-	361015-7	461015-7	-
CROSSOVER SEAL	1	DZ2091	DZ2591	DZ2591	DZ2591
PACKOFF, DZ POLISHED ROD	1	DZ2039	DZ2539	DZ2539	DZ2539
LOCK	1	DZ2048	DZ2548	DZ2548	DZ2548

SEAL and PACKOFF SUB ASSEMBLIES used in DUAL ZONE ROD ASSEMBLIES

ASSEMBLY		COMPONENT PARTS		
NUMBER	DESCRIPTION	DESCRIPTION	NO. REQ.	NUMBER
SEAL ASSEMBLIES				
DZ2040C	PUMP LOWER SEAL	BODY	1	DZ20402C
		SPACER RING	2	20-093C
		FOLLOWER	1	20-094C
		RING, PLUS .045	3	DZ20405
DZ20548C	PUMP TOP SEAL	BODY	1	DZ20546C
		CUPS, PLUS .070	6	DZ20545
		CUP SPACER	4	DZ20542C
		DIVIDER	1	DZ20543C
		FOLLOWER	1	DZ20544C
DZ20549C	CROSSOVER SEAL	BODY	1	DZ20541C
		CUPS, PLUS .030	6	20-16
		CUP SPACER	4	DZ20542C
		DIVIDER	1	DZ20543C
		FOLLOWER	1	DZ20544C
DZ2091	CROSSOVER SEAL	SEAL EXTENSION	1	DZ20914
		HEAD, NO GO	1	DZ20912C
		BODY	1	DZ20911C
		FOLLOWER RING	2	20-094C
		SPACER RING	4	20-093C
		SEATING RING	6	20-095
DZ2554	PUMP TOP SEAL	NUT	1	DZ2554D
		SPACER RING	1	DZ2554B
		BODY	1	DZ2554A
		CUP SPACER	4	25-13
		CUPS, PLUS .070	6	25-16
DZ2591	CROSSOVER SEAL	HEAD, NO GO	1	DZ25913
		BODY	1	DZ25911
		FOLLOWER RING	2	DZ25912
		SPACER RING	4	25-13
		SEATING CUPS, PLUS .070	6	25-16
PACKOFF ASSEMBLIES				
DZ2039	PACKOFF, DZ POLISHED ROD	COLLAR	1	05029
		JACKET	1	05311-3
		LINER, 7/8" x 6"	6	05201
		SAFETY COLLAR	1	DZ1035
DZ20391	PACKOFF, DZ POLISHED ROD	COLLAR	1	05022
		JACKET	1	05311-3
		LINER, 7/8" x 6"	6	05201
		SAFETY COLLAR	1	DZ1035
DZ2539	PACKOFF, DZ POLISHED ROD	COLLAR	1	DZ2561
		JACKET	1	05311-3
		LINER, 7/8" x 6"	6	05201
		SAFETY COLLAR	1	DZ1047
LRC059	PACKOFF, LRC POLISHED ROD	GUIDE BUSHING	1	05601
		JACKET	1	05351-3
		LINER, 7/8" x 6"	6	05201
		COLLAR	1	05029
LRC15	PACKOFF, LRC POLISHED ROD	GUIDE BUSHING	1	15601
		JACKET	1	15351-3
		LINER, 1-1/16" x 12"	3	1520
		EXTENSION	1	15101
LRC159	PACKOFF, LRC POLISHED ROD	GUIDE BUSHING	1	15601
		JACKET	1	15351-3
		LINER, 1-1/16" x 12"	3	1520
		EXTENSION	1	15109
LRC25	PACKOFF, LRC POLISHED ROD	GUIDE BUSHING	1	25601
		JACKET	1	15351-3
		LINER, 1-1/4" x 12"	3	25201
		EXTENSION	1	15101

January 14-59-1557 Con & Cities Service;

6° Gravity - 36° Slinda

39° ~~40°~~ Blinbery

500 More Test.

equalize Pressure

Bottom

334

Stuffing Box

exhibit #2

Lower Pack off assembly.

1/2 - 7 (2½)

1700

limited size of tubing

Sand in Roberlan Pool Sand production

FLUID PACKED PUMP CO., LOS NIETOS, CALIF.

oilmaster PUMPS

FOREMOST IN THE INDUSTRY

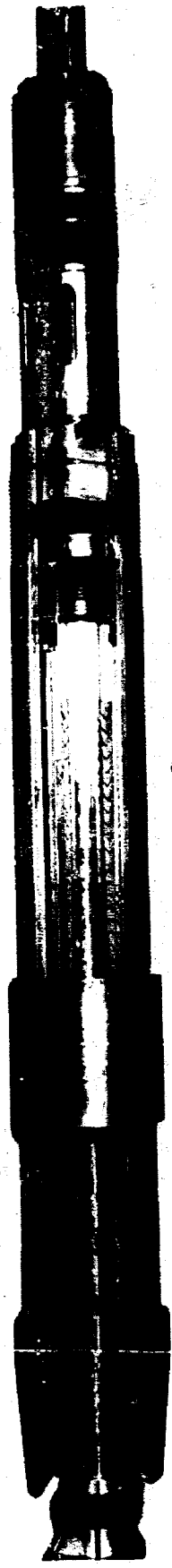
DUAL ZONE INSTALLATIONS BY STATES

State	1957	1958*
Alabama	1	0
Kansas	4	3
Louisiana	3	0
Mississippi	3	2
Oklahoma	27	14
Texas	110	137

* Includes installations January through September

These installations consist of crossover equipment with two pumps being operated simultaneously on a single rod string by one pumping unit or crossover equipment is installed in preparation for use of dual zone pumps when the zones cease to flow.

Prior to January, 1957, approximately 500 dual zone pumps were installed in the United States. In addition, dual zone pumps are operating in Canada, Columbia, Venequela and Germany.



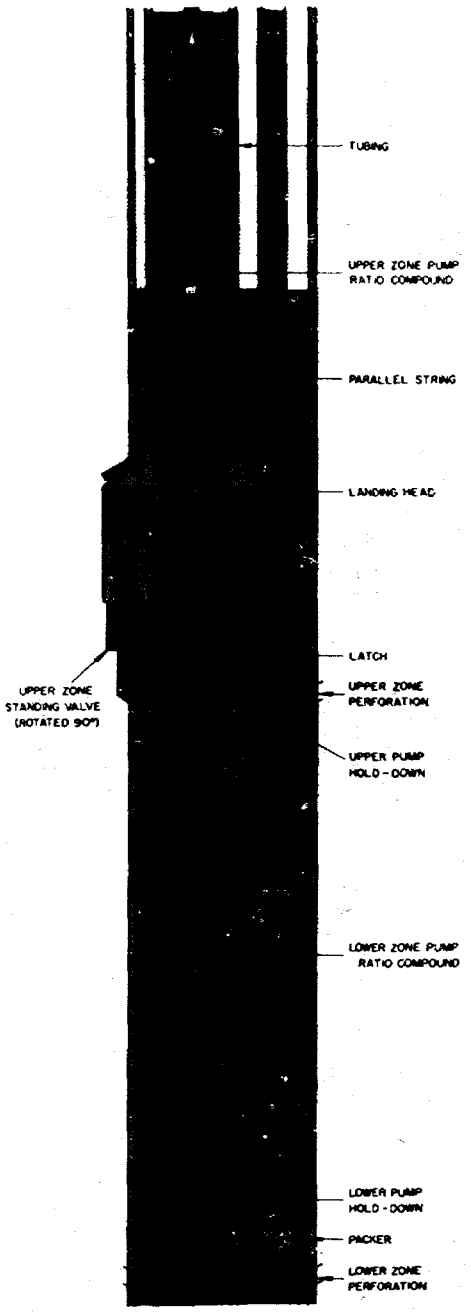
CUTAWAY OF [illegible]
PACKOFF AND SEAL [illegible]
WITH LATCHING [illegible]
HOLDDOWN DEVICE AND
STANDING VALVE

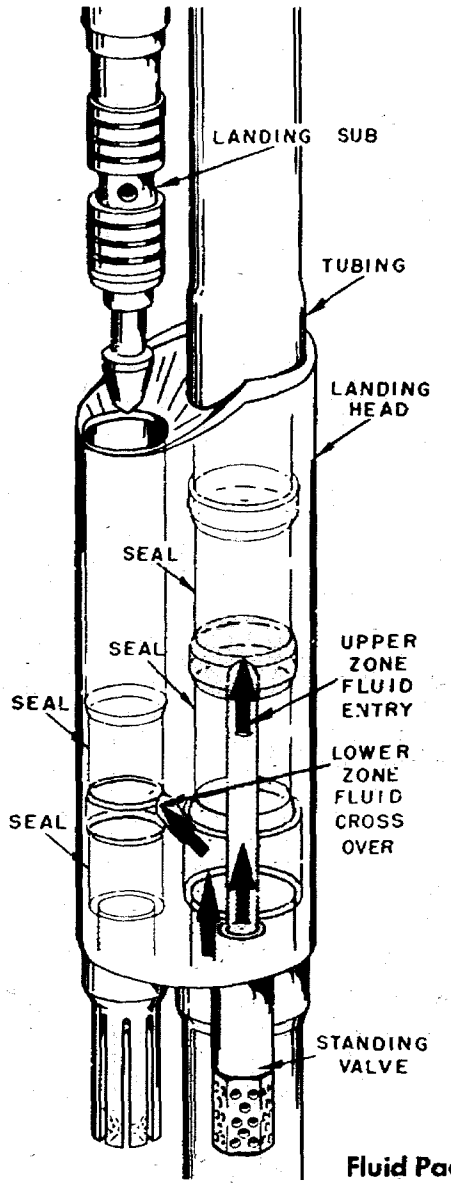
CONTINENTAL EMSCO CO.

This sheet supplements Page DZ-6, Bulletin 5702.

Typical Dual Zone Installation

WITH RATIO-COMPOUND PUMPS





Fluid Packed Pump Co.

In the installation illustrated, a packer separates the perforated intervals of the upper and lower zone. Both upper and lower zone pumps are positioned in the long string of tubing, and are run in, operated, and pulled with a single string of rods. The long string conducts the upper zone production while a second string of tubing conducts the lower zone production to the surface. No gas is vented from the lower zone, but gas from the upper zone is vented up the casing. The two tubing strings are run independently. The crossover shoe with integral landing head is run in on the long string. A landing spear is run on the bottom of the short string. This spear is automatically guided into place by the landing head and the seal elements are properly positioned by a no-go ring and latch.

In the illustration, a Ratio-Compound Pump is shown in both the upper and lower zone. A Ratio-Compound has the following advantages over a conventional pump in Dual Zone installations. In the lower zone where gas is not vented, it will reduce gas lock and improve pump efficiency. In the upper zone it will improve pump efficiency and will permit the upper pump to continue to produce even if a standing valve should fail. In both zones it will eliminate fluid pound and in gassy wells will maintain a tension in the rod string on the down stroke. Ratio-Compound pumps are available for all types of Dual Zone installations and may be run as an option without modification of the tubing assembly.

FIG. 3a

SINGLE PACKER DOUBLE STRING
Installation Typical of
DZT2092-55 DZT2092-70
DZT2592-70

with
Ratio-Compound Pumps

DZ-6 a

CASE 1557: Cities Service Oil Co. application for DC of State "P" #3 Well, 32-22S-38E, Lea Co.

BEFORE THE
OIL CONSERVATION COMMISSION
SANTA FE, NEW MEXICO

IN THE MATTER OF:

Case No. 1557

TRANSCRIPT OF HEARING

JANUARY 14, 1959

DEARNLEY - MEIER & ASSOCIATES
GENERAL LAW REPORTERS
ALBUQUERQUE, NEW MEXICO
Phone CHapel 3-6691

BEFORE THE
OIL CONSERVATION COMMISSION
SANTA FE, NEW MEXICO

IN THE MATTER OF:

Case 1557 Application of Cities Service Oil Company for a hearing de novo before the Commission on its application for a dual completion. Applicant, in the above-styled cause, seeks an order authorizing it to dually complete its State "P" No. 3 Well located 990 feet from the South and West lines of Section 32, Township 22 South, Range 38 East, Lea County, New Mexico, in such a manner as to permit the production of oil from the Blinebry Oil Pool and from an undesignated Glorieta oil pool through parallel strings of tubing.

Mabry Hall
Santa Fe, New Mexico
January 14, 1959

BEFORE:

A. L. Porter
Murray Morgan
John Burroughs

TRANSCRIPT OF HEARING

MR. PORTER: The meeting will come to order, please. We will take up Case 1557.

MR. PAYNE: Case 1557, "Application of Cities Service Oil Company for a hearing de novo before the Commission on its application for a dual completion."

MR. KELLAHIN: If the Commission please, Jason Kellahin of Kellahin and Fox, Santa Fe, New Mexico, appearing on behalf of the applicant, Cities Service Oil Company.

Prior to opening our case, I would like to briefly state

that this case is before the Commission as a hearing De Novo under the proper statute providing for such hearings having previously been heard before the Commission's examiner.

The application in this case is simply stated, an application for a dual completion, which in most of its elements is a routine application similar to those which have heretofore been approved by the Commission, the difference in this case being simply that it is proposed in this installation to pump two separate horizons with a single string of rods on a pumping unit. That is simply the difference in this and other applications which have been approved by the Commission.

Now, in making this type of installation, it is necessary to use a slightly different type of equipment, which we will display to the Commission at some length, the Commission willing. In the presentation of our testimony, we propose to show to the Commission that this type of completion is as practical as two pumping units actuated by two rods through two strings of tubing, but has numerous advantages over the conventional type of installation and it will protect the two separate producing horizons completely and adequately to meet the requirements which may be set by the Commission. That is what we hope to show by our testimony and we will have three witnesses, Mr. Callan, Mr. St. John and Mr. Motter.

MR. PORTER: Mr. Kellahin, we will have the witnesses sworn in a moment; in the meantime, I will ask if there are other

appearances in the case? Anyone else desire to make an appearance in Case 1557?

We have some telegram communications from other operators which will be read and entered into the record.

Will the witnesses stand and be sworn?

(Witnesses sworn in).

MR. KELLAHIN: We will call as our first witness, Mr. Motter.

E. F. MOTTER

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

DIRECT EXAMINATION

BY MR. KELLAHIN:

Q Will you state your name, please?

A E. F. Motter.

Q By whom are you employed, Mr. Motter?

A Cities Service Oil Company.

Q Mr. Motter, have you ever testified before this Commission as an expert engineer and have your qualifications been accepted?

A Not before this Commission; I have appeared many times before the examiners.

MR. KELLAHIN: Does the Commission wish to have the witness qualified?

MR. PORTER: Just one moment, Mr. Kellahin. The witness'

qualifications are accepted.

MR. KELLAHIN: Perhaps you didn't hear the question, Mr. Porter. The witness has never testified before the Commission, only before the examiners. Now, if you wish that he qualify --

MR. PORTER: It won't be necessary, his qualifications are a matter of record, unless someone cares to questions the witness' qualifications.

Q (By Mr. Kellahin) Mr. Motter, in what position are you employed?

A Assistant Division Engineer, Hobbs, New Mexico.

Q Are you familiar with the application in this case?

A Yes sir, I filed the application.

Q Is the area involved within your division?

A Yes, sir.

Q The division under which you have supervision?

A It is.

Q Now, briefly state what is proposed by this application?

A We propose to dually complete our State "P" Number 3 Well, which is in the Blinebry Pool and an undesignated pool with production from the Glorieta by means of two strings of tubing with two pumps actuated on one rod string by one pumping unit.

Q Have you prepared a plat showing the area involved in this application?

A Yes sir, I have.

MR. KELLAHIN: Will you mark that as Exhibit Number One, please?

A We have some exhibits up over here and I plan to make some marks on them, so maybe we ought to use these.

(Whereupon, the document was marked as Exhibit Number One for identification).

Q (By Mr. Kellahin) Referring to what has been marked as Exhibit Number One, will you state what that is designed to show?

A Yes sir, this is a map of the area surrounding our State "P" Lease. The lease itself is marked in yellow, the subject well is the State "P" Number 3, which I will circle in red, and is located 990 feet from the south, 990 from the west line, Section 32, 22, 38, Lea County, New Mexico. This well has been completed in the--I should say is now in the Glorieta formation. I would like to give some of the producing characteristics of some of the wells around this well. The Pan American State "T" Number 2, which is the direct east offset, is a Glorieta producer. The most recent test on that well was in August of 1958. That well produced 58.6 barrels of oil, 30 barrels of water, GOR was 350 to 1 with a gravity of 36 degrees. The Gulf Andrews Number 3 is completed in the Glorieta. It is located 1980 from the south line and 1980 from the east line of Section 32, Range 38 East, Township 22 South. That well, on a test--the most recent test on this well produced 43 oil, 4/10 barrels of water --

Q 43 oil, what do you mean by that?

A 43 barrels of oil, 4/10 barrels of water in six hours through a 15/64 choke. That well is producing top allowable, gravity of that oil os 36 degrees. The Blinebry production is from our State "P" Number 2, which is located 1980 from the south line, 660 from the west line of Section 32. One of the most recent tests on that well produced 31 barrels of oil and 6 barrels of water in 24 hours on a pump. The GOR was 3795 tc 1, the gravity is 40 degrees and 60 degrees. Pan American's State "S" Number 3, which is located 1980 from the north line, 660 from the west line of Section 32, is currently flowing from the Blinebry with an extremely high GOR, 15,713 to 1. It has a penalized allowable and the gravity on that well was 39 degrees. I would like to pount out that the GOR limit in the Blinebry pool is 6,000 to 1. The State "P" 3 Well, as I previously stated, has been completed since our previous hearing. We have 7-inch casing set at 59--pardon me--5809, it was cemented with 100 sacks of cement and one-third cubic feet of stratocreate per cubic foot. The cement--the top of the cement was at the surface at 3695. The Blinebry was perforated at intervals from 5763 to 65, 5772 to 76, 5648 to 61, 5666 to 74 and these zones were acidized, and this zone was swabbed at a rate of 45.6 barrels of oil per day. We set a Baker Model "D" production packer at 5600 feet and we are now producing from the Glorieta. The perforations of that zone are 5187 to 92, 5168 tc 71. 24-hour potention on this zone was

360 barrels of oil and 6 barrels of water in 24 hours through a 20/64 choke with a flowing tubing pressure of 75 pounds. GOR is 280 to 1 and the gravity is 33.4 API. It is now producing top allowable, 46 barrels per day.

Q Are we to understand then that the Glorieta is presently flowing in that well?

A Yes, sir. We do not believe that it will flow for any length of time.

Q Is that the reason for this application then, to pump that zone as well as the Blinebry?

A Yes sir, it is. We have reason to believe that we will perhaps increase the water production in the Glorieta zone, which will necessitate pumping equipment.

Q Mr. Motter --

MR. PORTER: Mr. Motter, pardon me just a minute. What did you say the gravity was, the gravity of the Blinebry oil was?

A Mr. Porter, I don't believe I gave you the gravity of the Blinebry production in our well because we tested that for only a short interval and it was acidized water. We do have the gravity of two offset wells, which was 40 and 39.

MR. PORTER: Thank you.

Q (By Mr. Kellahin) In connection with that gravity, Mr. Motter, I believe in the previous hearing in this case, you testified that the difference in the gravities between the two zones of the Glorieta and the Blinebry was approximately two

degrees, is that correct?

A That's what we expected from production of offset wells. Now that we have tested and produced the Glorieta for some time, we found that the gravity is 33.4, so apparently there would be a considerable difference in the surface gravities of the two zones.

Q Approximately 6 degrees then?

A That's correct.

Q Now, in your opinion, is that a sufficient difference in the gravities that would enable you to detect the commingling of the fluids, in the event such an event occurred?

A It certainly is.

Q How would that show up?

A Well, in the first place, any tanks that are run are gauged in by the pipe line for gravities run on them, which we get a record of. Our own switchers take gravity tests periodically, and in the case of dually completed wells, more often than in single completed wells, so any leakage would show up at the surface as a matter of change in gravity of fluid.

Q Now, are you familiar with the lease ownership in the areas involved in this case?

A Yes, sir.

Q Is the lease ownership common?

A Yes, it is.

Q And is the royalty ownership common?

A It is.

Q Now, Mr. Motter, you have prepared a schematic diagram of the proposed completion?

A Yes sir, I have.

MR. KELLAHIN: Will you mark that as Exhibit Number Two?

(Whereupon, the document was marked as Exhibit Number Two for identification).

Q (By Mr. Kellahin) Referring to what has been marked as Exhibit Number Two, will you describe the operation of that completion?

A Yes sir, I will explain the schematic diagram. We have a Baker Model "DA"--I believe I testified before that it was a Model "D"--"DA" Packer set at 5600 feet. We propose to run two-inch tubing with the crossover assembly set at approximately 5500 feet in this well. A second string of tubing will be set in the cross over assembly. We will then run two rods on a single rod string in the long string of tubing, this will be actuated with a single pumping unit. Production in this setup from the bottom zone enters the perforated production tubing. The production is picked up by the lower zone pump, pumped to the crossover assembly and crossed over to the short string of tubing and from there to the surface and into the tankage. The upper zone production enters the crossover assembly, is picked up by the upper pump, pumped from there to the surface and into tankage. We have a gas vent line around the bottom pump to prevent that

pump from gas locking. I would like to point out that we have a standing valve in our tubing below the bottom pump and also a standing valve below the upper pump. Those valves are placed so that if the two pumps are pulled from the well for any type of workover, that there will not be any communication of fluid between the two producing zones. While those pumps are out of the hole, the only fluid that can enter is if the bottom zone would happen to have a higher pressure than the upper zone, then the tubing will fill up to the point where the upper standing valve would check the fluid and stop it from entry into that zone and vice versa, if the upper zone has a higher pressure, it can only enter and fill some one hundred feet of tubing and then it will be checked by the lower standing valve.

Q Then all the production from the well would be through tubing, is that correct?

A That's correct.

Q Now, have you had any personal experience with this type of installation before, Mr. Motter?

A Yes sir, we have some of this type of production equipment installed in Texas. Our Odessa Division has quite a few of these, similar installations that are being quite successful.

Q On the basis of your experience, have you found it possible to do any necessary workovers or treat the separate horizons as may be required through this type of installation?

A Well, this is just about as simple to treat as any other single completion. The upper zone, of course, can be treated down the annulus; however, to acidize it or kill it or anything, to treat it in the bottom zone, it would be necessary to pull the rods--excuse me, the pumps and rods from the hole and treat down the long string and treat through the long string.

Q That would be no different than any other type of dual completion, would it?

A No sir, it's actually a little simpler because we could, if necessary, and we anticipated a higher pressure in treating the lower zone, we could merely pull the short string in the crossover assembly and treat down the string of tubing, which would give us somewhat less pressure on the casing head, which in a pumping installation is normally a low pressure head. This way we would get a somewhat higher pressure through the string of tubing and when we got through treating below, we would merely reset the stinger in the crossover assembly and we would go back to production.

Q Now, with this type of installation, will it be possible for you to keep track of the production from the two separate horizons?

A Yes, they will be tanked and gauged separately.

Q Now, with the single pumping unit, how would you control production should one zone or the other become over-produced?

A Well, there are four means of controlling production with this type of installation. The first one and the most practical means is by sizing the two pumps. We know approximately what our allowables will be and we will size those pumps so as to produce that production. In case one zone would get ahead of the other and it would be necessary to shut in or stop production from the zone that is ahead of the other, there are numerous ways we can do that. If the upper zone has been produced, its allowable has been produced, then we would merely cycle the oil from the flow stream back into the casing of the upper zone and this would not allow any production from the upper zone to be tanked. Another means of doing this is by means of a traveling overload valve, which means loading the traveling valve in the pumps so that if production on one zone exceeds the other, we close the valve and by pressuring up the fluid in that particular tubing string, this spring-loaded valve will be overcome and fluid by-passed so that no fluid is pumped with that pump. One other means of controlling fluid production is in case the bottom zone has produced its allowable before the upper zone, we will space the two pumps in such a manner that the bottom pump will unseat before the upper pump, therefore we can go out there and we can go and pick up the bottom pump some fifteen feet and it will not pump because it is not seated in the tubing.

Q Now, you mentioned some water production in connection with your discussion of the wells in this area. What type of

water is found in this area?

A Well, Actually, we don't have too much information right in this area. I do believe that we will get some water production but we do not anticipate an active water drive. If there were an active water drive, I believe these zones would flow much longer than I have shown.

Q Is the water production from the Glorieta and the Blinebry comparable?

A In volume?

Q In volume, yes.

A Well, these tests indicate that perhaps the Glorieta would produce a little bit more water than the Blinebry.

Q But in your opinion, this is not water-drive water?

A I don't think it would be an active water drive, no sir. I don't think we will have any abnormal volumes of fluid.

Q Well, getting to this point, Mr. Motter, would there have to be a portion of this fluid lifted from the two separate zones in the operation of this type of installation in order to reach the allowable assigned to each zone?

A Yes sir, I believe there would be.

Q So your problem in controlling the production from one zone or the other would be minimized?

A Yes, sir.

Q Now, in discussing Exhibit Number Two, you mentioned some of the safety factors which were designed to prevent the

commingling of fluids. Did you cover all of those, Mr.Motter?

A I believe I have covered most of them. I believe our other two witnesses will be able to go over that in more detail, the means of preventing commingling. I might point out at this time that we believe this type of installation is more safe in a case of rod failure where it becomes a necessity to fish in the well. If we had rods in both zones and one rod string broke and maybe hit the lower tubing on one particular string and parted it, we would have some difficulties in fishing those rods and tubing out of the hole. By means of this type of arrangement, in case our rods parted or anything, we could pull the string of tubing which has no rods and then very easily go over the other tubing string and pull it from the hole through the crossover assembly.

Q Now, have you made any study of a completion of this type of installation as compared to other types?

A Yes sir, I have, on this type of installation.

MR. KELLAHIN: Would you mark that as Exhibit Number Three, please?

(Whereupon, the document was marked as Exhibit Number Three for identification).

A Exhibit Number Three is the economics of a two-zone pump versus two pumps with individual pumping units. I have these broken down, I don't believe it will be necessary to run all the way through it, but by using only one pumping unit, we can realize a savings of $13,533.00 on this particular installation.

Q Mr. Motter, would that have any significance in the ultimate recovery of oil from either or both of the zones?

A Yes, it would mean that we would probably pay for the well much sooner and could probably produce a well longer to get more oil from the zones.

Q In the operation of the unit, would that have any significance on the ultimate savings?

(Whereupon, the document was marked for identification as Exhibit Number Four).

A Yes sir, we have prepered Exhibit Number Four, which shows some economics of pumping with two-zone pumps as compared to two single zone pumping units. I would like to point out that I have these wells in groups. Group one and group two are wells producing from 4200 to 6200. All these wells are in the Odessa production area. All the wells, upon completion, have been equipped with crossover equipment identical to what we propose. When these wells cease to flow, it is merely a small matter of running the single rod string with two pumps in the well to continue to produce the wells. These wells vary in age from 6 to 19 months in group one and are wells that are equipped for dual zone pumping but both zones are still flowing. I would like to point out that the lift cost on these wells is four cents per barrel of fluid or 4.4 cents per barrel of oil. On the wells where it has been necessary to go ahead and complete with artificial lift equipment, the same production zones, the same

age wells, this cost has been increased for each barrel of fluid to 6.3 cents, for each barrel of oil, 8.2 cents with the selected --

Q On that group two, is that referring to the group in which both zones are pumping with dual zone equipment?

A Identical to this, yes sir.

Q Identical to this?

A We have selected some wells that were single completed to compare to these wells and I might state that the reason for selecting these group three wells, which there were nine of them, at no time did we have to pull the rods and tubing from any of these wells that are using dual zone pumping equipment in group two, so we selected these wells that had no pulling expense during a two-year period, or approximately eighteen-month period to use as a comparison. Some of these wells are several years old, but they are--in general, most of them, I think, with the exception of two, they are all producing top allowable and very little water. I might also point out that the average figures that we used in this case for group one and group two are average figures for the entire life of the well. Since some of the wells in group three have a much longer life, we used only one year as an average. I would like to point out that these are single completions and since we do not have as much fluid as on the duals and the lift cost was 11.4 per barrel of fluid and 12.2 per barrel of oil lifted.

I believe that this shows that we can safely predict that

we can deplete a reservoir much further with dual zone equipment on a dually completed well because of lower costs. I admit that as production declines, these costs will go up but they will not advance on a dually completed well using dual zone equipment fast enough but what we can deplete the reservoir further. I would like to try to make that a little more plainer. In other words, if we had reached a decline stage to where one zone was only pumping, say one barrel of oil per day, which in a normal single zone completion we would have to abandon it, if the other zone in a dually equipped well for dual pumping was producing as much as five or six barrels a day where it would still be economical, that one barrel a day would be getting a free ride and we would actually be able to deplete the reservoir that much further. I have made some estimates, or tried to, on several different formations, and I believe that in these cases, we can deplete the reservoir several thousand barrels further with this type of equipment on dual units than we could if we had single pumping units on each well.

Q Is it your opinion that it would be in the interests of conservation and prevention of waste?

A Yes, it certainly is.

Q Now, have you any method worked out whereby you can determine whether packer leakage is occurring?

A Yes sir, I wouldn't say that we can determine specifically if there is packer leakage, but we feel that we can

determine whether there is any leakage in any of the equipment. To show whether the packer is leaking or any other type of cross-over --

Q You are referring to a diagram.

MR. KELLAHIN: Would you mark that as Exhibit Number Five, please?

(Whereupon, the document was marked as Exhibit Number Five for identification).

A The diagram, Exhibit Number Five, shows a means of determining fluid levels. In other words, we all know that we have a leak in this equipment, we shut the well down for any time and the fluid level would all tend to seek the same level. We can run a bomb in the tubing string that does not have rods in it to determine that fluid level; we can use an acoustic well sounder to determine the fluid level in the upper zone. This is one means of checking the whole installation for any type of leaks. Of course, if we run bottomhole pressure to determine whether there is any pressure across the packer, we will pull the two rods on a single rod string, pull the bottom standing valve, run a bottomhole pressure on the bottom zone, and we will run a PSI straight through to where this packoff assembly is in place and run a bomb down to check the bottom pressure. The pressure, the upper pressure, we can run through a straight PSI tool and run a PSI to the bottom above and we can check the pressure on the upper zone. I might point out that the way we have

this particular well set up that we can run our bomb within one hundred feet from the perforations on these entire intervals, which I do not think is enough difference that we can safely extract fluid and accurately determine pressure on either side of the packer.

Q In your opinion, then the pressures can accurately be determined on each side of the packer?

A Yes, sir.

Q And would that reflect whether packer leakage was occurring or not?

A That's correct.

Q Now, have you compared this type of installation with similar installations which have been approved by this Commission?

A Yes, I have read of the approvals by this Commission. I think in New Mexico there have been approximately fifty wells dually--have been authorized for dualling. I don't have the exact figure, but I think it's in the twenties, of the wells that have actually been dualled. Many of these wells have been dualled where a zone is depleted or not currently shown on the allowable schedule, but one zone is producing. I have found eight wells where one zone is being artificially lifted and I know of two installations where there are two pumping units lifting fluid from two separate zones.

Q Have you made a schematic diagram comparing different types of completions with this completion?

A Yes sir, that will be Exhibit Number Six.

(Whereupon, the document was marked as Exhibit Number Six for identification).

Q (By Mr. Kellahin) Referring to what has been marked as Exhibit Number Six, would you discuss that?

A Exhibit Number Six shows two types of assemblies that are now in common use in New Mexico, gas gas duals or gas over oil duals. These are known as the Otis Sidebar and the Garrett Sliding Shelf. I prepared this exhibit to show that the same type of packing element is used in the Oilmaster crossover assembly as is in use in this other sidedoor assembly, the only difference we have is the packing that is around the polish rod that travels through the crossover packing assembly. That is the only difference that we can see where there is possible chance for leakage other than what has been discussed previously, I might point out--I said the only other, the stinger that is used in the other zone has identical packing to what is used in this type of equipment that we propose.

Q Now, you referred to the polish rod. That element through which it runs, I believe in the previous case you referred to it as a stuffing box. Would you discuss that?

A Yes sir, I have been corrected by some of the people that make this equipment that I have erroneously referred to it as a stuffing box, that is the lower seal assembly. And I would like to point out for the members of the Commission that both of

these drawings are exagerrated drawings. This was done for means of simplicity in showing the equipment. In actual use, we would not find the sharp bend in this tubing below the crossover assembly like I show it in both of these diagrams. I think that that can be shown by the models which we have and I believe one of the other gentlemen will discuss that.

Q Now, in regard to this definition you have given to what we normally call the stuffing box, is that in any sense a stuffing box in the sense that that term is used on surface pumping equipment?

A No sir, it is not.

Q Is the construction comparable to that type of a box?

A No sir, it is much finer manufacturing. The specifications are much closer in tolerance than stuffing boxes that we normally refer to at the surface. These stuffing boxes that we normally refer to at the surface are adjusted by means of tightening the packing to prevent leakage of oil. There is no such thing in this type of a crossover assembly. This can be done by two different means, by the use of Chevron Teylor packing, or by a straight metal to metal seal. I would like to show that we have means of testing the packing in this crossover assembly. I will draw some --

Q You are referring again to Exhibit Number Five?

A Exhibit Number Five, if we want to test this packover-- crossover assembly packing at the surface, we can put a pressure

gauge in either zone and close the valve in the flow line. If this packing element is not leaking, this pressure gauge should build up immediately. If we do not get a buildup in pressure at the pressure gauge, then we check for production from the other zone into the tankage and if we do not get an increase in production, we will assume then that we either have a standing valve or a traveling valve in the lower pump leaking and it will then be necessary to pull it from the well, which is common with any type of pumping equipment, it happens quite often. In the same manner, we can get the flow line of the upper string, put a pressure gauge, close the valve and pressure this zone up. And if we get no pressure immediately, we know that we should get a pressure increase, and say we got an increase in production from our bottom zone, then we would probably believe, and safely believe, that we have a leak in our crossover assembly.

Q What action would be taken?

A Well, in that case, the two pumps, of course, would be pulled from the well, the crossover assembly would be repacked and run back in the well. I might point out, while we are talking about that, that any normal pumping installation is going to have pump trouble and will be pulled from the well periodically, I think it averages somewhere between twelve and eighteen months to pull a pump from a well. Each time that those rod strings are pulled from the well, this packing assembly comes out and is inspected. Should we find any sign of wear or damage to the

packing in this assembly, it will be immediately replaced and run back in the well with any other necessary repairs that need to be made to the pumps.

Q Now, if it becomes necessary to do that, then you don't use the production from both zones during that period of time, is that correct?

A Yes sir, that's correct.

Q How does that compare to conventional dual completions with both zones pumping through two pumping units?

A Well, if the pumps need to be pulled on a situation such as you described, one zone can continue to pump for perhaps some short period, until a pulling unit was moved to location, then it would have to be shut down while the other zone was repaired and after the repairs, both zones could be put back to pumping.

Q So in that sense, there is very minor difference between the two types of completions?

A Yes sir, as I say, upon finding any leaks, it would be a matter of just maybe--whatever it takes to get a pulling unit to the location.

Q Now, are you familiar with the installation of dual zone pumping units of this type in other States?

A Yes sir, I have prepared an exhibit to show the installations in other States.

MR. KELLAHIN: Would you mark that as Exhibit Number

Seven, please?

(Whereupon, the document was marked as Exhibit Number Seven for identification).

Q (By Mr. Kellahin) Referring to Exhibit Number Seven, would you state briefly what that is designed to show?

A Exhibit Number Seven indicates the number of installations, of dual zone pumping installations, made in the year 1957 and until September 1st, 1958. This does not necessarily mean that both pumps are actuated in the well, this means that dual zone equipment was run in the wells in preparation for dual zone pumping. The wells may still be flowing, we don't have any record on those. In Alabama there was one in 1957, none in '58; in Kansas in '57 there were four installations, 3 in '58; in Louisiana, three in '57, none in '58; in Mississippi, three in '57, two in '58; in Oklahoma, 27 in '57, 14 in '58, and in Texas, 110 in '57 and 137 in 1958.

Prior to January, 1957, there were between seven and eight hundred dual zone pumping equipment manufactured but we do not know if all of that is still in use. Prior to 1957, there were probably five hundred of those still in use, so that means that today we probably have somewhere in the neighborhood of eight or nine hundred installations in use. In addition, dual zone pumps are operating in foreign countries such as Canada, Columbia, Venezuela and Germany.

Q Mr. Motter, on the basis of your experience and your examination of this type of equipment, is this a practical means

of completing a well?

A Yes, it is. There may be a few technicalities above a single completed well, or I should say a dually completed well with two single pumps and separate rod strings, but considering the whole, I see no additional trouble that we may have over some of the other installations.

Q Does it afford adequate protection, in your opinion, to the two producing horizons in regard to the danger of communication?

A Yes. As I have pointed out previously, I see no possible means for communication that we cannot check at the surface and which we cannot evidence immediately, and also we think we have installed enough safety devices by the use of the standing valves that will not allow commingling of fluid should there be a leak in the crossover assembly.

Q Does this type of installation permit you to make all the required tests and such other tests as may be required by this Commission to determine if there is packer leakage or to see if communication has occurred?

A I would say that we can make more tests than can be made in a dually completed well involving two rod strings and two strings of tubing.

Q You can make more tests?

A Yes, sir.

Q Now, the Commission in the previous hearing and an order

issued thereon, made a finding 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. Assuming that that finding is based upon a comparison to a conventional dual completion that has two pumping units, and without taking issue with the Commission's finding, have you any comment on that finding?

A Yes, I do not--well, I do not believe that there are any abnormal chances of commingling between the two zones as long as we have the two standing valves which I pointed out on both Exhibit Two and Exhibit Five in place. I do not believe there is any chance of commingling, any abnormal chance of commingling, I'll put it that way.

Q Now, is this type of completion as practical as two pumping units actuated through two strings of tubing, in your opinion?

A Yes, and it's much more economical.

Q You referred to the tests which could be made with this type of completion. Are you willing to make any and all tests which may be required by this Commission?

A Yes, we will be willing to make any type of tests so designated by the Commission. I see no reason why we wouldn't.

Q Mr. Motter, in view of the fact that the Commission, as a result of the hearing before, the Commission examiner determined that in their opinion, there--or the opinion of the examiner,

there would be some danger of communication, would your company be willing to accept an order approving this unit for a temporary period of time and make tests that may be required by the Commission and present the results of those tests to the Commission, either at a hearing or to the Commission staff?

A Yes, I believe we would. I might point that as far as our company goes, we are sold on the equipment. We have enough installed in other areas where we think it's pretty satisfactory, but we have none in operation in New Mexico at this time. We would be happy to go along with a, say three to six month test period if they so desire to properly evaluate this type of equipment.

Q Now, Mr. Motter, were Exhibits One through Seven inclusive prepared by you or under your direction or supervision?

A Yes, they were.

MR. KELLAHIN: At this time, we would like to offer in evidence Exhibits One through Seven.

MR. PORTER: Without objection, the exhibits will be admitted.

Q (By Mr. Kellahin) Do you have anything else to offer, Mr. Motter?

A Yes, in the previous hearing I read some exerpts from the proceedings of the Fifth Annual West Texas Oil Lifting Course, Texas Tech College, Lubbock, Texas, which was held April 17th and 18th. I again would like to refer to an article that was written

by Mr. W. W. Whitaker and H. P. Lieb, Gulf Oil Corporation. The title of that article is Dual Zone Pumping with Two Rods Actuated by One Rod String. In their discussion and conclusions, they state, and I'll quote, "Our experience with Tandem pumps indicates that as a general rule, this equipment will give satisfactory service. The newer design should limit or minimize some objectionable features of earlier models. Most dual zone pumping equipment problems have occurred during installation and immediately thereafter."

Some of the advantages and disadvantages which they give, the advantages are, and again I quote, "Number one, smaller initial cost in comparison with other methods. Number two, compactibility in casing design in most wells. Number three, limitation of upkeep of two pumping units. The disadvantages are, number one, lack of simplicity as compared to other methods. Number two, inability of equipment to handle suspended sand as well as other methods. Number three, loss of production from both zones due to surfacing of downhole equipment for one zone. Number four, pumping depth and quantity of production limited by the strength of rods. Number five, lack of flexibility."

Q Now, on their list of disadvantages, do they list the danger of--increased danger of communication?

A No sir, they do not, and I also have some objections to their disadvantages.

Q I will ask you then if you have any comment on the

disadvantages which they do list there, insofar as they apply to this well?

A Yes sir, I have. Taking the disadvantages in order, number one, lack of simplicity, and I will grant that there is perhaps a little more equipment which could fail in this type of installation. Number two, inability of equipment to handle suspended sand. I can see no reason why this type of equipment can't handle it and we have found in other areas no objectionable properties of the equipment to handle suspended sand over conventional single zone pumping units.

Q In this area, have you encountered any problem of suspended sand?

A No sir, we have no fracing in this area, which is normally where suspended sand comes from. Loss of production from both zones while servicing downhole equipment, well, we just went over that a few minutes ago. I don't feel that the loss of time would be any more than the length of time from which the failure occurred that it took us to get a pulling unit to the location to correct any trouble were having. Number four, they have as a disadvantage, pumping depth and quantity of production. We have a record of one installation such as this that the bottom pump is pumping from 12,300 feet. I don't believe that the pumping depth would be objectionable when we can pump from that depth with this type of equipment.

Q What is the maximum depth that you are pumping from in this

well?

A Approximately 5600 feet.

Q Does this type of installation have any advantages over two long strings of tubing installed in five and a half inch casing?

A Yes sir, it certainly has. When we use five and a half inch casing, we are limited on the size of two strings of tubing that normally are used. I think the biggest tubing that can be used is 2 1/16 inch Hydrill and that is quite costly, and we are limited by the size of pumps which we can use on the 2 1/16 inch Hydrill. Even though this can be run in five and a half inch casing, it's a very close tolerance and in case of failure of equipment, we would have trouble in fishing any failed equipment from the hole.

Q Do you know whether that type of installation has been approved by the Commission in New Mexico?

A Not with dual zone pumping equipment. I know of some installations where they have approved 2 1/16 inch tubing to be used where one zone is being artificially lifted. This, of course, is in case of five and a half inch casing.

MR. KELLAHIN: That's all the questions we have, sir.

MR. PORTER: Did you offer your exhibits, sir?

MR. KELLAHIN: Yes sir, I did.

MR. PORTER: Thank you. Mr. Motter, one question. In your experience with this type of installation, would you say

there is greater or less danger of communication than there would be using the installation which has been allowed by the Commission or any of the installations?

A Mr. Porter, I would like to ask you, do you mean communication between zones or communication between produced fluid?

MR. PORTER: Between the zones.

A No sir, I don't.

MR. PORTER: That's what I had in mind. And you say that you would expect to produce each zone to a greater ultimate completion?

A Yes, sir.

MR. PORTER: Because of the difference in cost?

A Yes, sir.

MR. PORTER: Anyone else have a question of the witness?

MR. FISCHER: Yes, sir.

MR. PORTER: Mr. Fischer?

MR. FISCHER: Mr. Motter, would you please go over again your method of treating, what you have to go through to treat your bottom zone, the Blinebry?

A I will refer to Exhibit Five, it's a larger exhibit. If we want to treat the bottom zone, it will be necessary to pull the rod string and the two pumps from the well, retrieve the standing valve with wire line equipment and then treat the well. We have a standing valve on the well and we have PSI straight

through tubing so that we could pump from the Blinebry formation without any fluid entering into the upper zone.

Q Your PSI tubing would set where?

A It would set in the same interval that the crossover packoff assembly sets.

MR. FISCHER: On your Exhibit Number Five, the vent tubing --

A Yes, sir.

MR. FISCHER: Coming in your packer, the bottom zone, the ball there in your vent tubing, does it set in an upright position?

A No sir, it sets down by gravity. It's merely a standard standing valve inside of one-inch tubing.

MR. FISCHER: It does not set, it goes up, it won't shut off against flow through that tubing, into your tubing, is that right?

A No sir, it's built like any standard standing valve.

MR. FISCHER: That's all, thank you.

MR. PORTER: Mr. Payne?

MR. PAYNE: Mr. Motter, is this relatively new equipment?

A This equipment was manufactured first in 1947. It has been in use since that time.

MR. PAYNE: Well now, in view of the fact that you achieve a considerable saving, according to your testimony, by the installation of these dual zone pumps, to what do you attribute the fact that the installation of this type pump has decreased

in 1958 as opposed to 1957 in every State except Texas?

A Mr. Payne, I can point out a couple of reasons. First thing, 1958 was only eight months, I believe it's eight months, it's up to the 1st of September, it is not a full year. And one definite reason for the decrease in Oklahoma is because they are allowing them to commingle fluid and assign one allowable to wells up there, which is probably the reason for the decrease in Oklahoma. For the other States, it's just a matter of a decrease of one or two wells, I don't know for what reason.

MR. PAYNE: Now, to the best of your knowledge, Louisiana, the Louisiana Commission has not entered any order denying the use of this dual zone pump.

A No sir, I don't know of any.

MR. PAYNE: Thank you, that's all.

MR. PORTER: Mr. Fischer?

MR. FISCHER: Mr. Motter, which one of these zones, if either or both should go to water totally, which one do you think would go first?

A I would say the Glorieta, because referring to Exhibit Number One, the Glorieta was tested in the Gulf Scarborough Number 3, which is located 1980 from the south line and 660 from the east line in Section 31, and it tested at a hundred per cent water in the Glorieta.

MR. FISCHER: If it went to--your upper zone, which is the Glorieta, if it went to a hundred per cent water, would you then,

I assume, change your whole installation, is that correct?

A We would just use the single pumping installation.

MR. FISCHER: Thank you.

MR. PORTER: Mr. Nutter?

CROSS EXAMINATION

BY MR. NUTTER:

Q Mr. Motter, on your Exhibit Number One, you gave some of the test data on certain of these wells. Did you give the test date for Gulf's Number 3 "P" in Section 32?

A The test date that I have is the potential on January 12, 1958. At that time, it produced 43 oil, 4/10 barrel of water in six hours, which would give a 24-hour potential of somewhere in the neighborhood of 160 barrels. The last time I checked with Gulf, the well was flowing top allowable. The pressure has dropped somewhat, the ratio has declined from 430 at the time of the potential to 212 to 1 in November.

Q Now, Pan American State "T" Number 2 had a GOR of 350 to 1 in August, is that correct?

A That's right.

Q Did you give the GOR on your Glorieta formation in your Number 3 Well?

A Yes sir, 280 to 1. I may have missed it, but that is our GOR.

Q And do you have a GOR in the Blinebry in that well?

A That well was swabbed for a short time after we recovered

load acid and naturally, by swabbing, we cannot run GOR's.

Q All you got is the swabbing in the Blinebry?

A That's correct.

Q What are the characteristics of the fluid produced from each zone, has either one of them a high sulphur content?

A Not that we know of. There is sour, but we have had no indication in either of our other installations down there if any abnormal corrosion in the downhole equipment.

Q Is the Blinebry sour?

A Yes sir, I believe it is.

Q Is the Glorieta sour?

A Yes sir, to some extent.

Q I see. The machine is setting over there, and I notice it has two black rubber-like packers on it. What do those packers do to protect the metal surface on the tubing of the machine?

A Mr. Nutter, we have a witness that will go through the complete installation of this and will explain everything in detail.

Q You can't answer it?

A Yes sir, I can.

Q What type of packing do you have there?

A Are these the packers that you are referring to?

Q Yes.

A Those are identical packers to what we use here. The packers right here are identical packers to what we use on the

Otis sidedoor assembly.

Q Now, the metal tubing in which those packers are set, do you know the type of metal that is used in the construction of that tubing?

A We can buy that in any material, any alloy that we so desire. We can get Monnel or any corrosion resistant material. I have been told recently that they have even made this particular piece of equipment where the packing sets, that they have made that in bronze.

Q Is it your intent or do you propose to purchase corrosion resistant tubing for this pump?

A Not this particular tubing, but the polish rod that travels through the packing will be corrosion resistant.

Q In other words, the packings that are outside there don't move?

A No, sir.

Q And the polish rod which would move would be a corrosion resistant material?

A That's correct.

Q Mr. Motter, have you ever calculated what the hydrostatic head of a column of fluid in the Glorieta tubing would be? That is, the amount of pressure due to the column of fluid which will be exerted on the top of the lower stuffing box?

A No, I have never calculated it. It wouldn't take very long, if you will give me a minute, sir.

Q Would you give us an approximation of what that pressure would be?

A If it was in mud and not clearly on the surface, I calculate it would be approximately 1900 pounds. That is considering it's all oil.

Q Yes. On your Exhibit Six, you have depicted three different types of installations here, the Otis Sidedoor on the far side and you have the Oilmaster crossover assembly and the Garrett. Do you know what I am talking about here?

A Yes sir, this is it right here.

Q This is the only one of the three that has any constant moving parts in it, is it not?

A Yes sir, and I have indicated by red the packing that separates the fluids around the moving parts on the inside of this packing.

Q So you are comparing a machine that has all moving parts to a machine that doesn't have constant moving parts?

A Mr. Nutter, I think you missed what I was trying to show here. Our packing in this assembly right here where it sets is identical to that non-moving packing, identical to what we are using in these other types of installations.

Q I see. Now, what is the distance from the tubing crossover assembly to the lower zone pump housing?

A From here to here?

Q Well, on Exhibit Two, I see the tubing crossover assembly

approximately midway of the drawing there.

A Well, it would be a hundred feet from the packer to the crossover assembly, so the pump would be in between there. I would say from the crossover assembly to the top of the tubing would be somewhere in the neighborhood of sixty feet.

Q This would be from the point more or less labeled on this exhibit as the one-inch gas vent line in the lower assembly?

A Yes.

Q To the tubing crossover assembly which is above that --

A That's correct.

Q --would be sixty feet?

A Approximately sixty feet. I might point out that with this type of assembly and this particular gas vent line, we can actually pump below the packer in this type of assembly should we so desire, but we do not feel that it will be necessary. In that case, it would be some little but further up in the crossover assembly.

Q Mr. Motter, you suggested that one of the means by which you could stop the bottom zone from producing in the event it met its allowable would be to raise the rod strings, is that correct?

A That's correct.

Q And unseat the lower pump?

A Unseat the lower pump.

Q Is there any danger to upset the lower stuffing box in the upper pump?

A No sir, we would probably unseat the pump--the bottom pump would be unseated some, oh, twenty to thirty feet before the upper pump would be unseated. The lower stuffing box would have to fall in between those two and it would probably be unseated approximately twenty feet after the lower pump was unseated.

Q So that if you unseated the lower pump, all of the movement at the top of the rod string would be through the side of the lower stuffing box and the lower stuffing box would not move?

A That's correct.

Q Mr. Motter, do you believe that there is any appreciable amount of whip or side motion to a rod string as it pumps the well?

A No sir, not if it has a full fluid load, I don't believe there is any appreciable whip.

Q In other words, you would have to size your pump very exactly, and if you had the pump sized exactly and had a full fluid load on it, you would have a very straight and rigid rod string all the time?

A That's correct, normally we have no flipping, or I think you are referring to what is commonly called pounding, where the well is pumping fluid and then you get your rods to whipping your tubing string.

Q In your economic analysis of the lift cost comparing these various types of installations, Mr. Motter, I believe you

stated that group two, which is the both zones pumping with dual zone equipment category, there are no rod jobs, is that correct?

A No, sir.

Q Had there been any rod jobs in group three?

A No, we particularly chose these with no rod jobs in the interval in which we took the monthly expenses.

Q And in rod jobs, you are including pump jobs, too?

A Yes, sir.

Q So that in either of these groups, there have been no pumps pulled or rods pulled?

A No, sir. I might explain one thing: In group two, we had one well which watered out completely and we pulled the crossover equipment out of the well and ran single completion equipment. I did not include that expense in this category.

Q In group two, did you include the additional expense that may be necessary to go out and recycle the upper zone in the event it met its allowable or to pull the--or unseat the lower pump in the event it met its allowable or any such inherent additional cost that may be associated with the use of the dual zone pump?

A No sir, that has not been necessary. We have apparently been fortunate in selecting these wells and we have produced our allowable in both zones at the end of the month.

Q I see. I note that group three as a whole is a lower allowable group, or at least a shallower zone group. Do you think

that the fact that it only produced 8,429 average barrels per month as compared to 13,000 might not have an effect on the determination of the average lifting cost per barrel of fluid?

A Well, it might but I think maybe you are missing the point that I made. You see, we are lifting approximately twice as much fluid through the dual zone than we would be with a single, and therefore, naturally our expense will be somewhat less. In other words, when you look at the average expense column in group two and group three, there is approximately a hundred and thirty dollars difference but we lifted much more fluid with the group two wells than we did with group three wells. We had no wells singly completed at that particular depth of 6200 feet. I might say that the 42 to 4800 wells were primarily Queen and San Andres production.

Q You didn't have a representative sample of single zone wells to compare with dual zone?

A No sir, not in this area where all duals have been installed. The only single completion we have is the one that I told you went to water and that was the bottom zone.

Q Considering that certain costs related to pumping wells are affected, it would have brought the cost per barrel of fluid lifted down if you had had available to you a group of wells which would have produced approximately the same amount of fluid that the two zones produced, would it not?

A No, I can't agree to that. Our costs are fixed already

and I think that is borne out by group two and group three because we have no pulling expense. These fixed costs are mainly pumper's expenses, treating and minor repairs on the lease.

Q Well, those expenses would have been spread out over a larger number of barrels if you lifted more fluid and be lower per barrel, would they not?

A If we had lifted more fluid then it would have taken more pumping units for the particular depth. In other words, we just wouldn't lift any more fluid per well.

Q What I am driving at is that you didn't have a depth category comparable to the group two category which you could compare?

A My point on this thing here is that group one and group two are all Texas wells where we have had a little bit less allowable there than we have had in New Mexico for the same depth, and there is then more allowable, more production to be taken from this shallower zone because in group three most of them were New Mexico wells, I think in fact that whole number of wells with the exception of four.

Q Even with those higher allowables, they still produced less fluid there, didn't they?

A That's correct.

Q You made several references to the desirability of using this installation where you have five and a half inch casing. This isn't the point in this particular case, is it?

A No sir, this is seven-inch casing where we can run two strings of two-inch in the dually completed well.

Q You wouldn't have to run that expensive 2 1/16 inch Hydrill that you were referring to in this particular well?

A No, that's correct.

Q Have you already made your preliminary calculations as to the length of stroke that is going to be necessary and strokes per minute and so forth?

A Oh no, we haven't done that. We calculated the size of pumping unit we would need and that would be 228, 228-thousand inch pounds of tork. Those things usually have a stroke of I think eighty-four inches.

Q Would you give me an estimate as to what you expect the stroke of the pumping unit to be?

A Well, to begin with, considering that we are making nearly all oil, we will probably run this unit rather slow at, say ten strokes a minute. And it would take me ten or fifteen minutes to determine actually the size of stroke.

Q I don't want it exact, just approximately.

A Roughly, I would say fifty-four inches, in that neighborhood.

Q Ten 54-inch strokes per minute?

A Yes sir, and that would vary with the size of pumps which we run in this installation to get our fluid.

Q Well, I realize that, but if you had to use 54-inch

strokes and you used ten strokes per minute, that would be 540 strokes per minute, would that not be correct?

A That's correct.

Q And assuming there are 1440 minutes per day, how many inches of travel would you have through that packer in the hole, Mr. Motter?

A That would be quite a few inches, Mr. Nutter, but I might point out one thing: I don't think you could have it better lubricated due to the fact that you've got oil on both sides of the seal.

Q Is that oil corrosive, Mr. Motter?

A No.

Q Mr. Motter, in the event that the Commission should approve the installation, would Cities Service be willing to take pressure tests such as you described, would it be possible on the well, say a period of every thirty days?

A We would be glad to take tests, say every thirty days for a period of three or six months, whatever you decide, and we will also be glad to check the gravity of this particular fluid at the same time and also check to see that there is no commingling being done.

Q Would you be willing to pull the pumps after a period of say six months and make an inspection of them at the surface?

A I would see no reason why we would object to that.

MR. NUTTER: I believe that's all, thank you.

MR. PORTER: Anyone else have a question?

MR. FISCHER: Mr. Motter, I will be satisifed with a few questions here. Mr. Motter, what is the allowable of each zone at the present time?

A Well, the Glorieta is 46 barrels and the Blinebry would probably be the same amount because it is in same depth bracket.

MR. FISCHER: And if you went to pumping both these zones, you could design your--or would your pumping unit be an electric motor or gas engine?

A It would be a gas engine.

MR. FISCHER: Thank you.

MR. PORTER: Mr. Utz?

CROSS EXAMINATION

BY MR. UTZ:

Q Mr. Motter, referring to Exhibit Number Seven, do you have knowledge of the total number of dual completions in these various States?

A No sir, my source of information for those dual installations was from the two manufacturers that have placed this equipment, so I do not know the number of actual duals that were allowed for flowing wells or any other type of dual completion.

Q Would it be safe to say that there are many more dual completions of all types than there are of this particular type

that you have recommended here?

A I just don't believe I can answer that question, sir.

Q What type of equipment do you intend to use in this completion, the --

A We propose to use the metal to metal seal in this particular installation. That's one thing I might point out, this seal assembly seems to be somewhat a point of interest. That is made in complements of three feet and we can put as many of those seal assemblys together as the Commission thought might be necessary to stop any commingling that might occur. I might point out that from the experience of one of these companies, they have started manufacturing this equipment with a 36-inch seal at the reduced 2 3/4 inch. That is in case of using Tevlon. I think that perhaps that was brought about more by the introduction of Tevlon over a lesser grade of sealing material that they had.

Q I take it that you feel that metal to metal is better than Tevlon, or is that your decision because of cost?

A No, cost has very little to do with it, that has been my opinion. I think that a metal to metal seal would hold a very close tolerance and that would be in the neighborhood of plus or minus 2/1000.

Q By using longer seals, in your opinion, would it decrease the possibility of commingling?

A No, I don't think that, I think the three-foot metal to metal seal is standard and adequate. In case we found that we

did have some leaks, we could always add more sealing area.

Q In your opinion, by adding say two standing valves in each instance, would that decrease your possibility of commingling?

A Well yes, it certainly would. I would say that two of anything would be better than one.

Q Would you be willing to do that?

A Well, I just don't think it's necessary, Mr. Utz.

MR. UTZ: That's all I have.

MR. PORTER: Anyone else have a question?

MR. PAYNE: Mr. Commissioner, I would like to ask Mr. Kellahin if he has any objection to introducing the entire article from which Mr. Motter quoted into evidence in view of the fact that he only quoted a portion.

MR. KELLAHIN: We would have no objection, certainly not.

MR. PAYNE: Would you do that, please?

A Yes, sir.

MR. PAYNE: Thank you.

MR. KELLAHIN: I have a couple of questions on redirect if the cross examination is completed.

MR. PORTER: Depends on your redirect, I suppose.

REDIRECT EXAMINATION

BY MR. KELLAHIN:

Q Mr.Motter, is there any--what is the pressure in between the two zones that you propose to produce in this well,

approximately?

A Well, Mr. Kellahin, we have very little bottomhole pressure information available. The only bottomhole pressure information I have in the Glorieta is the drill stem test that was run on the State "P" 2, which is the north offset well, and a 30-minute shut-in gave 1700 pounds. I would assume that that is probably a little bit low. The Blinebry on further north up in the pool was tested for bottomhole pressure and I think that it ran safely over 2,000 pounds in this immediate area. I don't have those pressures, I did not think that they would be necessary since this a pumping well and you don't need to run bottomhole pressure in this installation.

Q In this type of installation between the two zones, will it be a matter to be considered, communication between the two zones?

A Well, it's always a matter to be considered, but I don't think there's any possibility of that. The equipment that we have proposed will safely handle any pressure and any pressure differential.

Q In your opinion, this equipment is adequate to handle any pressure differential that might exist?

A The same Baker Model "DA" packer has been approved previously and I don't feel we have a large enough pressure differential to affect any of the equipment.

Q You testified, I believe, that this type of equipment

has the same safeguards as two long strings of tubing with separate pumping units?

A Well, I would say it has more safeguards than the two pumping unit installation.

Q In regard to the problem of whipping of the pumping rod, does that occur in most pumping wells?

A It does, as I explained to Mr. Nutter, whenever you have what we normally term pounding or there is not adequate fluid entering the well bore to keep the tubing full of oil.

Q Now, has that created a problem to you in the installations which you have operated in other States?

A No sir, it has not.

MR. KELLAHIN: That's all I have.

MR. PORTER: Any further questions?

The witness may be excused.

(Witness excused).

MR. KELLAHIN: Our next witness, Mr. Gallian.

J. E. GALLIAN

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

DIRECT EXAMINATION

BY MR. KELLAHIN:

Q Would you state your name, please?

A J. E. Gallian.

Q By whom are you employed, Mr. Gallian?

A Continental Emsco Company.

Q In what business is Continental Emsco Company engaged in?

A We are engaged in the manufacturing and distribution of oil field equipment throughout the world.

Q Now, Mr. Gallian, have you previously testfied before this Commission as an expert on the dual zone equipment, which is the subject matter of this hearing?

A Not before the Commission, but before the Commission's examiners.

MR. KELLAHIN: Would the Commission care to hear the witness' qualifications?

MR. PORTER: I believe his qualifications are complete in this transcript of the previous record, Mr. Kellahin. Unless someone has a question of his qualifications, they are accepted.

Q (By Mr. Kellahin) Mr. Gallian, is your company one of the companies that manufactures this type of equipment?

A Yes, we were one of the first to manufacture this.

Q Would you briefly outline your experience with this type of equipment?

A It initially began with out pump company working with Otis Engineering Company in the development of this tool. That was in 1947; subsequently, our pump company, which at that time was the D & B Division of the Emsco Manufacturing Company, took over the patent rights of the dual pumping equipment from Otis

Engineering and began manufacturing the full line of equipment and I entered into some discussion with Otis in '47, and in '51 when our company, or our subsidiary company, undertook the complete manufacture, I assisted in that work, and in '51, came into the infield operation to a rather full extent.

Q Now, does your company keep any type of record on the success or failure of the operation of its equipment?

A We do during a test period, and after it has proven to be satisfactory, those records are discontinued. As in the case of our two-zone pumping equipment, we maintained early records, but they have been discontinued and we no longer keep records of installations. As such, we do not have a complete record of all dual pumping equipment that we have installed.

Q Was the discontinuance of that because of the fact you had no difficulties with this type of installation?

A Yes, it was found to be satisfactory and therefore, there was no further requirement or anything, just to see how many tools were in operation.

Q Do you have some pictures of this equipment?

A We have a picture of the lower packoff and seal element which was taken of this model that I have with me. The purpose of this is to indicate how the packing is held in place and how it is placed around the reciprocating rod, which is the moving part of the crossover assembly.

MR. KELLAHIN: If th Commission please, those will be

marked as Exhibit Number Eight and Exhibit Number Nine.

MR. PORTER: Which is Eight and which is Nine?

MR. KELLAHIN: The large one showing the packing assembly would be Exhibit Number Eight and then the --

A I believe you have both the same, Mr. Porter. Mr. Morgan has one of the --

MR. KELLAHIN: And then the picture of the entire tool, the length of the tool, would be Exhibit Number Nine.

A Sorry there were not sufficient photographs brought to furnish each member with one.

(Whereupon, the documents were marked for identification as Exhibits Number Eight and Nine).

Q (By Mr. Kellahin) Exhibits Eight and Nine, are these photographs of the tool which you have in your hand, Mr. Gallian?

A They are actual photographs of this piece of equipment.

Q Referring to the model which you have in your hand, will you explain the operation of that tool to the Commission, please?

A This is actually only a portion of the complete crossover as depicted by Exhibit Five and Exhibit Four of Mr. Motter's. This shows only the lower packoff and seal assembly, which seem to be of great interest in that this is the element which packs off the two zones of fluid. Now, in operation, this lower seal nipple is screwed below the crossover and made a part of the crossover. The element that is projecting through that is carried

on the sucker rod string down through the crossover by means of this lower release assembly, which is a spring-loaded release assembly that latches into a recess on the packoff and seal assembly. That is carried through and is landed in the spring collet which is depicted as the large spring fingers at the lower part of the seal nipple. As that is landed mechanically, it must be pulled mechanically. It cannot be pushed out by pressure because of the square shoulders in both of these elements and they are of extreme hardness. If I am not mistaken, these two elements are of rock seal hardness, which is about as hard as you can harden steel without it becoming too brittle for practical useage. That locates this packing assembly in such a position that complete zone separation is maintained while the rod is reciprocating through and while the assembly is in use in the well.

Q That packing assembly has been referred to as the stuffing box. Is that the correct term?

A Not in the common connotation of a stuffing box. Generally speaking, a stuffing box is exposed to air and packs off a fluid from coming out into the air. This is actually a seal assembly, it is surrounded by a lubricating fluid at all times and has pressure above and pressure below. Generally speaking, a stuffing box has pressure operating only at one end of it in the common oil field usage. And further, a surface stuffing box, as we commonly see on top of the wellhead, is exposed at the top of atmospheric conditions and it is at the whim

of the pumper as to how tight he should make his packing. In this, it's a fixed, prescribed packing held at a very close tolerance with pressure above and below and is completely surrounded by lubricating fluid. So actually it is not a stuffing box in that connotation, but a seal assembly.

Q Is that type of equipment sufficient to prevent commingling between two different producing horizons?

A Our experience has been that it is ample.

Q Have you made any pressure tests on this type of equipment?

A Our laboratory ran a test one time in an effort to determine the Tevlon seal, as to how much pressure could be maintained on that and the equipment was capable of 15,000 pounds. We did not detect leakage while the rod was reciprocating at 15,000 pounds pressure; therefore, we felt that it would be adequate and conducted no further tests, to my knowledge.

Q Now, in reference to the entire assembly, in your opinion, is that adequate to prevent commingling of fluid between the two producing horizons?

A It has proven to be adequate in the many installations we have made. In my opinion, it is thoroughly adequate.

Q In some of the exhibits, particularly in Exhibit Five, it would appear that there is an offset in the crossover shoe offsetting the rods that operate the pumping unit. Will that cause any undue wear in the downhole seal assembly?

A As Mr. Motter, explained, those drawings in Exhibit Four and Five are quite exagerrated. The offset is only --

Q You mean Exhibits Two and Five, do you not, sir?

A Two, I beg your pardon, Exhibits Two and Five, that offset is only one half of your tubing or approximately slightly over an inch in offset. Now, in general practice, in running this type tool that is proposed in the Cities Service well, the parallel flow tube in the Baker Model "D" Packer is latched in the tubing and then pulled in tension intended to give us a perfectly straight tubing column above the crossover. Now, the rods traveling above the crossover are directly in line with this seal assembly, which incidentally, is held rigidly in place and latched, both top and bottom, and made a portion of this long assembly so that we have no side play or side thrust at this point in the crossover. Now, should we get fluid pound, as Mr. Motter explained, it would be possible to rattle the rods in the tubing column, but with proper sizing of equipment, that is minimized, if not completely ruled out of the picture.

Q Now, what are some of the advantages of this type of installation, Mr. Gallian?

A Well, in use of single string actuated dual pumping equipment, we are not limited as much as to rod size as we would be in parallel string. Obviously, even in seven-inch, two-inch tubing is our maximum size tubing that can be run in that safely. Therefore, the maximum size sucker rod that can be introduced

through two-inch tubing is 7/8 sucker rods. The maximum size pump that can be run through that is 1 3/4 inch tubing pump. With this equipment, even in 5 1/2, it is possible to run 2 1/2 inch tubing, which would permit the use of larger pumps, would permit the use of one inch or an inch and an eighth sucker rod, and therefore handle greater volumes of fluid with greater safety to your rod string.

Then the other factor that enters in mind at this moment, should we have a rod part in this equipment, there is room within the tubing, sizes that could be used to fish the sucker rod from the well. Then when you use particularly the smaller size parallel tubing strings, there are no fishing tools with adequate strength to fish a 3/4 inch sucker rod from the small inch and a half or 2 1/16 tubing to do a thoroughly good job. So if you should have a tubing part, there is room to fish one string of tubing, where if you had two strings of tubing in the well and one string should part, then the other becomes quite difficult to get out until you can go in and fish the parted string. Does that answer your question, Mr. Kellahin?

Q Yes, sir. Now, you heard Mr. Motter's testimony in regard to the procedure for testing the two separate zones. Are you in agreement with that testimony?

A Yes, very much.

Q Have you anything to add to it in regard to testing procedures which may be followed?

A We have felt that the most successful tests of the lower packoff and seal assembly are those described by Mr. Motter as closing off one zone and detecting a pressure build-up, a fluid increase in the other zone, that is the quickest and most effective. The other, on checking of the gravities of the oil, should we find an increase in a low gravity, we would naturally suspect that it came from the zone which had a higher gravity and we would immediately investigate to determine if we had commingling of fluid in the well bore. Those are the two chief methods used and that is what we recommend highly.

Q Now, with this type of equipment, is it possible to treat the two zones as may be needed?

A Yes, it is. As Mr. Motter explained, the lower zone can be--lower zone pump can be unseated without disturbing any of the other elements and treating fluid can be introduced around the pump into that. The upper zone can be treated down the annular space. In the case of parallel string, the treating fluid for the lower zone would be introduced down the short string past through the crossover, by-pass the pump and enter into the well. Now, with the bottom ball and seat, it would be necessary to adapt to the lower pump a retrieving mechanism which could easily be done to pull it and allow treating at that point to go through there. The upper zone fluid, as I say, or the upper zone, could be treated through the casing annulus and out into the formation without disturbing the upper pump or packoff

elements.

Q Now, does your company manufacture equipment for use in the conventional dual completion units through two long strings of tubing?

A Yes sir, our company manufactures tubing, pumping units, sucker rods and pumps, as well as gas engines and electric motors, so we are equipped to handle both the conventional two-string, two pumping unit installations or the single unit, single string dual pumping installation.

Q The two-string unit installation is more costly, is it not?

A Quite a bit, yes sir.

MR. KELLAHIN: At this time, we would like to offer in evidence Exhibits Eight and Nine as being the photographs of the model which has been used and demonstrated by the testimony of Mr. Gallian.

MR. PORTER: You're not going to leave the model?

Is there objection to Counsel's motion for admission of the exhibits?

They will be admitted.

MR. KELLAHIN: In connection with Mr. Payne's request for the full article, a portion of which was read by Mr. Motter, I would request the Commission for permission to offer this as Exhibit Number Ten and submit a copy of the complete article, subject to the Commission's approval.

MR. PORTER: Does that meet with your approval, Mr. Payne?

MR. PAYNE: Yes, sir.

(Whereupon, the document was marked as Exhibit Number Ten for identification.)

MR. PORTER: Then it will be entered as an exhibit.

Q (By Mr. Kellahin) Do you have anything to add to your testimony, Mr. Motter--I mean, Mr. Gallian?

A Nothing that I don't believe Mr. Motter has covered very thoroughly.

MR. KELLAHIN: That's all the questions I have.

MR. PORTER: Anyone else have a question?

MR. NUTTER: Yes, sir.

MR. PORTER: Mr. Nutter?

CROSS EXAMINATION

BY MR. NUTTER:

Q Mr. Gallian, just what portion of that device is it that Mr. Motter mentioned could be extended by adding 36-inch complements or segments?

A In this particular model, Mr. Nutter, we are showing the Tevlon seal, which is actually 5 3/4 packing element. This portion right here can be extended by adding other packing housings with the packing placed in it to an indefinite length as determined by the customer.

Q On the Tevlon packing type as well as the metal to metal

packing type?

A As well as the metal to metal. Now, both of the manufacturers here represented today make either the Tevlon or the metal to metal, as preferred by the customer, and they both may be extended to any length decided by the customer.

Q I see. Mr. Gallian, you sell ordinary single zone pumps as well as this type of pump, do you not?

A Yes, sir.

Q Have you noticed any peculiarities in connection with the use of these pumps that you haven't encountered with the normal single zone type of pumps?

A In peculiarities, I would interpret that to mean --

Q Unusual performance or anything that you haven't encountered in the single zone pump?

A There have been a few instances that we seem to have had more difficulties in putting this equipment into actual operational use than we have had with single zones, but in each instance, Mr. Nutter, we have found upon investigating that there was some basic element of the well that was improper or incorrect and would have given us undoubtedly the same trouble if we had been using single zone equipment. So in reality, I must say that we have encountered no problems in this that are to any great extent different from those that we might expect and do encounter in single zone installations.

Q Does your company offer an engineer's service whereby

you can help the operator install this equipment in place properly?

A We install each and everyone of this type of equipment for the operator.

Q Do you know of your own personal knowledge whether the other manufacturer that is represented here furnishes the same service?

A They do.

Q I see. Now, would it be possible for you to pressure test one of these sealing assemblies while it was in motion? That is, while the reciprocating rod was in motion, at the present time?

A The pressure test I mentioned was done with the reciprocating rod in motion.

Q Are you still in a position to test that device, Mr. Gallian?

A Yes, sir.

Q Would you be in a position to test the machine in the same manner say six months after it had been in use?

A Yes, sir.

Q Yes?

A It would have to be taken back to our laboratory where facilities are available for that.

Q I see.

A It could not be done on the well in the field.

MR. NUTTER: I see. Thank you very much.

MR. PORTER: Anyone else have a question of Mr. Gallian? You may be excused.

(Witness excused).

MR. KELLAHIN: We will call at this time, Mr. St. John. Off the record.

(Discussion off the record).

J. A. ST. JOHN

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

DIRECT EXAMINATION

BY MR. KELLAHIN:

Q Would you state your name, please?

A J. A. St. John.

Q By whom are you employed?

A By Fluidpack Pump Company.

Q In what position?

A I am Manager of the Technical Service Division.

Q Now, Mr. St. John, what education and experience have you had in mechanical or petroleum engineering?

A Well, I have a--I have a high school education and my experience with technical service has been calculated from experience.

Q Would you outline briefly what that experience has been?

A Well, I worked in production for seventeen years, since

1934 until 1950, when I went to work for Fluidpack Company.

Q When you say you worked in production, what do you mean?

A I started from roustabout, what they call a roustabout, and worked on up to superintendent of one oil company.

Q Will you state what oil company that was and what period of time?

A From 1947 to 1950, I was superintendent for the Street Investment Company, which was an independent oil company of Graham, Texas.

Q Where did you work then?

A I lived there. In and around Abilene, Texas.

Q Now, have you had any experience with dual zone pumping equipment?

A Yes sir, that's all I've done for the last four years, five years.

Q And what connection have you had with this type of equipment?

A Well, I have helped design part of the equipment and install this equipment regularly.

Q Have you personally supervised the installation of this type of equipment?

A Yes, sir.

Q Have you kept track of it after your installation?

A We make an installation report. In other words, when we

install an installation, we make an installation report which will show who the operator is, what is in the well, and what position, where it is located.

Q And is that installation under your personal supervision?

A It is when I make the installation, I make a report of that well, and when one of the other boys makes an installation, he takes care of his own installation report.

MR. KELLAHIN: Are the witness' qualifications acceptable?

MR. PORTER: Yes sir, they are.

Q (By Mr. Kellahin) Now, Mr. St. John, do you have a diagram of the type of equipment which your company manufactures?

A No, I don't have one with me except--do you have one of those? This diagram right here, I thought I came up here and didn't bring it. We didn't know exactly what we were going to need for this equipment.

Q Now, you have been handed a diagram, which we will request to be marked as Exhibit Number Eleven.

(Whereupon, the document was marked as Exhibit Number Eleven for identification.)

Q (By Mr. Kellahin) Referring to Exhibit Number Eleven, Mr. St. John, does that depict the type of equipment your company manufactures?

A Yes, sir.

Q The dual zone installation?

A Yes, sir.

Q Referring to that diagram, did you bring a cut-away model of that type of equipment --

A Yes, sir.

Q --with you?

A Yes, sir.

Q Referring to the cut-away model, will you briefly demonstrate to the Commission--and attempt to avoid any repetition of prior testimony--the operation of your equipment?

A Okay, sir. In other words, you would like for me to show how the equipment is installed? In other words, what procedure we go through to install it?

Q Yes, and I would like, during the course of your testimony, if you please, for you to outline the safety factors built into the equipment to prevent commingling of fluid between the two producing horizons.

A Okay, sir. In other words, this is what we call our tubing assembly in dual zone equipment. This is life-size; in other words, this is the size that we would actually use in running this equipment. Of course, you have your Baker Model "D" Packer located somewhere below this equipment. In other words, we can run this any distance above a Baker Model "D" but ordinarily run them around a hundred feet. Above your Baker Model "D" Packer you still have your packing sealing element with a standing valve below it. Then we have the lower pump setting shoe, which comes just above the locater and there is the Baker

Model "D" Packer, and then we run the tubing up until we get ready to put the crossover shoe and when you put the crossover shoe, you run it into the hole until the tubing has latched your Baker Model "D." And then your wellhead is--you make your wellhead spacing just like you would on an installation where you are using a packer in the hole. Then we pick up our parallel string, which we attempt to use two-inch tubing, and it is run in by the side of your long string of tubing and when it gets to here, there is no place for it to go so it goes into this hole right here and is landed. In other words, this is locked in here and it is for us who are running the tubing to know when it is landed. When it is landed, it takes 1500 pounds to pull it and about 500 pounds to push it in. In other words, you can put pressure on it as much as you want to and it doesn't have an unseating force because you are pulling down as much as you are pushing up.

Then I will talk about the safety factors. Over here to prevent commingling, you have your standing valve which is to keep the upper zone fluid from going into the lower zone. And these standing valves here are just regular API and some people call these check valves. The lower zone, fluid from the lower zone, comes up the tubing to here and it can't get by the check valves. In other words, the only place it can go is up your tubing string and the only possible chance for commingling would be across the seals right here, which are ...

Q The seal is on what portion of that?

A This is your landing spear, what you call your landing spear. These seals were made, designed and made first by Baker Oil and Tool Company, which they used Baker Model "D" Packers and they wanted some kind of base so they put these two deep lines with tolerance which we use in making this seal. These seal rings here have been tested and we used one ring here and one here and they were tested at 12,000 pounds. And the reason we run five on each side is in case when you run it in the hole one gets nicked, why if you just had one it wouldn't hold, but we haven't had failure and so forth.

Q Is that the same type of packer as your Baker Model "D" Packer?

A These seal rings here are the same material used in the Baker Model "D," which I believe the Commission Board has approved for New Mexico. Then the rod string, when your tubing strings are landed and then placed, then you have your rod string to run in your lower pump. Your rods from this top pump will run down and screw to your lower pump. In other words, where one rod string actuates both pumps. In other words, when you move your top plunger, you are moving your bottom plunger. This is the seal assembly. On ours we prefer mostly to use metal to metal. In other words, that is what we use in nearly all of our installations, it's metal to metal with a three-foot metal seal. This rod is plunged in the hole and is honed to 2/1000

and inside it fits just exactly like a barrel in a plunger in a regular pump. So when you run your lower pump, you pick up your upper pump. In other words, our equipment is on a regular rod string. This upper pump is just a regular pump like you run in any well, the only difference is that it has a seal assembly attached to it and the lower pump is just a --

Q In regard to the seal assembly, you say that you prefer a metal to metal seal. Have you found that adequate to prevent communication between the producing horizons with the pump in operation?

A Yes sir, we sure have. In other words, if we are ever in doubt, we close the valve on the parallel string and whenever you close the valve on the parallel string, you are testing this seal, this seal, and your tubing strings and also this seal that is right here and this is your lower pump pressure. Then you go up and shut your well down and if they are holding, your pressure stays, then you know that you have all your seals in place and your seal assembly isn't leaking because if you get an assembly leaking here, you will build no pressure in your long string of tubing. These are locked up, this is a positive lock. In other words, you have to lock the top of this on the head so we have a positive lock when we run these in and it is closed. It really doesn't have to be that close, but you have to close it to get through here. Ordinarily, if that was setting unlocked, the weight of your hand would push it through. It goes in place,

there strings are locked, this is a positive lock, and when it does, it throws your seals across this hole here, you have a set of seals here and a set of seals here. Your lower zone fluid is pumped up your tubing until it reaches this sealing element in this packing in this hole right here, it's just below this packing.

Q You are referring to the hole --

A This hole here.

Q The area that is painted red?

A Yes sir, this hole right here is where your lower fluid comes out of your tubing into your crossover shoe and it goes into the parallel string across where these holes are right here.

Q And what happens to the other zone then?

A Then your upper zone, you know, comes in here where this yellow mark is, the upper zone enters these balls and sets and comes up into your upper zone pump. In other words, it's above this sealing element in here and this set of seals. Your fluid goes in here and this set of seals is to keep your fluid from your tubing, it goes back into your pump. In other words, it's just circulating just like on a regular pump. This would be from the sealing up just like a regular pump. In other words, if you were leaking, your seals would leak right back and your fluid would just circulate. So in other words, it goes into your upper pump, which this plunger ties on this rod on the bottom of the

upper plunger. This would produce your fluid on your upper long string just like a regular pump.

Q Now, in this type of installation, Mr. St. John, is it possible to make what tests may be necessary or treat the separate horizons?

A Yes, sir. In this type of installation, our tests might work a little different than in the other installation. In other words, Mr. Motter said that we can pull this pump equipment out if we want to test the lower--treat the lower zone. We can pull the pump out and get a positive seal by running a through tubing, that is, a PSI through tubing blanking plug, which I believe the Commission has approved in New Mexico. In other words, when this is seated, we run a collar right here on your crossover shoe and the pump is in here. This is the blanking plug in here and when it is in place and the lock is up on the joint of tubing, it can't blow it out of the hole so these seals are above this intake, your upper zone intake, and these seals here are below this outlet into your parallel string where it has the hole through it. So your lower zone fluid comes through right up in here and that actually locks the lower zone tubing. That is a positive shut-off from the upper zone, there is no doubt. Then if you want to test your upper zone for any reason, you have to shut your bottom zone out of your tubing. This little plug, it's solid, it's just a blanket plug, and when it's in place, the seals are below this intake here and your lower

zone fluid comes up here and it is isolated into your parallel string, then your upper zone fluid can go on up your tubing. Or you can put it right down there, put a complete blank on the bottom clear over, you can put that plug solid on your seal here and completely isolate your lower zone at any time. That is just running a wire line plug.

Q Now, Mr. St. John, in your opinion, is this type of installation adequate to protect the zones against communication?

A Yes sir, we found them so.

Q You heard the testimony of Mr. Gallian and Mr. Motter in regard to the advantages of this type of equipment. Do you have anything to add to that?

A Well, this type of equipment, it's--in other words, it's more economical to produce a dual zone well than it is to run two pumping units and two strings. Just like if we were manufacturers of pumping units, well, we wouldn't--we'd rather see a man run two pumping units.

Q Now, can the two zones be produced as efficiently as with two pumping units?

A Yes sir, they sure can because actually, we don't have anything in our equipment that's not standard PSI pump. In other words, your upper pump is just like the conventional pump that you run in any well, your lower pump is just like a conventional pump that you run in any well. All the difference is, as I said before, there is a seal assembly that separates your two

zones.

Q I believe you testified that Exhibit Number Eleven was a diagrammatic sketch of the equipment which you have been demonstrating here, is that correct?

A Yes sir, it sure is.

MR. KELLAHIN: At this time, we would like to offer Exhibit Number Eleven.

MR. PORTER: Without objection, Exhibit Number Eleven will be admitted in the record.

Any questions of the witness?

CROSS EXAMINATION

BY MR. NUTTER:

Q Mr. St. John, have you noticed any peculiarities in the installation or operation of this type of equipment that are not present in the installation and operation of single zone pumping equipment?

A No sir, I don't think you'd find anything different from any other types of installations because in other words, your pumps are the same, and the only difference would be your seal assembly. You run in your tubing string just like in other words, just like it was another joint of tubing.

Q What provision is made for venting the lower zone?

A Venting the lower zone, we have it vented just like Mr. Motter brought up on this drawing over here. You can bring that fluid gas vent line up to be tied in with your bottom tubing

casing. In other words, you're by-passing your pump. You have a ball and set check valve on that just like you would on what we have right in here. And it has been proven to work because we have actually run it on wells that they could not pump the lower zone on account of gas and we have installed this equipment in those wells and actually pumped, produced them.

Q Is your laboratory or shop equipped so that you can pressure test one of these machines while it is in operation?

A Well yes, I am sure it is. We usually test this on location, in other words, with your pumping unit. In other words, we close the valve that is going to your well and close this valve and just let the pump build that pressure. Sometimes it may take a little while for it to compress the fluid. In other words, if you have a foamy gas, it may take a little while to compress, but if you got solid water, you don't want to go too far away from the clutch on that unit because that pump will actually build up a hundred pounds or more on each stroke.

Q You could test it in your laboratory prior to installation and say six months after installation --

A Yes, sir, that's right.

Q --where you know you wouldn't have any gas or anything else that might effect the pressure?

A That's right, or you can go to a well and do it after it has been installed.

MR. NUTTER: Thank you.

MR. PORTER: Mr. Utz?

CROSS EXAMINATION

BY MR. UTZ:

Q Mr. St. John, in reference to the metal to metal seal unit, what is your clearance around your sucker rod?

A 1/1000, we try to make it 1/1000 but it varies just a little bit one way or the other, but we try to make it at 1/1000.

Q Have you pressure tested this unit to see how much fluid will be passed through at so much pressure?

A No, we haven't, but on the metal to metal seal, as you understand it, they will always usually just have a slight fluid passage on pressures. That metal to metal seal is not a positive seal is what I mean, but actually, when this rod is working, you get a better sealing than you would with it standing still, because when you have a piece of metal working, you get a better seal than if it was not moving.

Q You have some by-pass fluid or water, right?

A That's right, you couldn't have a positive metal to metal seal if you wouldn't get any lubrication at all. Just like on these pump manufacturers that manufacture barrels and plungers with a metal to metal seal, you do have to have a clearance to get lubrication.

Q But you don't have any idea how much pressure you could get say at forty degrees gravity and so forth?

A No, we don't have any record of how much it would pass

through. No sir, we don't, but you could tell at the surface by pumping and pressuring up your parallel string. Maybe it's a half a barrel or a barrel that passes through in a day's time because you do have a differential in pressure, you have a pressure on top in the seal and you have a pressure under it. I'll grant that the pressure will be practically the same because you have your hydrostatic head up there and you have your hydrostatic head on your upper zone on top of it, so there wouldn't be much differential in the pressure.

Q Has your company had the same experience as Mr. Gallian's in reference to pressure testing the Tevlon seal?

A I don't believe that we have ever tested that in our plant; in fact, we have only used Tevlon packing in one installation that I know of.

Q On your new units, what type of --

A On our new units?

Q On your new units that you have regularly installed, have you used Tevlon?

A We don't make the Tevlon packing unless a customer requests it, we make all metal to metal seals. We have had one customer request the Tevlon packing, which was Tidewater Oil Company at East Texas.

Q What I am trying to find out is, is there any fluid passage through the Tevlon seal at all?

A I couldn't tell you that, sir.

MR. UTZ: That's all I have.

MR. PORTER: Any further questions?

MR. JOHNSTON: Yes, sir.

MR.PORTER: Mr. Johnston?

MR. JOHNSTON: We might have to get Mr. Gallian to answer this, but leaving out personal preferences that one individial or company might have, has the Tevlon seal withstood the same tests as the metal to metal?

A Well now, I couldn't answer that. Mr. Gillian might have the answer to that because as I said, we only had one customer that wanted to try the Tevlon seal, which was Tidbwater in East Texas.

MR. PORTER: Anyone else have a question?

MR. KELLAHIN: I would like to ask just one question.

REDIRECT EXAMINATION

BY MR. KELLAHIN:

Q Mr. St. John, assuming there is no pressure differential of any appreciable amount between the two zones, would there be any appreciable passage of fluid through the metal to metal seal?

A No sir, there sure would not.

Q In this installation in this particular well, do you know whether there would be any pressure differential or not?

A Well, in this particular well, Mr. Motter could more or less answer that. I think the only--in other words, our

pressures on the hydrostatic head would be the only difference in the pressures that I would think of.

MR. KELLAHIN: That's all I have.

MR. PORTER: Any further questions?

The witness may be excused.

(Witness excused.)

MR. KELLAHIN: I would like to recall Mr. Motter briefly to discuss the question.

MR. PORTER: You may.

MR. MOTTER: I would just like to make a point here that I think we are missing on this matter of differential across this packing seal element. The only differential we'll have is whatever length of seal we have, since this column of fluid and this column of fluid would be the same, and we might have a little bit of differential in case there is a different gravity of fluid, but that would be very minor in the differential across the packing element.

MR. KELLAHIN: That's all.

MR. PORTER: Any further questions?

MR. UTZ: By minor, what magnitude do you mean?

MR. MOTTER: Well, Mr. Utz, it would be minor depending upon the gravity of the fluid. If one would be 38 and the other 36, there might be--I am assuming without calculating it--it might be twenty pounds or something like that, but what I am getting at is, that the hydrostatic heads are almost, for practical purposes,

the same across the seal element.

MR. PORTER: Is that all the questions you have?

MR. UTZ: Yes.

MR. KELLAHIN: That completes our presentation.

MR. PORTER: The witness may be excused.

(Witness excused.)

MR. PORTER: Does anyone else have any testimony or exhibits to --

MR. JOHNSTON: Could we recall Mr. Gallian and clear up that point about whether or not the Tevlon has withstood the same tests as the metal to metal seal?

MR. PAYNE: Mr. Johnston, does Gackle have a residence Counsel here?

MR. JOHNSTON: That was a question for myself, and if necessary--off the record.

(Discussion off the record).

MR. PAYNE: Mr. Gallian, in your opinion, will it withstand the same pressure?

MR. GALLIAN: In my opinion, Mr. Payne, the metal to metal seal would serve as adequately as the Tevlon. Frankly, the only reason for using Tevlon was for the economy of space and the fact that it was giving adequate results at a very economical cost.

MR. PAYNE: There is no increase in efficiency in the metal to metal?

MR. GALLIAN: Yes sir, as far as I know, there is no appreciable difference in efficiency between the two.

MR. PAYNE: Thank you.

MR. PORTER: Any other questions?

Anybody have any statements to offer in the case?

MR. PAYNE: I have two that we received.

MR. PORTER: Telegrams?

MR. PAYNE: Yes, sir.

MR. PORTER: Read them into the record.

MR. PAYNE: "In regard to the hearing January 14, 1959 on Case 1557, application of Cities Service Oil Company for permit to operate a two zone pump on single rod string with crossover equipment and two parallel tubing strings at its State "P" Well Number 3 in the Blinebry and Glorieta Pools, this type installation has been used by Phillips Petroleum Company on more than ten wells in Texas, Oklahoma and Kansas for eight years and is giving satisfactory service. This operation creates no more danger of commingling between zones than with two zones flowing or with two pumping units. Industry ingenuity in developing this cost-saving device should not be thwarted. Phillips Petroleum Company urges that the Commission reconsider its decision and approve this installation." Signed --

MR. PORTER: Did you say statement or telegram?

MR. PAYNE: Signed, L. E. Fitzjarrald.

"In regard to application of Cities Service Oil Company

to dually complete its State "P" Number 3 well, by the installation of dual zone pump equipment, Terry Blinebry Oil Pool and an undesignated oil pool in the Glorieta Sand, Lea County, New Mexico, Case Number 1557. Magnolia Petroleum Company as an operator in the Terry Blinebry field, hereby supports Cities Service Oil Company in its application for permit to install dual zone pumping equipment to effect a dual completion of its State "P" Number 3 Well between the Terry Blinebry Oil Pool and an undesignated Glorieta Oil Pool, Lea County, New Mexico."

Signed, D. V. Carter of Magnolia Petroleum Company.

MR. KELLAHIN: I would like to make a very brief closing statement, if I might. I would like to make this observation, and I think it was brought out to some extent on the material just quoted: There are from time to time new developments in the oil field operations, as this Commission well knows, and we feel that we have presented an adequate case to show that the danger of commingling of reservoir fluid is at a minimum and certainly no greater than in the conventional types of dual completion which have heretofore been approved by the Commission.

So with a new Commissioner present, we feel that we have belabored the point in our presentation. If we have bored the Commission, we apologize, but we did feel that in view of all of these circumstances and this being a new type of installation in the State of New Mexico, we so attempted to give the Commission all of the information which would be pertinent to this

type of completion.

I think we have shown that the zones will be adequately protected, I think we have shown that this type of installation is in the interests of conservation and the prevention of waste in that it will result in the greatest ultimate recovery of oil from the two zones involved here. It is a type of installation that we feel the Commission should approve, and in connection with our presentation, I would like to make the observation that there has been no testimony offered against this type of completion. There has been no testimony or evidence offered to show where any excessive danger of commingling or other damage to the reservoir or to the creation of underground waste might exist. I think all of the testimony has been to the contrary, and we submit that the Commission should seriously consider approval of this type of installation in New Mexico.

MR. PORTER: Anyone have anything further to offer in Case 1557?

We will take the case under advisement and proceed to case 1581.

STATE OF NEW MEXICO)
: ss
COUNTY OF BERNALILLO)

I, JERRY MARTINEZ, Notary Public in and for the County of Bernalillo, State of New Mexico, do hereby certify that the foregoing and attached Transcript of Hearing was reported by me in Stenotype and that the same was reduced to typewritten transcript by me and contains a true and correct record of said hearing, to the best of my knowledge, skill and ability.

DATED this 18th day of January, 1959, in the City of Albuquerque, County of Bernalillo, State of New Mexico.

Notary Public

My Commission Expires:
January 24, 1962

BEFORE THE
OIL CONSERVATION COMMISSION
Santa Fe, New Mexico

IN THE MATTER OF:

Case No. 1557

TRANSCRIPT OF HEARING

NOVEMBER 19, 1958

DEARNLEY - MEIER & ASSOCIATES
GENERAL LAW REPORTERS
ALBUQUERQUE, NEW MEXICO
Phone CHapel 3-6691

NEW MEXICO OIL CONSERVATION COMMISSION

Mabry Hall

Santa Fe, NEW MEXICO

REGISTER

HEARING DATE Examiner November 19, 1958 TIME: 9:00 a.m.

NAME:	REPRESENTING:	LOCATION:
Leavy W Selvidge	Shelly	Tulsa
E. E. Motter	Cities Service Oil Co	Hobbs
J Sullivan	Cities Service Oil Co	Midland, Tex
C M Bumpass	Gulf Oil Corp	Hobbs, N.M.
W. V. Kastler	" " "	Roswell,
Jason Kellahin	Kellahin & Fox	Santa Fe
John B. Rass	Texaco	Midland
H. N. Woods	Texaco	Ft. Worth
R S Christie	Amerada	Tulsa
R.W. Sullivan	British-American	Denver, Colo
John E. Stein	British-American	Denver, Colo.
Marvin Cantwell	Marvin R. Cantwell	Hobbs N.M.
B Young, Jr.	Magnolia Petroleum Co	Hobbs N.M.
Thomas M. Hoppe	British-American	Denver, Colo
R N Miller	Tidewater	Hobbs
R. L. Lester	Shell Oil	Roswell
Oliver Seth	Seth & Montgomery	Santa Fe

NEW MEXICO OIL CONSERVATION COMMISSION

Mabry Hall

Santa Fe, NEW MEXICO

REGISTER

HEARING DATE Examiner November 19, 1958 TIME: 9:00 a.m.

NAME:	REPRESENTING:	LOCATION:
L. C. White	Texaco Inc.	Santa Fe
Guy Buell	Pan Am. Petr. Corp	Ft. Worth
Dan Currens	" " " "	Roswell
E. V. Boynton	Continental Oil	Hobbs
M. C. Watkins	Fluid Packed Pump Co.	Hobbs
J. C. Wells	The Pure Oil Co.	Ft. Worth
B. J. Griffith	" " " "	Midland
Frank C. Barnes	Independent	Santa Fe
H. H. Riddle	"	Salt Lake City
Robert Fox	Kellahin & Fox	Santa Fe
Nancy Royal	N.M. Stenotype Reporting Service	Santa Fe

BEFORE THE
OIL CONSERVATION COMMISSION
SANTA FE, NEW MEXICO
NOVEMBER 19, 1958

IN THE MATTER OF:

CASE 1557 Application of Cities Service Oil Company for a dual completion. Applicant, in the above-styled cause, seeks an order authorizing it to dually complete its State "P" No. 3 Well located 990 feet from the South and West lines of Section 32, Township 22 South, Range 38 East, Lea County, New Mexico, in such a manner as to permit the production of oil from the Blinebry Oil Pool and from an undesignated Glorieta oil pool through parallel strings of tubing.

BEFORE:

Mr. Elvis A. Utz, Examiner.

TRANSCRIPT OF HEARING

MR. UTZ: The next case will be 1557.

MR. PAYNE: Case 1557, "Application of Cities Service Oil Company for a dual completion."

MR. KELLAHIN: Jason Kellahin, Kellahin and Fox, Santa Fe, New Mexico, representing the applicant. We will have two witnesses, Mr. E. F. Motter and Mr. J. E. Gallian.

MR. UTZ: Are there other appearances to be made in this case?

If not, you may continue to swear the witnesses.

(Witnesses sworn in).

(Whereupon, the documents were marked as Exhibits One through Six for identification).

E. F. MOTTER

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

DIRECT EXAMINATION

BY MR. KELLAHIN:

Q Will you state your name, please?

A E. F. Motter.

Q Where are you employed?

A Cities Service Oil Company.

Q In what position?

A Division Engineer.

Q In what division?

A Hobbs, New Mexico, and portions of West Texas.

Q Mr. Motter, are you familiar with the application in this case?

A Yes, I submitted the application.

Q And the area involved falls within the jurisdiction which is your district?

A Yes, it does.

Q Mr. Motter, briefly, what is proposed to be done in this case?

A Well, we propose to dual the State P Number 3 in the Glorieta and Blinebry zones. We anticipate this well will have

to be artificially lifted a short period of time and we would like to do this by means of a pump on circle rod string with crossover equipment and two strings of tubing.

Q Referring to what has been marked as Exhibit Number One will you explain what that shows?

A Exhibit Number One is the area in question. The State P Lease, Well Number One is currently drilling about 4,400 feet. There are a couple of wells now completed in the Glorieta and Blinebry. Pan American State T 2 is producing from the Glorieta and Gulf's Andrews 3 is producing from the Glorieta and the Blinebry. On our west are State P Number 2 and Pan American State S Number 3, which is completed in the Blinebry.

Q Mr. Motter, I overlooked asking you if you have testified before this Commission in the past as an expert in engineering and had your qualifications been accepted?

A They have been.

MR. KELLAHIN: Are the witness' qualifications acceptable?

MR. UTZ: Yes, they are.

Q (By Mr. Kellahin) In the lease involved in this application, Mr. Motter, is there any difference in the ownership in the Glorietta and the Blinebry zones?

A No, there is not.

Q Could you discuss briefly the fluid characteristics in the Glorieta and Blinebry?

A Yes, referring again to Stanolind's State T Number 2,

this well is completed in the Glorieta from 5200 to 5216, those are the perforations. The most recent test on this well was taken August 6, 1958. It produced 58.6 barrels of oil, 30 water, GOR was 35 to 1, gravity was 36 degrees, it's API. Gulf's Andrews Number 3, which I pointed out, is perforated from 5164 to 5216. The most recent test on that was January 12, 1958, I believe--excuse me, that's not the most recent test, that was initial potential. It produced 43.4 barrels of water on a 15/64 choke in 6 hours. The GOR at that time was 430 to 1, gravity was 36 degrees API. The most recent test had a gas/oil ration of 212 to 1 and that well is currently producing top allowable. In our State P 2, which is north offset to the State P 3, there's a drill stem test on the Glorieta from 5135 to 5212. It produced 110 barrels of oil and no water in 4 hours. The GOR was 42--pardon me, that's 422 to 1, gravity was 38.8. A 30-minute shut-in gave 1700 pounds bottomhole pressure.

On the Blinebry production, again on the north offset of our State P Number 2, the most recent test on it was August 4, 1958. It produced 31.7 oil and 6 water in 24 hours on a pump. The GOR was 3795 to 1, the gravity is running between 39.6 and 40 API.

The north offset to this well, Pan American's State S Number 3, is currently flowing with a penalized allowable. The GOR is 1500--700 to 1, the gravity is 39.0 API. I might point out that the State P Number 3 is not completed. It is currently

drilling at about 4400 feet. It was spudded October 20, 1958, we have nine and five eighths casing set at 1330 and cemented to the surface.

Q You have not yet then run any production string in the well?

A No sir, we are drilling an eight and three quarters inch hole in preparation of running a seven-inch casing.

Q On the basis of the information you have, there would appear to be a substantial difference in the gas-oil ratio between the Glorieta and Blinebry, is that correct?

A Yes sir, there certainly is.

Q And there is a difference in the gravity of the fluids also?

A About two degrees.

Q In your opinion, Mr. Motter, is that a sufficient difference in gas-oil ratios and the gravities of the fluids to insure quick check as to the possibility of commingling in the well bore?

A Yes, I think it is. A GOR test will probably not be run too often, but certainly every time there's a tank of oil run we will have a gravity check on it in the produced oil from the two zones.

Q Now, referring to what has been marked as Exhibit Number Two, would you state what that shows?

A Exhibit Number Two is the well that we propose to dual,

State P Number 3. We will start out here toward the bottom. We are going to run a Baker Model DA Packer with a parallel flow tube that is used with that Packer. We have a one-inch gas vent line and along the side of the bottom pump to prevent this bottom pump from gas swamping, there will be a check valve in it. The check valve at the bottom I will come back to later. The cross-over assembly will be set probably almost opposite of the upper perforations or possibly just below the lower stuffing box packoff assembly and the oil will run through there, which will prohibit commingling of the fluids. The stinger assembly in the second string of tubing sets into the packing element on both sides of this entry and that second string is latched into place into the crossover assembly by some two thousand pounds on it. The upper part, of course, is above the packoff assembly and the fluid from the upper zone will enter and be pumped into the upper pump through the two-inch tubing and the fluid from the bottom will be pumped to the bottom pump at the crossover assembly and not to the surface. We have installed, or propose to install, a check valve in the tubing below the bottom and we will have one up here in the cross-over assembly so that if the two pumps were drawn from the well, there will be no commingling of fluid. In other words, if the bottom zone has a higher pressure, this tubing will fill up to this point here and will be checked, and vice versa, if the upper zone has a higher pressure, this valve will not allow it to enter, but will be checked by this valve down here. We will have a dual

head with a single pumping unit.

Q Now, with that single pumping unit, is it possible to control the production on this well?

A Yes, it certainly is. There are actually about four means to control production from the two zones. The first means is sizing of the pumps. The second means is usually used in case the upper zone has produced its allowable and the bottom zone has not, you merely re-circle the oil in the upper zone, just put it back in the casing. The third method is a traveling--I have to find the name of this thing--traveling overload valve, which is actually installed in the pump itself and by means of closing of a valve at the surface, enables the pump to actuate and does not produce any oil, that holds the valves open. The fourth method of controlling production in case the bottom zone allowable is produced before the upper zone is a polish rod. This polish rod is of sufficient length that this pump here, when the rod string is pulled, is unseated before the upper pump is unseated, so we can merely unseat this bottom pump and go ahead and pump the upper zone.

Q Now, in connection with your discussion of that type of application, have you mentioned all of the safety factors which are designed to prevent commingling?

A Well, admittedly there are a few others. We'll say the well was flowing, but we think that there is adequate protection in this stuffing box, this can be done in numerous ways, with a

metal to metal seal with a very close tolerance or we can use a long type packing in there. Both of these have proven quite satisfactory, and in the stinger assembly we use a Chevron type packing, which we do not feel has too much possibility for leak. The two check valves we feel are adequate in another manner, though they are the same thing that will be used in the case of two pumping wells. In other words, two pumps on two rod strings. So actually the only other two points of possible leakage would be the lower stuffing box and the stinger in the crossover assembly.

Q Referring to what has been marked as Exhibit Number Three, would you state what that shows?

A Well, this is a little schematic we had made up to show means of determining fluid levels to see if we have a packer leakage. We can run a bomb in this two-inch tubing in the inside to determine the fluid level in the bottom zone; we can use an acoustic well sounder to determine the fluid level in the upper zone. By knowing the gravities of the two fluids, we can actually calculate what the differential will be across the packer. Any time we find the fluid level to be the same, we will probably suspect a leak. In this particular area there is no bottom hole information available, this is rather new production. The bottom hole pressure that I do have from the drill stem tests indicates that we will probably have about ninety pounds per square inch differential at that packer, which should be easy to detect if we have any leaks.

Q With a ninety-pound pressure at that point, is that sufficiently high to cause any concern?

A No sir, not on this packer. This packer is used at much higher pressures than that.

Q Now, as I understand your testimony in regard to Exhibit Number Three, it is possible to determine the fluid levels for both zones?

A That is correct. Well, I might say with one exception. In case the lower zone did not have adequate fluid level to be up to the crossover assembly, however, we hope enough pressure will be there with the probability of dualling the well.

Q Your diagram shows a completion design for a seven-inch casing with two strings of two-inch tubing. Would it be possible to use any other type of completion in here?

A Yes sir, we could run five and a half inch casing and use one string of two-inch in which the two pumps and rod string would be entered and the string from the crossover assembly to the surface would be one inch. In this case, I believe I have made an estimate, I believe, that we will get to in a later exhibit, that we would expect to save as much as six or seven hundred dollars on this particular well should that be done.

Before I get away from this Exhibit Number Three, I would like to point out that although this can be done and probably will to determine a packer leakage, one of the best methods known to check an installation of this type for possible failures is merely

to close the valve at the surface. Either valve could be closed on either tubing string, a pressure gauge to be inserted and the pumping unit continued to act. If pressure builds up on the tubing on the side of the valve that has been closed and we do not get any increase in production on the other side, we know that we are safe. Should we have no build-up in pressure, we will naturally have no increase in production on the other side and we know that we have a failure or leak in the equipment.

Q Now, with this type of equipment, in your opinion, is it possible to make such tests or treat the zones as may be required from time to time either by a Commission order or by good oil field practices?

A Yes sir, we can. From the upper, we can treat this without even pulling the rod of tubing. In the lower zone, to treat it it would be necessary to pull the rod and tubing and then insert a wire line tool which separates the two zones in the crossover assembly. There are two different companies making this particular type of equipment that it's necessary to use.

Q And for that type of treatment, there would be no danger of commingling from separate horizons?

A I don't believe so.

Q Referring to what has been marked as Exhibit Number Four, can you state what that is, please?

A Exhibit Number Four as an economics of two zone pump versus two pumps with individual pumping units. I have broken the

cost items into two columns with all the necessary equipment. I should say not entirely the amount of necessary equipment, but in some instances it is necessary to have equipment whether it is completed one way or the other. Some few items were left out, but starting at the top, we have--well, probably if granted, we will use a 228 thousand inch pound pumping unit on the two zones, we will only need one. This unit will require a twenty-five horse-power engine, so we will only need one of those. Following right down through the different assemblies, we have a savings by using two zone pump of an estimated $13,533.00.

Q Is the estimate also based upon your proposed completion in the subject well?

A Yes sir, and those figures are just about as complete as we can get.

Q I believe you testified a while ago that a greater savings still could be achieved by using a five and a half inch casing instead of the seven-inch casing?

A That is correct, an additional six, seven hundred dollars.

Q Referring to what has been marked as Exhibit Number Five, would you state what that is?

A Exhibit Number Five are some dual installations. We have investigated in different States. In each instance, two pumps are being operated simultaneously with one rod string and one pumping unit or one zone is pumping and the other is flowing but the well is equipped for installation of pumping, the other

zone or the zone that is flowing, at a later date. These are approved in six States. In Alabama there was one installation in 1957 and none to date in '58. In Kansas, four in '57, to date in '58, three, or I should say that these were up until October of 1958. Louisiana, three in '57, none in '58. Mississippi, three in '57, two in '58. Oklahoma, twenty-seven in '57, fourteen in 1958. In Texas, a hundred and ten in 1957 and a hundred and thirty-seven in 1958.

There are two companies presently manufacturing this type of equipment. They started in 1947 and since that time, there have been about seven hundred crossover assemblies manufactured. We do not know whether all of these are still in use, but we estimate that there are approximately five hundred dual zone pumps in operation today in various States. They are also operating in four foreign countries, Canada, Columbia, Venezuela and Germany.

Q Has your company had any experience with this type of completion?

A Yes, we most certainly have. We have numerous installations such as this in West Texas. Those wells are pumping from depths as deep as ten thousand feet and we have had very little trouble with those installations over there.

Q Have you had personal experience with that?

A Yes, I certainly have.

Q What has that experience been?

A Well, the majority of these installations were not made

over my supervision. However, I have all the information available and naturally, any type of new equipment that our company uses such as this, any failure is immediately sent out to all outlying districts and divisions for their information. We have recently installed some of these installations under my direct supervision in the Fullerton Field and it is operating quite satisfactorily.

Q You have had no experience at all with failures?

A I will admit that we have had failures. The installations, when they do fail, it's an immediate failure and we know them the minute they happen and we run a packer in there. Recently we got some debris in the receptacle in the crossover assembly. We thought we had the stager in place but we didn't lock it and found it immediately. We had some commingling but we pulled it out and cleaned it and it is operating quite satisfactorily right now.

Q Have you made any study or has your company made any study of this type of equipment and have any other information you want to offer?

A Yes, one of your district engineers in the Odessa office, where most of this equipment has been installed, presented a paper at the West Texas Oil Lifting Short Course April 17 of this past year. That paper has also appeared in the Oil World, I believe it was in the May issue. He tells of installations in West Texas, of our installations and of others. There is one particular well that is using this type of equipment that is producing from twelve thousand, three hundred feet.

Well, numerous installations, most of ours, the lower zone is pumping from seventy-nine hundred to ten thousand, one hundred feet, and we have had little or no trouble with this type of equipment. Another paper which was presented at that same conference was titled, "Dual Zone Pumping with Two Pumps," actuated by one rod string by Mr. Whittaker and Libb of Gulf Oil.

Q Wait a minute. Mr. Motter, what are the publications you are referring to?

A That appears in the fifth annual West Texas Oil Lifting Short Course. I do not have additional copies, there are several comments I would like to read from that paper.

Q Would you give the page number you are reading from?

A All right. Before I read that, there is this brief article by Gulf describing numerous installations that they have had, it shows the tests they have run and they tell of the experience they have had in pulling these wells. Actually, they are getting very long runs out of these wells. This particular well they are talking about is averaging pulling I think one time every fifty months, which I think is an extremely long period. That is actually I think a longer run than we get in many of our single installations.

I would like to read from Page 189 some of Gulf's conclusions. "Our experience with tandem pumps indicates that as a general rule this equipment will give satisfactory service. The newer designs should eliminate or minimize some objectionable

features of earlier models." He is speaking of models that were manufactured as early as 1947 and then his next statement brings out, "Dual zone pumping certainly involves more problems than single zone pumping. Most dual zone pumping equipment problems have occurred during installation or immediately thereafter."

Along with some more conclusions that he draws are advantages and disadvantages and again I will read from his article. "Dual zone pumping using tandem pumps has distinct advantages and disadvantages. Some advantages are: 1. Smaller initial cost in comparison with other methods. 2. Comparison with casing designs in most wells and 3, elimination of upkeep of two pumping units. The main disadvantages are: 1. Lack of simplicity. 2. Inability of equipment to handle suspended sand as well as some other methods. 3. Loss of production from both zones due to the servicing of downhole equipment for one zone. 4. Pumping depth and quantity of production limited by strength of rods, and 5, lack of flexibility, even in the most advanced models."

Further on down in his advantages and disadvantages he goes on to say: "The tandem pumping method has demonstrated its value as a means for producing dually completed wells. Like any type of oil field equipment, however, it has its limitations and should be thoroughly engineered to suit conditions existing in each specific well."

I might say at this time that I do not agree fully with his disadvantages and if the Commission would like, I would be

glad to tell why I do not agree.

Q Would you comment on the disadvantages listed there in regard to the completion of this particular well, Mr. Motter?

A Well, granted--the first disadvantage is lack of simplicity. This is probably more simple than a pumping unit. Inability to handle suspended sand is a possibility, however, we have had no trouble in this area with sand that I have been able to find. Number Three, loss of production from both zones due to the servicing of downhole equipment. I do not agree with that because I have witnessed and seen numerous dual installations where two pumping units are involved and when one unit goes down, there is always a short period of time when the other unit can't operate until the other unit is on location but certainly that is not a bad disadvantage. Pumping depth and quantity of production. As I have stated previously, we know of installations that go down to twelve thousand, three hundred feet. I believe the deepest single pumping units in New Mexico right now are in the Caudill Field and that's slightly below thirteen thousand feet, so we are not limited too much.

Q What is your maximum depth on this installation?

A This maximum depth here will be about 5650 feet, some such thing. I would like to comment briefly also on more economics. We believe that with this type of installation we can deplete the reservoir further with this type of equipment than we could with two pumping units. In other words, on a well at that depth, our

economic limit would probably be somewhere in the neighborhood of four or five barrels per day. With this type of equipment, I feel that we can go until we get the four, five barrels a day from both zones. In other words, we can deplete the two zones to one, two or three barrels or whatever the production might be. In other words, to go a little further, if one zone is making ten barrels a day and the other is only making one, we can pump it because the production on this zone is giving it a free ride with this type of equipment.

Q. In other words, in your opinion, that would prevent waste of unrecovered oil in the reservoir?

A Yes, I certainly think it will.

Q Do you have anything further you care to add?

A I don't believe so at this time.

Q Were Exhibits One through Five prepared by you or under your direction or supervision?

A Yes, they were.

MR. KELLAHIN: At this time, we would like to offer in evidence Exhibits One through Five inclusive.

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

MR. KELLAHIN: That's all the questions we have, sir.

MR. UTZ: Are there questions of the witness?

MR. FISCHER: The mechanics of this installation will be discussed by your other witness?

MR. KELLAHIN: To some extent. I believe that Mr. Motter

will be prepared to answer most of the questions you might have if you care to ask him.

CROSS EXAMINATION

BY MR. FISCHER:

Q Mr. Motter, on that stuffing box on the rod, how is it set, is it set on a shoulder?

A Yes sir, it's set with the same shoulder that the normal wire line tools are used. I might mention at this time there are two companies manufacturing this equipment, Continental Emsco Company and Fluid Pack. Continental uses the oldest type of setting shoulder and Fluid Pack uses PSI equipment.

Q In other words, there are no dogs on this shoulder, on this stuffing box?

A Yes, and then--it's a little hard to show, but right below the rod over here is another collar affair that the equipment actually latches into place. It takes additional pull over the weight of the rods to get this equipment back out, so it is actually latched into place.

Q Did you estimate how much it takes to pull that up from its position if you want to pull both rods--I mean both pumps?

A I think, and I believe I am right--Mr. Gallian here will probably answer more closely--about two thousand pounds is what it usually takes over the weight of the rods to pull that loose.

Q Do you have knowledge of any body brakes in the rods or

any brakes in the rods, rather, in between the two pumps in the stuffing box there?

A I have never heard of any body breaks in the stuffing box. I might say that the polish rod that operates in the stuffing box is of normally much better metal than the rods and I may be corrected, but I believe it is manufactured right now as corrosive-- I don't think you can break it and it prevents corrosion.

Q Both these zones are corrosive fluids?

A Well, both the zones are sour gas, but to date we have noticed no indication of corrosion at the surface. We have not pulled any of our equipment from down in the hole. There may be corrosion, but I have not heard of any.

MR. FISCHER: That's all I have, thank you.

MR. UTZ: Are there other questions of the witness?

CROSS EXAMINATION

BY MR. UTZ:

Q Mr. Motter, I believe sometime ago you presented a similar case to this Commission, did you not?

A Yes sir, it was in the Vacuum Pool.

Q Yes, sir. Now, what is the difference between this mechanical installation and in the case that you presented at that time?

A Primarily, this valve that is below the bottom pump to prevent those two from commingling. Another difference is the fact that we have proposed to use two two-inch tubing strings here

rather than the two-inch and one-inch which we had previously proposed. The well in the Vacuum Pool was a well that was completed some years ago and had a five and a half inch casing.

Q What was the first difference?

A The addition of the standing valve below the bottom pump. That's it right there, yes sir.

Q I believe you mentioned there's a possibility to alternate packer leakage tests, that you shut in one zone and allow the pump to continue to operate and build up pressure in the tubing?

A Yes, sir.

Q Where would that pressure build up, would it not be above the pump shelves?

A Yes sir, it depends on which zone you shut in in the tubing. If the upper zone production would be pumped, it would be from the point of the standing valve on that upper pump to where you close it in at the surface.

Q From here up then?

A Yes, sir.

Q That would in effect not give you a packer leakage test, would it?

A No sir, it would give you an indication of where you had commingling and you had your failure of the equipment.

Q Would it not be better to shut in the lower portion and let your pressure then build up and also tell your packer separation

between your two pumpers?

A Yes sir, the way we run these tests, we shut in one zone and take a pressure reading and we have a very close gauge on the production while it is pumping.

Q Now, when the pump is pumping the build-up pressure, you close this valve and it builds up to a certain pressure, is that correct?

A You mean at the surface?

Q No.

A No, we would actually have a closed gate, closed with a pressure gauge upstream and we can immediately see if it starts getting pressure build-ups of say fifty to a hundred pounds, we would suspect a leak then so we would go ahead and --

Q Where is your pressure released?

A The pressure is released--I don't show it. There would be a valve, both these valves here, and then we would have a valve downstream here and possibly we would insert a pressure gauge here and a valve down here and insert a pressure gauge there.

Q Well, perhaps I am not making myself clear. If you want to pump one zone without producing the other zone, how do you operate?

A Oh, I'm sorry. When you produce one zone, I think I listed four means of walling out production. If you want to pump one zone without pumping the other, there are two means. Actually, it is impossible to pump the upper zone without using these--I have

to refer to it again, I don't want to use the wrong name--a traveling overload valve, which is string operated with a flange located in the valve and there is a valve at the surface. This valve holds the traveling valve open. In other words, the pump just sets there and does not pump anything at all. Now, there's one other means that we can use so as not to pump the bottom pump. The upper pump is seated first and this pump is seated last and we can lift this up some five or six feet and unseat this pump and it is not actually bent, but you only have your upper pump pumping fluid to the surface.

Q Mr. Motter, referring to your Exhibit Number Five, under 1957, that, if I am correct, indicates the number of tandem or two zone unit pumps in use in each of those States?

A That is correct.

Q Likewise under 1958?

A Up until our latest available information, which was sometime in October.

Q Do you have any explanation as to why all States decreased in this type of installation except Texas?

A Well, probably one thing is it's not a complete year, it's about nine months, and--oh, I wouldn't know exactly why there would be a decrease. It's very small, for instance, Alabama there's only a difference of one, Kansas has a difference of one, Louisiana, a difference of three, Mississippi, a difference of two, Oklahoma, there's a difference of thirteen, but we had a gain

of twenty-seven in Texas. I don't know why there is a decrease, perhaps it will balance out at the end of the year. Maybe Mr. Gallian, when he takes the stand, will have some explanation for that. He's in that business and may help us.

MR. UTZ: Are there any other questions of the witness?

MR. FISCHER: If you run upset tubing, two strings of upset tubing, do you have to use your collars to set them in?

A Yes, we would have to use collars. One string, it will be the short string and it will be turned and bevelled, or unless we would use **Hydril** tubing or some such, but normally we use regular EUE tubing.

MR. FISCHER: If you want to pull the short string, how would you shut off the bottom zone then?

A If I wanted to pull out the short string?

MR. FISCHER: Yes.

A If you pull the short string, there are no means of shutting off the bottom zone. I don't know for what reason you would ever pull the short string unless you had a--you found that the setting element right in here had a leak and that would be about the only time that you would pull that.

MR. FISCHER: What if there's a bomb in the hole and --

A Well, that might be true.

MR. FISCHER: You couldn't fish your bomb. You would have to pull it then?

A Right. Now, if that took any prolonged period of time

or we felt that it would, where it would allow the two zones to commingle, our normal procedure would be to pull the rod in the other zone, run separation tools and then pull the short string.

MR. FISCHER: Thank you.

MR. UTZ: Any other questions?

If not, the witness may be excused.

(Witness excused).

MR. KELLAHIN: We will call Mr. Gallian, please.

J. E. GALLIAN

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

DIRECT EXAMINATION

BY MR. KELLAHIN:

Q Would you state your name, please?

A J. E. Gallian.

Q By whom are you employed, Mr. Gallian?

A Continental Emsco Company.

Q In what position?

A Sales representative for the West Texas-New Mexico Division.

Q What business is Continental Emsco engaged in?

A In the manufacturing and distribution of oil field equipment.

Q Mr. Gallian, you have heard the testimony that has been offered by Mr. Motter. Does your company manufacture the

type of equipment which is under discussion here?

A Yes, we are one of the companies that manufacture that.

Q Do you know how long your company has been engaged in manufacturing that type of equipment?

A We corroborated with Otis in 1947 at the initial introduction of the two zone pumping by use of our trade name, D & B Pumps, in conjunction with the Otis Crossover. In 1951, we took over the Otis patent and started the complete manufacture ourselves.

Q Now, what personal experience have you had with this type of equipment?

A I worked for Otis and in the D & B Division in 1947 and then have worked more or less continuously since that period in this type of operation.

Q Are you personally familiar with the operation of this type of equipment?

A Yes.

Q Does your company keep any check or records on an installation of this type?

A Not at present. When this equipment was initially manufactured, so that we could have an opportunity to determine its degree of satisfaction and operating proficiency, we kept records, but to the best of my knowledge, none have been kept since about 1952 as to the actual installations.

Q What is the practice of your company in keeping records

of that type?

A Any new piece of equipment is followed closely to determine whether or not it is satisfactory. After it has been determined satisfactory, we discontinue those records because they serve no useful purpose.

Q Now, Mr. Gallian, referring to the large exhibit up there, I will just mark that Exhibit Number Six, would you state what that is?

A This is a drawing of the D & B Otis, 7B2B1, which closely parallels the type of equipment Mr. Motter has introduced in his operation. Now, itis full scale, is laying on its side and is colored to depict the corrosive downhole stuffing box in place in the crossover element. It shows the manner in which it is locked in place and the packing which seals off the two zones of fluid. Now, the question was asked of Mr. Motter how it was held in place. This brown element with the square shoulder sets into a square shoulder receptacle, spring loaded, called a spring collet, and it is carried into place by a mechanical means that is firmly attached to the polish rod, which is indicated by the black. When it is in place, the carrying element spreads the fingers and as it passes through, when it has passed through the release, the fingers close over this square shoulder, then it cannot be pulled loose without the landing element once again spreading the strings to release its grip on the square shoulder. So actually, it cannot be pulled without a release of the spring

element itself and it does require--Mr. Motter stated he thought two thousand pounds, but this cannot be pulled, and I believe that is also a true statement with our other manufacturers, it has to be a mechanical unlocking means, pressure will not unseat it. The yellow as depicted here is Tevlon packing rings, which have been found to be highly satisfactory when operating against a reciprocating smooth rod. They are very tight rings and sealed under pressure and Tevlon has been determined to be practically impervious to all well fluids we know of, and it is available to all manufacturers of this equipment in a metal to metal seal which carries very, very close tolerances. The polish is made of heat treated material, Monnel is used most commonly in West Texas to combat corrosion and it is a precision piece of equipment and is much higher in strength and corrosion resistency than the sucker rods which are employed.

The external seals are of non-corrosive rubber. This has been used by Continental Emsco and was patented by Otis Engineering of Dallas, who have been many, many years in the pressure control business. They have found it to be highly successful. Tevlon, once again, there is a V-type ring which seals tighter at the increase of pressure. Now, the fluid that is introduced from the lower zone comes up your main tubing string but cannot by-pass and get further up the stream because it is blocked off externally and internally. It is then forced around that sealing element and through your parallel string, which in the case of the

application of Cities Service, this is two-inch. It is locked in place by a mechanical device and sealed at that point with **Hydril** rings as well.

Q Would you outline briefly the advantages of this type of installation?

A The advantages in my opinion are basically one string of tubing in the hole to carry your rods, which would enable you to fish your rods and would enable you then to pull, in case you would have a fishing job in here, you could get into this. We can use two and a half inch tubing, which will permit the use of larger size sucker rods for added strength, while in your other installation you are limited somewhat by the size of your tubing. The cost which Mr. Motter brought out, a saving of some fourteen thousand dollars, those are two of the biggest reasons for using this equipment.

Q Are we to understand from your testimony that you can perform a fishing job without the loss of a zone, loss of production from one zone?

A I don't believe I quite understand.

Q In connection with the--you referred to the possibility of fishing. Does that mean that you can fish one zone or the other in the event of breakage or something or other?

A Yes, in the event we had breakage below the crossover assembly, fishing tools are available which will go completely through and fish the lower pump and there are fishing tools which

would enable you to fish the upper zone if we had a breakdown in the upper string. We would run no danger of damaging either zone, but you would have loss of production while you were fishing because your actuating unit at the top would have to be shut off.

Q According to Mr. Motter's testimony, the subject well in which it is proposed to install this equipment is presently being drilled. Is there any particular advantage to installing this type of equipment upon completion rather than going back in at a later date and making such an installation?

A Well, if you install the crossover equipment upon the initial completion, it is not necessary then to kill either zone to place them on the pump at any time. In other words, you run no danger of loading one zone with a killing solution which may be detremental to that production zone. The equipment can all be run under pressure.

Q Now, the question was asked in regard to Exhibit Number Six, would you refer to Exhibit Number--I mean Number Five, please? That apparently shows a decrease in the number of installations in all of the States except Texas. Do you have any explanation of that, Mr. Gallian?

A I would like to refer particularly to the State of Oklahoma, as I am perhaps more familiar with that. The bulk of the installations in the State of Oklahoma were made in Southern Oklahoma and as you all recall, the beginning of the year 1958 was one in which Oklahoma curtailed production rather drastically.

Therefore, the wells, there were not as many completed dually in 1958 as had been in '57. Now, the other areas I am afraid I cannot answer that. As you can see, there are very little producing, or dual producing wells in those States. I am not familiar enough to qualify as one who could answer that question, but the State of Oklahoma, I believe it was due entirely to reduced allowables and the pipeline proration which went in effect in Southern Oklahoma, which drastically curtailed drilling of all types and very seriously affected dual completion wells.

Q Mr. Gallian, on the basis of your experience with this type of equipment and in your opinion, does this type of dual completion afford adequate protection against the commingling of fluids?

A Our experience has indicated that it does, since we can determine almost immediately when we have commingling because of a loss of production in one of the zones, and the tests that are possible to run to determine loss of production, and we have had very little trouble in commingling of fluids. Our packing elements, as a general rule, have been found to be in excellent condition when it was necessary to pull the wells for servicing because of other mechanical failures.

Q Was Exhibit Number Six prepared by you or under your direct supervision?

A Yes.

MR. KELLAHIN: Would you mark this as Exhibit Number Six,

please, sir?

(Whereupon, the document was marked for identification as Exhibit Number Six).

MR. KELLAHIN: At this time, we would like to offer in evidence Exhibit Number Six.

MR. UTZ: Without objection, it will be received.

MR. KELLAHIN: That's all the questions we have.

MR. UTZ: Are there questions of Mr. Gallian?

CROSS EXAMINATION

BY MR. FISCHER:

Q Mr. Gallian, your stuffing box is stationary?

A Yes, sir.

Q Completely stationary?

A Yes, sir.

Q And as I understand your testimony, the packoff element in your stuffing box runs the entire length of the box, is that right, the packing element, the inside packing element between your polish rod and the inside of your stuffing box, runs the entire length of the stuffing box?

A Yes sir, it is prepared to receive a pre-determined length of packing.

Q And the mechanical means of unseating this, should you need to pull the rods, is to set down your tubing --

A It is attached to the rod string. It is a part and attached directly to the bottom end of the polish rod and then

attached to the sucker rod string carrying on below so that when your rods are retrieved, it automatically unlatches and will bring your stuffing box out.

Q Just by pulling up?

A By pulling up.

MR. FISCHER: Thank you.

MR. UTZ: Are there other questions of the witness?

CROSS EXAMINATION

BY MR. UTZ:

Q Mr. Gallian, referring to Exhibit Five, since you are familiar with Oklahoma, and there was a thirteen well decrease between 1957 and '58, were all of these wells abandoned?

A There were a number of--I can't say they all were, but there were a number of wells in which one zone was abandoned because it was not economically feasible to go ahead and produce it.

MR. KELLAHIN: I believe there is some confusion there. I will recall Mr. Motter if you so wish. The figures appearing on Exhibit Number Five indicate, not the number in actual operation, but the number of installations during those years, additional installations.

MR. UTZ: So the total in use would be the total of the two figures?

MR. KELLAHIN: That is correct. I will be glad to put Mr. Motter back on if you wish to verify that.

MR. UTZ: I don't think that will be necessary.

A I believe the next statement says, "Prior to January, 1957, approximately five hundred dual zone pumps were installed." Now, there are many more than the forty-one listed in operation in Oklahoma, but those are installations made during that period of time only.

MR. UTZ: That clarifies my question.

Are there any other questions of the witness?

If not, the witness may be excused.

(Witness excused).

MR. UTZ: Do you have anything further in this case?

MR. KELLAHIN: That completes our presentation.

MR. UTZ: Are there any other statements to be made in this case?

If not, the case will be taken under advisement.

MR. KELLAHIN: I did offer Exhibit Number Six, did I not, sir?

MR. UTZ: Yes, sir.

The hearing will be adjourned until one-fifteen.

(Noon recess).

STATE OF NEW MEXICO)
: ss
COUNTY OF BERNALILLO)

I, JERRY MARTINEZ, Notary Public in and for the County of Bernalillo, State of New Mexico, do hereby certify that the foregoing and attached Transcript of Hearing, pages numbered 1 through 34, were reported by me in Stenotype at the time and place aforesaid; that the same was reduced to typewritten transcript by me and contains a true and correct record of said proceedings, to the best of my knowledge, skill and ability.

I FURTHER CERTIFY that I am not employed by or related to any attorney or party of interest in this matter; and, further, that I have no financial interest in the outcome thereof.

DATED this 26th day of November, 1958, in the City of Albuquerque, County of Bernalillo, State of New Mexico.

Notary Public

My Commission Expires:
January 24, 1962

I do hereby certify that the foregoing is a complete record of the proceedings in the Examiner hearing of Case No. 1557, heard by me on Nov. 19, 1958.

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

DEARNLEY - MEIER & ASSOCIATES
GENERAL LAW REPORTERS
ALBUQUERQUE, NEW MEXICO
Phone Chapel 3-6691

No. 2-59

DOCKET: REGULAR HEARING JANUARY 14, 1959

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

ALLOWABLE: (1) Consideration of the oil allowable for February 1959

(2) Consideration of the allowable production of gas for February 1959 from six prorated pools in Lea County, New Mexico; also consideration of the allowable production of gas from seven prorated pools in San Juan and Rio Arriba Counties, New Mexico, for February 1959.

NEW CASES

CASE 728 Application of El Paso Natural Gas Company for an order revising and amending Order No. R-586. Applicant, in the above-styled cause, seeks an order amending Order No. R-586 to extend the vertical limits of the Justis Gas Pool in Lea County, New Mexico.

CASE 1308: In the matter of the hearing required to be held by Order R-1069-B to permit all interested parties to appear and show cause why the Special Rules and Regulations set forth in Order R-1069-B should be continued beyond February 28, 1959.

CASE 1557: Application of Cities Service Oil Company for a hearing de novo before the Commission on its application for a dual completion. Applicant, in the above-styled cause, seeks an order authorizing it to dually complete its State "P" No. 3 Well located 990 feet from the South and West lines of Section 32, Township 22 South, Range 38 East, Lea County, New Mexico, in such a manner as to permit the production of oil from the Blinebry Oil Pool and from an undesignated Glorieta oil pool through parallel strings of tubing.

CASE 1581: Southeastern New Mexico nomenclature case calling for an order for the creation of new pools and the extension of existing pools in Eddy and Lea Counties, New Mexico:

(a) Create a new oil pool for San Andres production, designated as the South Loco Hills-San Andres Pool, and described as:

TOWNSHIP 18 SOUTH, RANGE 30 EAST, NMPM
Section 32: NE/4

(b) Create a new oil pool for Seven Rivers production, designated as the West Pearl-Seven Rivers Pool, and described as:

TOWNSHIP 19 SOUTH, RANGE 34 EAST, NMPM
Section 25: SE/4

(c) Create a new oil pool for Queen production, designated as the North Red Lake-Queen Pool, and described as:

TOWNSHIP 16 SOUTH, RANGE 28 EAST, NMPM
Section 34: NE/4

(d) Create a new oil pool for Delaware production, designated as the Shugart Delaware Pool, and described as:

TOWNSHIP 18 SOUTH, RANGE 31 EAST, NMPM
Section 22: SW/4

(e) Extend the Allison-Pennsylvanian Pool to include:

TOWNSHIP 9 SOUTH, RANGE 36 EAST, NMPM
Section 10: NE/4

(f) Extend the South Carter-San Andres Pool to include:

TOWNSHIP 18 SOUTH, RANGE 39 EAST, NMPM
Section 7: NE/4

(g) Extend the Dos Hermanos Yates-Seven Rivers Pool to include:

TOWNSHIP 20 SOUTH, RANGE 30 EAST, NMPM
Section 28: N/2 SE/4

(h) Extend the High Lonesome Pool to include:

TOWNSHIP 16 SOUTH, RANGE 29 EAST, NMPM
Section 12: SW/4
Section 13: NW/4

(i) Extend the Justis-Blinebry Pool to include:

TOWNSHIP 25 SOUTH, RANGE 37 EAST, NMPM
Section 24: E/2
Section 25: E/2
Section 36: E/2 & SW/4

(j) Extend the Justis-McKee Pool to include:

TOWNSHIP 25 SOUTH, RANGE 37 EAST, NMPM
Section 24: SE/4

(k) Extend the Loco Hills Pool to include:

TOWNSHIP 18 SOUTH, RANGE 30 EAST, NMPM
Section 8: S/2

(l) Extend the Maljamar Pool to include:

TOWNSHIP 17 SOUTH, RANGE 33 EAST, NMPM
Section 18: SW/4

(m) Extend the vertical limits of the East Millman-Queen Pool in Eddy County, New Mexico, to include therein the Grayburg formation.

(n) Extend the East Millman Queen-Grayburg Pool to include:

TOWNSHIP 19 SOUTH, RANGE 28 EAST, NMPM
Section 13: N/2 & SW/4
Section 22: N/2
Section 23: NW/4

(o) Extend the Pearl Queen Pool to include:

TOWNSHIP 19 SOUTH, RANGE 35 EAST, NMPM
Section 21: N/2 SE/4 & SW/4 SE/4
Section 33: NW/4

(p) Extend the Ranger Lake Pennsylvanian Pool to include:

TOWNSHIP 12 SOUTH, RANGE 34 EAST, NMPM
Section 24: SW/4

(q) Extend the Shugart Siluro Devonian Gas Pool to include:

TOWNSHIP 18 SOUTH, RANGE 31 EAST, NMPM
Section 27: NE/4

(r) Extend the Skaggs-Glorieta Pool to include:

TOWNSHIP 20 SOUTH, RANGE 37 EAST, NMPM
Section 12: NW/4

(s) Extend the South Vacuum-Bone Springs Pool to include:

TOWNSHIP 18 SOUTH, RANGE 35 EAST, NMPM
Section 22: S/2
Section 27: W/2

CASE 1582: Northwestern New Mexico nomenclature case calling for an order for the extension of existing pools in San Juan and Rio Arriba Counties, New Mexico:

(a) Extend the South Blanco-Pictured Cliffs Pool to include:

TOWNSHIP 25 NORTH, RANGE 3 WEST, NMPM
Section 27: W/2

TOWNSHIP 26 NORTH, RANGE 5 WEST, NMPM
Section 13: NE/4

(b) Extend the Tapacito-Pictured Cliffs Pool to include:

TOWNSHIP 26 NORTH, RANGE 3 WEST, NMPM
Section 21: SW/4

(c) Extend the Blanco-Mesaverde Pool to include:

TOWNSHIP 27 NORTH, RANGE 8 WEST, NMPM
Section 30: E/2

TOWNSHIP 29 NORTH, RANGE 4 WEST, NMPM
Section 6: All

TOWNSHIP 30 NORTH, RANGE 4 WEST, NMPM
Section 31: All

(d) Extend the South Los Pinos-Dakota Pool to include:

TOWNSHIP 31 NORTH, RANGE 7 WEST, NMPM
Section 22: N/2
Section 34: N/2

(e) Extend the Verde-Gallup Oil Pool to include:

TOWNSHIP 31 NORTH, RANGE 14 WEST, NMPM
Section 8: SW/4 SE/4
Section 17: SW/4

ir/

OIL CONSERVATION COMMISSION
SANTA FE, NEW MEXICO

Date 11-20-58

CASE NO. 1557 HEARING DATE 11-19-58

My recommendations for an order in the above numbered case(s) are as follows:

1. Deny using same order as used in Vacuum pool Denial.
2. Cites - Lovina - State "P" #3, 32-22S-38E. 990/50W lines.
3. Use order R-1125.

Staff Member

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

December 2, 1958

COPY

Mr. Jason Kellahin
Kellahin & Fox
P.O. Box 1713
Santa Fe, New Mexico

Dear Mr. Kellahin:

On behalf of your client, Cities Service Oil Company, we enclose two copies of Order R-1298 issued November 28, 1958, by the Oil Conservation Commission in Case 1557, which was heard on November 19th at Santa Fe before an examiner.

Very truly yours,

A. L. Porter, Jr.
Secretary - Director

bp
Encls.

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. 1557
Order No. R-1298

APPLICATION OF CITIES SERVICE OIL
COMPANY FOR AN OIL-OIL DUAL COMPLETION
IN THE BLINEBRY OIL POOL AND IN AN
UNDESIGNATED GLORIETA OIL 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 November 19, 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 28th day of November, 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, Cities Service Oil Company, is the owner and operator of the State "P" No. 3 Well, located 990 feet from the South line and 990 feet from the West line of Section 32, Township 22 South, Range 38 East, NMPM, Lea County, New Mexico.

(3) That the applicant proposes to dually complete the said State "P" No. 3 Well in such a manner as to permit the production of oil from the Blinebry Oil Pool and the production of oil from an undesignated Glorieta oil pool through parallel strings of 2 inch tubing utilizing a dual-zone pump operated by a single rod string.

(4) That communication between said pools 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.

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

IT IS THEREFORE ORDERED:

That the application of Cities Service Oil Company in Case No. 1557 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

EDWIN L. MECHEM, Chairman

MURRAY E. MORGAN, Member

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

ir/

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. 1557
Order No. R-1298-A

APPLICATION OF CITIES SERVICE OIL
COMPANY FOR AN OIL-OIL DUAL COMPLETION
IN THE BLINEBRY OIL POOL AND IN AN
UNDESIGNATED GLORIETA OIL 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 November 19, 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, and Order No. R-1298 was entered denying the subject application, and this cause came on for hearing de novo at 9 o'clock a.m. on January 14, 1959, at Santa Fe, New Mexico, before the Oil Conservation Commission of New Mexico.

NOW, on this 2nd day of February, 1959, the Commission, a quorum being present, having considered the application and the evidence adduced 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, Cities Service Oil Company, is the owner and operator of the State "P" No. 3 Well, located 990 feet from the South line and 990 feet from the West line of Section 32, Township 22 South, Range 38 East, NMPM, Lea County, New Mexico.

(3) That the applicant proposes to dually complete the said State "P" No. 3 Well in such a manner as to permit the production of oil from the Blinebry Oil Pool and the production of oil from an undesignated Glorieta oil pool through parallel strings of 2-inch tubing utilizing a dual-zone pump operated by a single rod string.

(4) That there is an inherent risk of communication between the separate zones of any dually completed well which is augmented by the use of dual-zone pumping equipment; however, the

evidence in this particular case indicates that sand will present no problem, and that the effect of corrosion will be held to a minimum by the use of corrosion-resistant materials.

(5) That the evidence presented justifies the granting of the subject application on a one-year trial basis provided that adequate tests are taken periodically to insure that communication is not occurring.

(6) That during the one year trial period the Commission should be notified if it becomes necessary to remove the dual-zone pumping equipment from the well.

(7) That upon the completion of one year's service in the well, the dual-zone pumping equipment should be removed from the well and a complete examination made thereof, including pressure testing while the lower polished rod is in motion through the seal assembly.

IT IS THEREFORE ORDERED:

(1) That the applicant, Cities Service Oil Company, be and the same is hereby authorized to dually complete its State "P" No. 3 Well, located 990 feet from the South line and 990 feet from the West line of Section 32, Township 22 South, Range 38 East, NMPM, Lea County, New Mexico, in such a manner as to permit the production of oil from the Blinebry Oil Pool and the production of oil from an undesignated Glorieta oil pool through parallel strings of 2-inch tubing utilizing a dual-zone pump operated by a single rod string.

PROVIDED HOWEVER, That the use of the dual zone pump in said State "P" No. 3 Well is approved on a one-year trial basis.

(2) The Secretary-Director be and the same is hereby authorized to approve the continued use of said dual-zone pumping equipment in the subject well beyond the one-year trial period upon a satisfactory showing by the prescribed tests that commingling between the two separate zones is not occurring.

(3) That the Commission shall be notified at any time within the one-year trial period if it becomes necessary to remove the dual-zone pumping equipment from said State "P" No. 3 Well prior to such removal.

(4) That the operator shall make all such tests as the Secretary-Director shall prescribe from time to time.

(5) That upon the completion of one year's service in the subject well the dual-zone pumping equipment shall be removed from said well and a complete examination made thereof, including pressure

testing while the lower polished rod is in motion through the seal assembly. Results of such pressure test shall be submitted to the Commission.

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

STATE OF NEW MEXICO
OIL CONSERVATION COMMISSION

JOHN BURROUGHS, Chairman

MURRAY E. MORGAN, Member

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

ir/

ECONOMICS OF TWO ZONE PUMP VERSUS TWO PUMPS WITH INDIVIDUAL PUMPING UNITS

	Two Pumping Units	Two Zone Pump
Pumping Unit 228D	$15,206	$ 7,653
25 H.P. Gas Engine	6,100	3,050
Pumping Unit Base	1,200	700
Tubing - Upper Zone 5100'	3,417	3,417
Tubing - Lower Zone 5700'	3,819	3,819
Rods - Upper Zone 5100'	3,060	
Rods - Lower Zone 5700'	3,420	3,420
Pumps - $1\frac{1}{2}$" x 16'	900	900
Labor to run rods and tubing	536	472
Dual Head	811	977
Polish Rod - Clamps	304	152
Cross Over Assembly		780
Packer - Stinger	1,291	1,291
Vent Tube	80	80
Totals	$40,244	$26,711

Savings by using two zone pump - $13,533

#3
Cities Service

LIFT COST COMPARISON DUALS VERSUS SINGLES

	No. Wells In Group	Depth Wells	Age Wells	Avg. Mo. Bbls. Fluid	Avg. Mo. Gross Oil	Avg. Mo. Expenses	Lift Cost/ Bbl. Fluid	Lift Cost/ Bbl. Oil
Group I	9	4200 to 6200	6-19 months	15,767	14,243	$ 627.00	4.0	4.4
Group II *	7	4200 to 6200	6-19 months	13,009	9,975	821.00	6.3	8.2
Group III	9	4200 to 4800	17-148 months	8,429	7,899	956.00	11.4	12.2

Group I — Both zones flowing - equipped for dual zone pumps

Group II — Both zones pumping with dual zone equipment

Group III — Single zone pumping

* Dual Pump

Cities Service H-4

LOWELL STOUT
LAWYER
218 WEST LEA
HOBBS, NEW MEXICO
EXPRESS 3-2211

February 12, 1964

State of New Mexico
Oil Conservation Commission
Santa Fe, New Mexico

Attention: Mr. Dan Nutter

Dear Mr. Nutter:

I am returning herewith the transcript of hearing in case No. 1557 which was loaned to Mr. Joe Buck and I. I want to thank you for the courtesy and consideration you showed to Mr. Buck and I when we were in Santa Fe January 20.

Sincerely,

LOWELL STOUT

S/ls
Encl.

No. 32-58

DOCKET: EXAMINER HEARING NOVEMBER 19, 1958

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

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

CASE 1337: Application of Gulf Oil Corporation for permission to commingle the production from two separate oil pools. Applicant, in the above-styled cause, seeks an order amending Order R-1093 and Order R-1093-A to authorize it to commingle the production from the Montoya formation with the production from the Ellenburger, Fusselman, and McKee formations on its Learcy McBuffington Lease consisting of the S/2 of Section 13, Township 25 South, Range 37 East, Lea County, New Mexico.

CASE 1548: Application of Shell Oil Company for an automatic custody transfer system and for permission to commingle the production from four separate leases. Applicant, in the above-styled cause, seeks an order authorizing it to install an automatic custody transfer system and to commingle the production from the Vacuum Pool on four State Leases located in Sections 29, 30, and 31, Township 17 South, Range 35 East, Lea County, New Mexico.

CASE 1549: Application of Tidewater Oil Company for two non-standard gas proration units. Applicant, in the above-styled cause, seeks an order establishing a 120-acre non-standard gas proration unit, in both the Tubb Gas Pool and the Blinebry Gas Pool, each to comprise the S/2 SE/4 and SE/4 SW/4 of Section 36, Township 21 South, Range 37 East, Lea County, New Mexico, and to be dedicated to applicant's State "Q" Well No. 1, located in the SE/4 SW/4 of said Section 36, which well is dually completed in the aforesaid pools.

CASE 1550: Application of Tidewater Oil Company to commingle the production from several separate oil pools. Applicant, in the above-styled cause, seeks an order authorizing it to commingle the production from the Ellenburger, McKee, Fusselman, Montoya and any other pool or pools encountered which produces oil of similar qualities on its Coates "C" Lease comprising the E/2 and SE/4 NW/4 and NE/4 SW/4 of Section 24, Township 25 South, Range 37 East, Lea County, New Mexico. Applicant further requests permission to commingle production from the Drinkard formation on said lease with any other pool or pools encountered which produce sour crudes. Applicant proposes to separately meter production from each pool prior to being commingled. Applicant further seeks permission to produce more than sixteen wells into said common facilities.

CASE 1551: Application of Pan American Petroleum Corporation for permission to commingle the production from three separate leases and for permission to produce more than sixteen wells into a common tank battery. Applicant, in the above-styled cause, seeks an order authorizing it to commingle the production from the Empire-Abo Pool from the three separate Federal leases hereinafter described:

LC-065478-B N/2 NW/4, NE/4, N/2 SE/4, and E/2 SW/4 Section 3; E/2 Section 10

NM-025604 S/2 SE/4 Section 3; W/2 Section 10

LC-067858 N/2 and SW/4 Section 11

all in Township 18 South, Range 27 East, Eddy County, New Mexico. Applicant further requests authority to produce more than sixteen wells into the common tank battery for said leases. Applicant proposes to separately meter production from each of the above-discribed leases prior to being commingled.

CASE 1552: Application of Pan American Petroleum Corporation for permission to commingle the production from four separate leases. Applicant, in the above-styled cause, seeks an order authorizing it to commingle the production from the Abo formation adjacent to the Empire-Abo Pool from the four separate State leases hereinafter discribed:

E-5461 NW/4 NW/4 Section 2

B-7244-30 S/2 NW/4, NW/4 SW/4, and SE/4 SW/4 Section 2

B-8814-12 NE/4 SW/4 Section 2

E-7833 SW/4 SE/4 Section 2

all in Township 18 South, Range 27 East, Eddy County, New Mexico. Applicant proposes to separately meter the production from each of said leases prior to being commingled.

CASE 1553: Application of The Texas Company for a dual completion and for permission to commingle the liquids produced from two separate pools. Applicant, in the above-styled cause, seeks an order authorizing it to dually complete its Peery-Federal (NCT-1) Well No. 1 located 1980 feet from the North and East lines of Section 29, Township 15 South, Range 30 East, Chaves County, New Mexico, in such a manner as to permit the production of oil from an undesignated Devonian oil pool and gas from an undesignated Ellenburger Gas Pool through parallel strings of tubing. Applicant further requests permission to commingle the liquids and low pressure gas produced from the Devonian and Ellenburger formations from all existing and future wells on its Peery-Federal Lease which comprises all of said Section 29.

CASE 1554: Application of The Texas Company for an automatic custody transfer system and for permission to commingle the production from five separate leases. Applicant, in the above-styled cause, seeks an order authorizing it to install an automatic custody transfer system and to commingle the production from the Bisti-Lower Gallup Oil Pool on five Navajo Allottee Leases located in Sections 14, 15, and 23, Township 25 North, Range 11 West, San Juan County, New Mexico. Applicant proposes to separately meter the production from each lease prior to being commingled.

CASE 1555: Application of H. K. Riddle for two non-standard oil proration units and two unorthodox oil well locations. Applicant, in the above-styled cause, seeks an order establishing a 61-acre non-standard oil proration unit consisting of Lots 1, 2, 3, and 4 of Section 18, said unit to be dedicated to a well to be drilled on an unorthodox location 1980 feet from the South line and 252 feet from the West line of said Section 18; applicant further seeks

the establishment of a 63-acre non-standard oil proration unit consisting of Lots 1, 2, 3, and 4 of Section 19, said unit to be dedicated to a well to be drilled on an unorthodox location 660 feet from the North line and 256 feet from the West line of said Section 19, all in the Bisti-Lower Gallup Oil Pool, Township 26 North, Range 13 West, San Juan County, New Mexico.

CASE 1556: Application of Chaco Oil Company for an exception to Rule 104 of the Commission Rules and Regulations. Applicant, in the above-styled cause, seeks an order authorizing it to drill four additional oil wells in the Red Mountain-Mesaverde Oil Pool in the SW/4 SE/4 of Section 20 and the NW/4 NE/4 of Section 29, Township 20 North, Range 9 West, McKinley County, New Mexico.

CASE 1557: Application of Cities Service Oil Company for a dual completion. Applicant, in the above-styled cause, seeks an order authorizing it to dually complete its State "P" No. 3 Well located 990 feet from the South and West lines of Section 32, Township 22 South, Range 38 East, Lea County, New Mexico, in such a manner as to permit the production of oil from the Blinebry Oil Pool and from an undesignated Glorieta oil pool through parallel strings of tubing.

ig/

Case 1557

ANN OFFICE OCC

1958 OCT

CITIES SERVICE OIL COMPANY

BOX 97

HOBBS, NEW MEXICO

October 28, 1958

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

Attn: Mr. A. L. Porter, Jr.

Re: Application to Dual Complete
Cities Service Oil Company
State "P" No. 3

Gentlemen:

It is respectfully requested that the Oil Conservation Commission schedule a hearing at the earliest possible date to consider this application to dually complete the State "P" No. 3, located 990' FSL, 990' FWL, Section 32-22S-38E, Lea County, New Mexico. The attached plat shows the location of the well on the Cities Service Oil Company State "P" lease, together with the location of all offset wells.

Cities Service proposes to dually complete the State "P" No. 3 in the following manner.

1. Equip the well as shown on the attached schematic diagram.
2. Produce oil from the Blinebry formation through 2" tubing.
3. Produce oil from the Glorietta formation through 2" tubing.

A copy of this application with schematic diagram and plat included has been sent to each of the offset operators named on the attached list.

Very truly yours,

E. F. Motter

E. F. Motter
Asst. Division Engineer

EFM/gk
Attachs.

Anderson-Pritchard Oil Corporation
P. O. Box 196
Midland, Texas
Attn: Mr. L. H. Foster

Gulf Oil Corporation
P. O. Drawer 669
Roswell, New Mexico
Attn: Mr. M. I. Taylor

N. M. Oil Conservation Commission
P. O. Box 871
Santa Fe, New Mexico
Attn: Mr. A. L. Porter, Jr.

N. M. Oil Conservation Commission
P. O. Box 2045
Hobbs, New Mexico
Attn: Mr. Randall Montgomery

Pan American Petroleum Corporation
P. O. Box 899
Roswell, New Mexico
Attn: Mr. C. L. Kelley

The Texas Company
P. O. Box 1270
Midland, Texas
Attn: Mr. T. P. Drew

Western Natural Gas Company
823 Midland Tower Building
Midland, Texas
Attn: Mr. R. H. McKoy

R 38 E

29

Gulf 1-B ✱ BG Drinkard	Texas Co. 5 ● DO Blinebry	Texas Co. 2 ● DO Blinebry	Gulf 1 ✱ TG Watkins
Gulf 1 ● DO Scarborough	Pan-Am. 2 ● DO State "S"	Pan-Am. 1 ● DO State "S"	Gulf 1 ● T.D. Andrews
Gulf 2 ● DO Scarborough	Pan-Am. 3 ✱ D TG BO	CSO 1 ✱ D TG BG State "P"	Gulf 2 ✱ D TG BG Andrews
Gulf 3 ✱ D DO Scarborough	CSO 2 ● D DO BO	Pan-Am. 1 ● DO Andrews	Gulf 3 ✱ D TG SPO Andrews
Texas Co. Scarborough	CSO 1 ◎ 3 State "P"	Pan-Am. 1 ● 2 SPO State "T"	Gulf Andrews
Pan-Am.	West. Nat.	A-P	West. Nat.

T 22 S

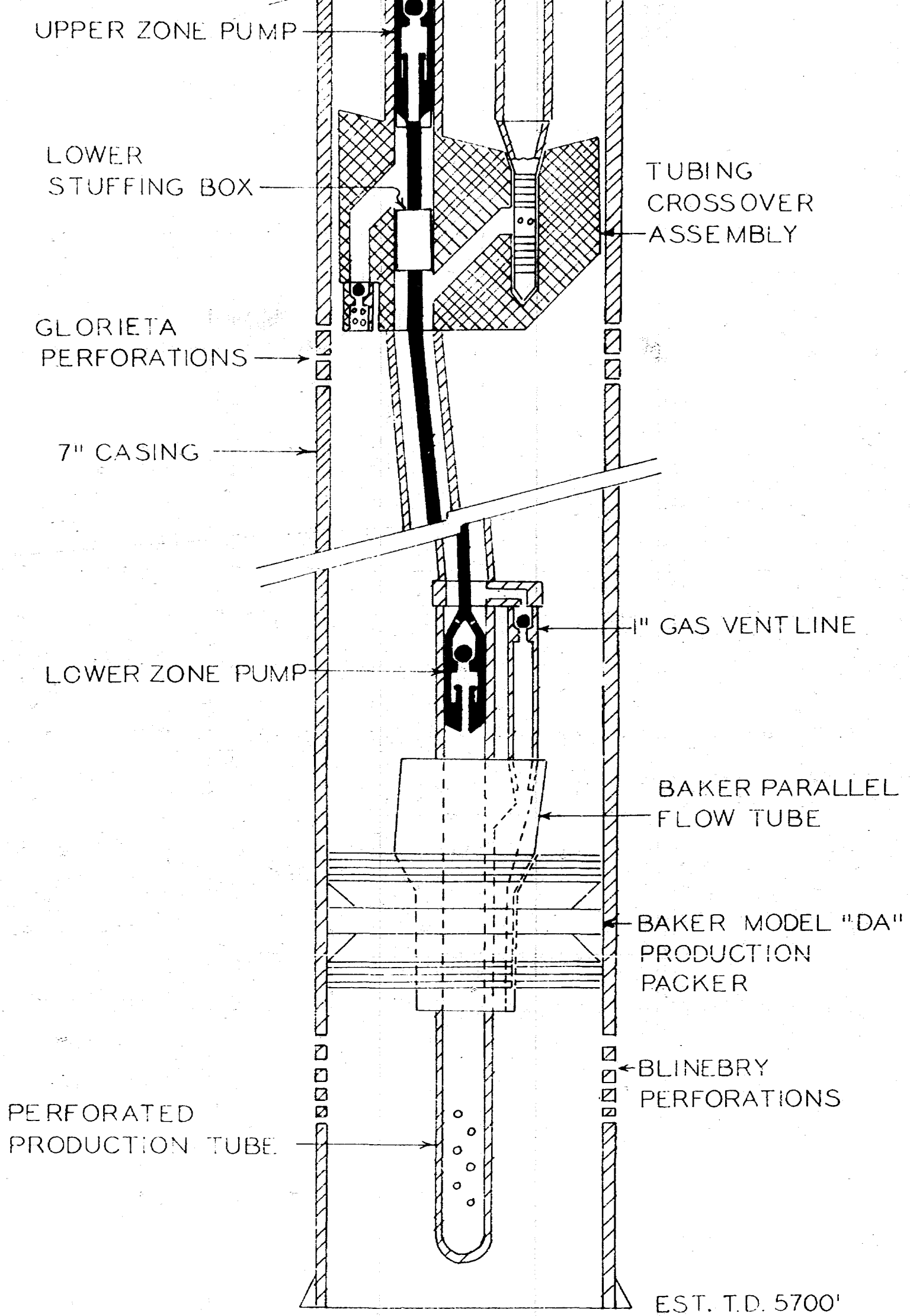
31 32 33

5

LEGEND

BO Blinebry Oil
BS Blinebry Gas
DO Drinkard Oil
TG Tubb Gas
SPO South Paddock Oil

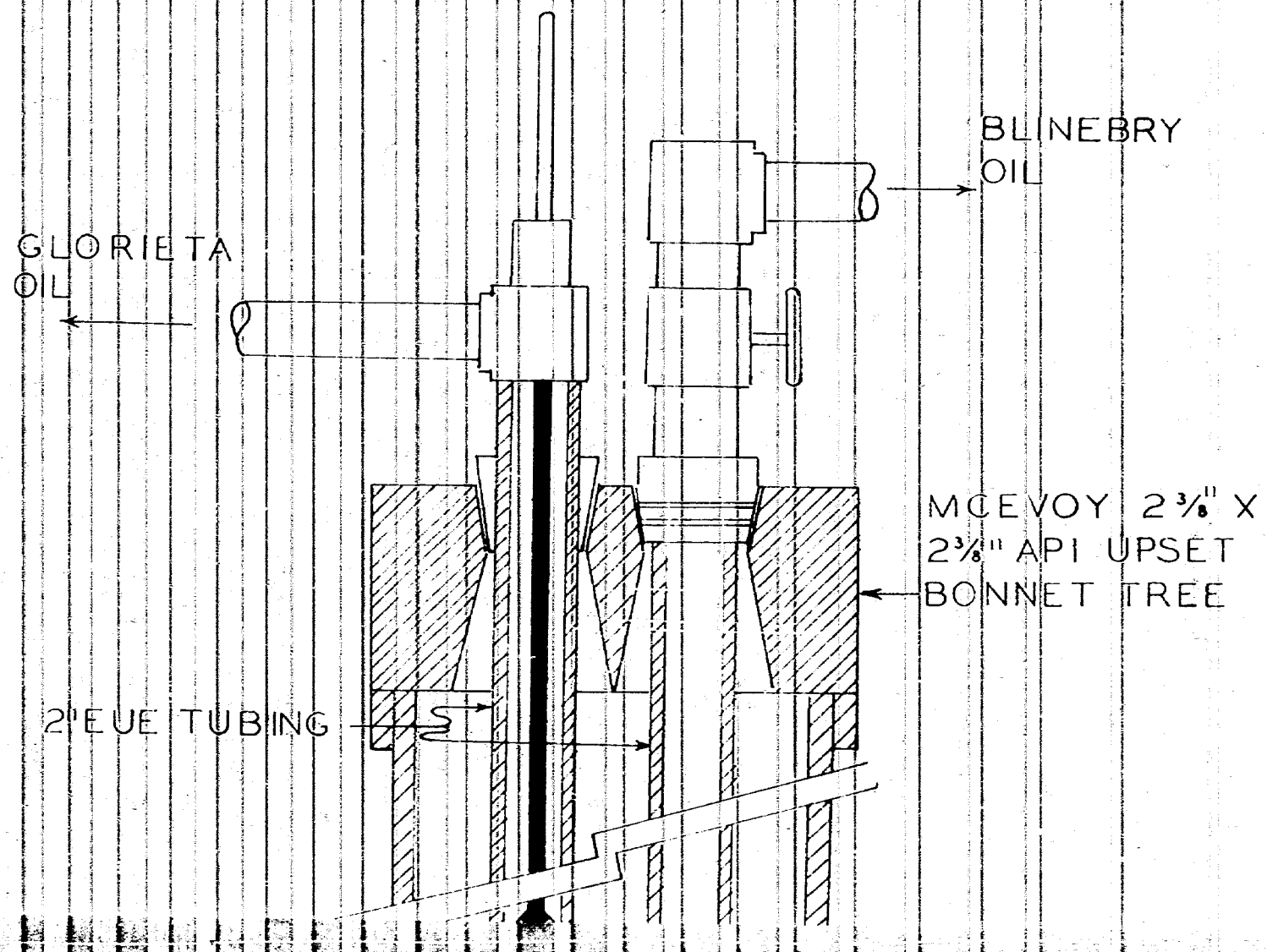
C. S. O. STATE "P" AREA
LEA COUNTY, N. M.


UPPER ZONE PUMP
LOWER STUFFING BOX
TUBING CROSSOVER ASSEMBLY
GLORIETA PERFORATIONS
7" CASING
1" GAS VENT LINE
LOWER ZONE PUMP
BAKER PARALLEL FLOW TUBE
BAKER MODEL "DA" PRODUCTION PACKER
BLINEBRY PERFORATIONS
PERFORATED PRODUCTION TUBE
EST. T.D. 5700'

CITIES SERVICE OIL COMPANY

PARALLEL TUBING STRING

INSTALLATION - DUAL COMPLETED WELL



BEFORE THE

OIL CONSERVATION COMMISSION OF

THE STATE OF NEW MEXICO

IN THE MATTER OF THE APPLICATION OF CITIES SERVICE OIL COMPANY FOR PERMISSION TO DUALLY COMPLETE ITS STATE "P" WELL NO. 3 FOR PRODUCTION OF OIL FROM THE BLINEBRY OIL POOL, AND THE PRODUCTION OF OIL FROM AN UNDESIGNATED GLORIETA OIL POOL, LEA COUNTY, NEW MEXICO.

Case No. 1557

APPLICATION FOR DE NOVO HEARING

Comes now Cities Service Oil Company, and pursuant to the provisions of New Mexico Oil Conservation Commission Rule 1120, and as provided by Section 65-3-11.1, New Mexico Statutes Annotated, 1957 Supplement, applies for a hearing de novo before the Commission in the above captioned matter, and in support thereof would show:

1. That by application filed October 28, 1958, Cities Service Oil Company sought approval for the dual completion of its State "P" Well No. 3, located 990 feet from the South line and 990 feet from the West line of Section 32, Township 22 South, Range 38 East, N.M.P.M., Lea County, New Mexico, for the production of oil from the Blinebry formation in the Blinebry Oil Pool, and for the production of oil from the Glorieta formation in an undesignated oil pool.

2. That said application was heard as Case No. 1557 on the Commission's Docket, before Elvis A. Utz, Examiner, on November 19, 1958.

3. That by Order No. R-1290, entered November 28, 1958, the Commission denied said application.

4. That by its application, Cities Service Oil Company proposes to dually complete the said State "P" Well No. 3 in such a manner as to permit the production of oil from the Blinebry Oil Pool and the production of oil from an undesignated Glorieta oil pool through parallel strings of 2-inch tubing utilizing a dual-zone pump operated by a single rod string.

5. That such proposal is in the interests of conservation and the prevention of waste, and should be approved.

Wherefore applicant prays that this matter be set for de novo hearing before the Commission as provided by law and the rules and regulations of the Commission, and after notice and hearing as provided by law, said application be approved.

Respectfully submitted,

CITIES SERVICE OIL COMPANY

Kellahin and Fox
Santa Fe, New Mexico

Attorneys for Applicant

By: Jason W. Kellahin

DUAL ZONE INSTALLATIONS BY STATES

State	1957	1958*
Alabama	1	0
Kansas	4	3
Louisiana	3	0
Mississippi	3	2
Oklahoma	27	14
Texas	110	137

* Includes installations January through September

These installations consist of crossover equipment with two pumps being operated simultaneously on a single rod string by one pumping unit or crossover equipment is installed in preparation for use of dual zone pumps when the zones cease to flow.

Prior to January, 1957, approximately 500 dual zone pumps were installed in the United States. In addition, dual zone pumps are operating in Canada, Columbia, Venequela and Germany.

Cities Service #7

SUMMARY OF

REPORT AND BEST ASSEMBLY

MUSH NOTCHING AND

HOLDDOWN DEVICE AND

STANDPIPE VALVE.

CONTINENTAL EMSCO CO.

CITIES SERVICE OIL COMPANY

BOX 97
HOBBS, NEW MEXICO

file dual zone pump case (no 1557)

Exhibit #10

February 2, 1959

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

Attn: Mr. A. L. Porter, Jr.

Gentlemen:

Attached are photostats of "Dual-Zone Pumping with Two Pumps Actuated by One Rod String" by W. W. Whitaker and H. P. Lieb, Gulf Oil Corporation. These were requested by Mr. Dan Nutter for the record in Case No. 1557.

Very truly yours,

E. F. Motter
Assistant Division Engineer

EFM/gk
Attachs.

Dual-Zone Pumping with Two Pumps Actuated by One Rod String

By W. W. WHITAKER & H. P. LIEB
Gulf Oil Corp.

ABSTRACT

This paper reviews our experience, dating from 1953, with dually completed wells equipped with tandem pumps (two pumps actuated by one rod string). In this span of time newer designs in dual-zone equipment and packer-tubing combinations have antiquated the initial installation. Subsurface schematic drawings depict seven deviations in equipment installed in various wells, which encompass most of the major techniques and assemblies. Commentaries on each method, which include installational and operational problems and production results from specific wells, give an insight into the applications and limitations of each assembly.

INTRODUCTION

The installation and operation of artificial lift equipment in dually completed wells often involve many problems not necessarily associated with single-zone producers. Many of these problems can be minimized or avoided if the operator will give some thought during initial completion to the type and size of future pumping equipment to install after one or both producing zones have ceased to flow. Sometimes one may find that it is feasible to equip a well in such a manner that dual-zone pumping equipment can be installed at a later date without disturbing the tubing. This fact may be especially true if the flowing life of one or both pays is anticipated to be rather short.

Perhaps the most important single item affecting dual-zone pumping, for consideration during the initial completion of a well, is the design of a casing program that will permit adequate clearance for passage and hanging of future tubing strings. Sometimes, however, the reverse may occur, and the casing in a well may limit the type and size of artificial lift equipment. This condition could prevent the installation of equipment best suited for the depth, productivity, corrosiveness, and other operating conditions prevailing in a well, thereby causing inefficiencies by increasing installation costs and/or operating costs and possibly by reducing production.

Casing Design

Currently, Gulf's West Texas District installs 7-inch OD production strings swaged to 7 5/8-inch OD casing near the surface in order to give more clearance for tubing hangers. This casing design is compatible with most artificial lift methods, and permits considerable flexibility in the selection of future dual-zone artificial lift [illegible].

Our experience with tandem pumps began more than four years ago in 1953. Considerable improvements in equipment and methods have occurred in this span of time. This evolution has been chiefly in the direction of improved flexibility and simplicity. Several installations cover most of the major changes that have taken place. Currently, fourteen wells have some form of equipment for this type of pumping. Operational and production histories, supported with schematic subsurface drawings from some of these dually pumped wells, reflect the applications and limitations of seven major deviations in equipment.

DOUBLE-PACKERS, SINGLE-STRING

Fig. 1 schematically shows a dual-zone pumping system that represents our first endeavor to produce

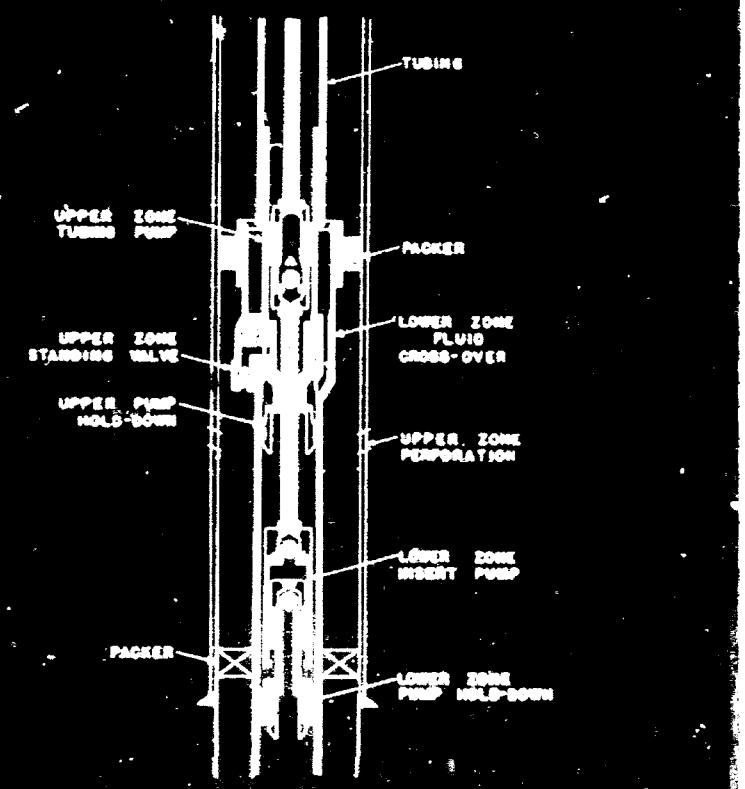


FIG. 1 DOUBLE-PACKERS, SINGLE STRING DUAL-ZONE PUMP INSTALLATION WITH TUBING PUMP AND INSERT PUMP

Production Tests - Table 1

Pay	Depth-Feet	Date	Hours Tested	Production - Bbls. Oil	Water	GOR	Pump Efficiency-Percent
5800'	5447	11-10-53	24	47	1	3745	23.1
Clearfork	6235	10-28-53	24	68	0	294	40.5

both zones of a dually completed well with tandem pumps. This equipment was installed in Well A in October, 1953. Only one string of 2-inch tubing was run. A retainer-type packer was set in the casing between the two producing zones in order to prevent commingling of their fluids around the tubing, and a hook-wall packer was set above the upper zone. A conventional insert pump and a tubing pump were used to produce the respective lower and upper zones. The upper-pump standing valve, composed of three API balls and seats recessed in the crossover shoe, was run as an integral part of the tubing string. The lower rod string and pump were actuated by a polished rod attached to the plunger of the upper pump that stroked through a pack-off assembly below the upper pump. The upper-zone fluid was taken into the pump suction at the crossover shoe and was pumped up the tubing. The lower-zone fluid was conducted through a jacket around the upper pump and was discharged above the upper packer into the annulus between the tubing and casing.

Locking Device

During the installation of this equipment the locking device on the pack-off assembly between the two pumps proved troublesome to latch. This device was held in an upward position until the pumps had been lowered to the desired position in the well. Then, jarring of the rod string was supposed to dislodge the positive lock permitting it to fall downward and lock the pack-off assembly into place in the tubing string. Three round trips with the rods and pumps were required to accomplish this.

Typical tests using this equipment are listed in Table 1.

New designs, in pumps adaptable to dual-zone pumping and in other dual equipment, were perfected and made available to the oil producer subsequent to this installation. A 2 1/2-inch model dual-zone pump was developed that was superior to the 2-inch model installed in Well A. It eliminated the troublesome and difficult method for latching the 2-inch model in place in the tubing and permitted the use of two insert pumps, instead of one tubing pump and one insert pump. About the same time a two-stage pump was designed. This pump is basically a stationary-barrel, bottom-anchor pump with a hollow, perforated, polished rod substituted for a pull rod and with a second traveling valve, which supports the fluid column during all or part of the downstroke. There is an annular chamber above the plunger into which all or part, depending upon the pump efficiency, of the fluid swept from the suction chamber by the plunger is displaced on the downstroke.

This two-stage pump is almost impossible to gas lock, and should continue to pump although any one of its three valves has failed. If the upper traveling valve should fail, it would revert to a conventional pump; if either the intermediate traveling valve or the bottom standing valve should fail, it should continue to pump with reduced efficiencies. The new 2 1/2-inch model equipped with a two-stage pump alleviates to some extent two major problems inherent in the pumping equipment shown as Fig. 1: (1) all produced gas from both zones must pass through the pumps, (2) the recovery of the working barrel and standing valve for the upper pump for repairs requires a tubing job.

Conventional Pumps

In March 1954, the equipment in Well A was converted to the newer 2 1/2-inch model shown as Fig. 2, except conventional pumps instead of two-stage pumps were

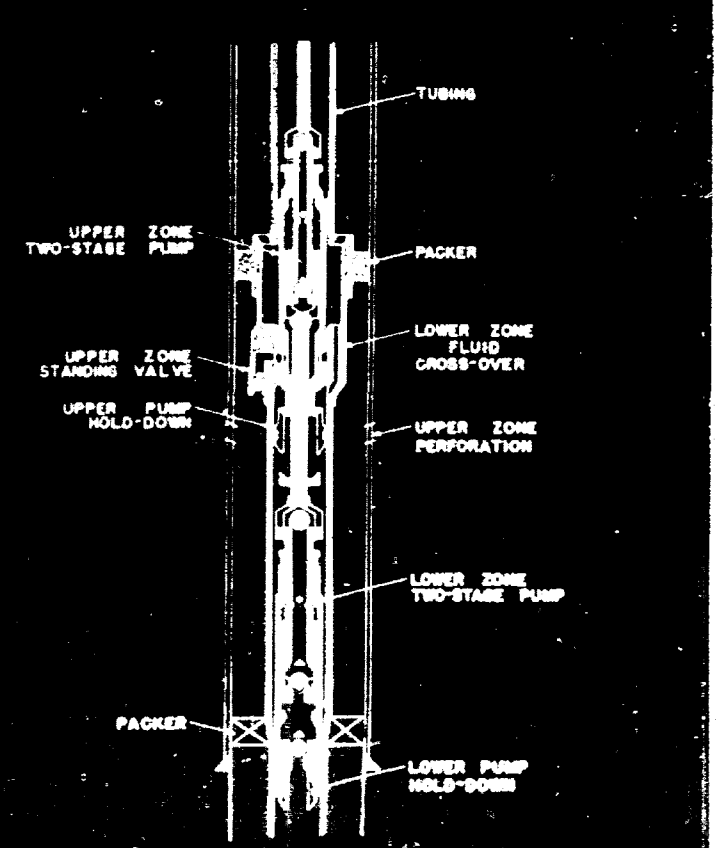


FIG. 2 DOUBLE-PACKER, SINGLE STRING DUAL-ZONE PUMP INSTALLATION WITH TWO TWO-STAGE PUMPS

Production Tests - Table 2

Well No.	Pay	Depth Feet	Date	Hours Tested	Production - Bbls. Oil	Production - Bbls. Water	GOR	Pump Efficiency Percent	Remarks
A	5600	5447	8-25-54	24	21.2	0.4	3726	10.4	Unvented
	5600	5447	1-17-56	24	27.0	0	0857	20.2	Unvented
	5600	5447	7-26-57	18	23.2	0	1897	23.1	Unvented
	Clearfork	6235	7-21-55	24	10.4	0	14423	6.7	Unvented
	Clearfork	6235	8-9-57	24	8.9	0	33208	5.7	Unvented
B	5600	5317	1-12-55	24	13.6	0	3382	12.5	Unvented
	5600	5317	7-30-57	12	6.1	0	5410	11.2	Unvented
	Clearfork	6339	11-26-54	24	19.0	0	1684	15.0	Unvented
	Clearfork	6339	9-11-57	10	8.0	0	1625	15.1	Unvented

used. Following this installation production from both zones was lower than had been anticipated. The 5600' pay (upper zone) produced a daily average of 22 barrels of clean oil with a gas-oil ratio of 2200 to 1, and the Clearfork pay (lower zone) produced a daily average of 10 barrels of clean oil with a gas-oil ratio of 5000 to 1. Due to the high gas-oil ratios, gas locking of the pumps appeared to be a possible cause for the low production. In May 1954, the conventional insert pumps were replaced with two-stage pumps in an attempt to alleviate this condition. After stabilization of production, the 5600' pay produced a daily average of 45 barrels of clean oil, and the Clearfork pay produced a daily average of 26 barrels of clean oil. This is an increase in production, attributed to the installation of two-stage pumps, amounting to 205 and 260 percent from the respective 5600' and Clearfork pays.

Similar equipment to that shown in Fig. 2 was also installed in Well B in August, 1954. Representative tests using this combination of pumping equipment are shown in Table 2.

Both wells pump off, which accounts for the low pump efficiencies. Production is generally comparable to the yield of nearby single-zone producers.

The pumps in Well A have been pulled a total of four times since installation of the converted equipment in March, 1954. Each of these pulling jobs was necessary for annual bottom hole pressure measurements of the upper 5600' pay according to the Railroad Commission orders; the pumps were serviced at these times. In order to obtain a true bottom hole pressure of the upper zone, a wireline retrievable plug is set in the lower-pump shoe, thereby blanking off lower-zone fluid.

Operation in Well B

In Well B during the first 1-1/2 months of operation the sucker rods and pumps only were pulled three times, and the tubing, sucker rods, and pumps were pulled one time. Debris from jet slots, swab rubbers, packer rubbers, [illegible] plugged the pumps and the tubing crossover. Since the well was cleaned of this debris approximately 3-1/2 years ago the pumps have not required servicing. The pumps were pulled three times for annual bottom hole pressure measurements and once when the sucker rods unscrewed.

The dual-zone pumping equipment in both wells has given excellent service since removal from the well bores of debris deposited during initial completion and during the flowing life of the wells. Possibly, production would have been slightly improved if both zones could have been vented. However, the relative displacement of the pumps, compared with the fluid yield from the pay zones, is great enough that considerable pump displacement can be sacrificed to the production of gas without a loss in oil production. The large volume of the tubing-casing annulus, which serves as a conduit to transmit lower-zone fluid to the surface, proves somewhat troublesome. Since lower-zone production has been 15 barrels or less per day and the tubing-casing annulus will hold approximately 180 barrels, it is sometimes difficult to determine whether the lower-zone pump is functioning properly or not.

The two-packer combination, which currently can be obtained in the newer model in both the 2-inch and 2 1/2-inch sizes, still is applicable for some wells. For instance, it usually results in the smallest initial investment since it only requires one tubing string. This equipment can also be run in small-bore casing, which may prevent the installation of some other methods.

This subsurface hook-up imposes a number of restrictions on each zone due to its lack of flexibility. For example, neither zone can be treated with hot oil, corrosion inhibitor, or paraffin solvent; nor can fluid be circulated, gas be vented, or fluid level measurements be taken from either zone.

SINGLE-PACKER, DOUBLE-CLAMPED-STRINGS

A dual-zone pumping installation of the type schematically illustrated in Fig. 3 was installed in Well C in October, 1954. This installation differed from the double-packer, single string method in that parallel strings of 2 1/2-inch and 1 1/4-inch tubing were clamped together and run in place of a 2 1/2-inch tubing string and packer. The remainder of the equipment was identical. Fluid from the lower zone is produced up the 1 1/4-inch tubing, thereby leaving the tubing-casing annulus available as a gas vent for the upper zone.

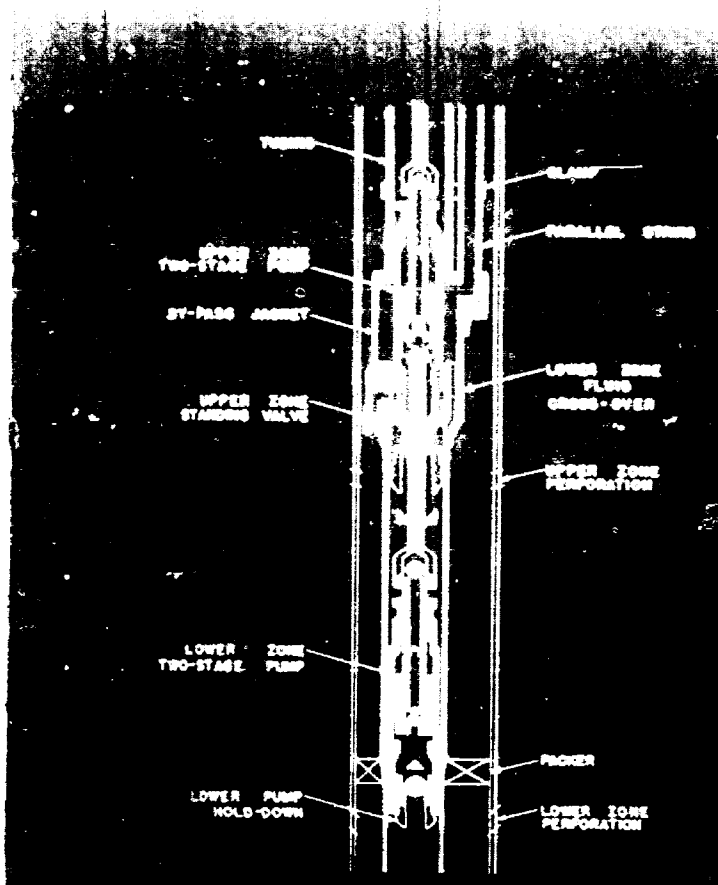


FIG. 3 SINGLE-PACKER DUAL-ZONE-PUMP INSTALLATION WITH DOUBLE-CLAMPED-STRINGS

These parallel tubing strings were preferred rather than the double-packer, single-string method, in order to provide a means for control of severe paraffin deposition from the lower-zone fluid. Hot oil is injected periodically into the casing, with paraffin accumulations from the interior of the tubing being successfully removed by the heat transfer. With this method of hot-oil treatment the pumping equipment is not shut-down, since its operation is desirable during treatment in order to remove melted paraffin.

Sand, suspended in the produced fluid from the lower pay, caused trouble immediately upon completion of this installation. The sand stuck the lower two-stage pump, which is not designed for sand production. A three-tube pump was run for a short time to clean up lower-zone production.

Representative tests from this well are listed in Table 3.

The decline in production during these tests was caused by a similar decline in the productivity of the pay zones. The production rates are very similar to those of nearby single producers.

The dual-zone equipment in Well C has undergone a total of 20 malfunctions in 38 months of operation, which is an average of 1.9 months operation for each service job. Operation of the dual equipment has therefore been extremely expensive. There have been 12 rod jobs to service the pumps, 4 fishing jobs to recover parted rods; and 4 stripping jobs to recover stuck dual-zone equipment. Eighty-five percent of these service jobs occurred during the first 16 months of operation with 15 percent occurring during the next 22 months. Produced sand seems to have been the main source of trouble causing worn pumps, stuck pumps, and stripping jobs. The dual-zone equipment has five locks or seals exposed to well fluids (three to the lower-zone fluid and two to the upper-zone fluid). The rod-string failures were possibly caused by its over stress during attempts to loosen stuck equipment and by over pumping of one or both zones.

When the equipment in Well C was converted in March, 1957, to the popular, independent-string method of dual-zone pumping, the clamps were still firmly attached to the tubing. Clamped-parallel-string installations, however, are hazardous since the buckling of the tubing by pump action could cause the clamps to loosen, fall; and stick the tubing.

SINGLE-PACKER, DOUBLE-UNCLAMPED-STRINGS

Fig. 4 shows a typical schematic drawing of this type of installation. In this subsurface combination only one packer is used to separate the two pay zones. The long string is run and latched into the retainer-type packer. This string is set with sufficient tension to avoid excessive tubing buckling and attendant sucker-rod abrasion during pump action. The short macaroni string, with beveled coupling edges, is then run and landed in the parallel-string landing head integral with the long string of tubing. Two insert pumps are used as in the other installations, with fluid from the lower pump passing up the macaroni string and fluid from the upper pump passing up the long string. This equipment is available in both the 2 1/2-inch and

Production Tests - Table 3

Pay	Depth Feet	Date	Hours Tested	Production - Bbls. Oil	Production - Bbls. Water	GOR	Pump Efficiency Percent	Remarks
Glorieta	4570	3-27-56	24	51.1	1.4	391	31.5	Vented
Glorieta	4570	1-13-56	22.6	56.1	16.6	446	51.5	Vented
Glorieta	4570	1-8-57	24	20.3	1.8	985	11.5	Vented
Fusselman	7574	10-20-56	24	62.5	5.5	714	50.5	Unvented
Fusselman	7574	10-13-56	24	34.9	5.5	903	22.5	Unvented
Fusselman	7574	10-8-57	24	16.4	0.2	433	14.2	Unvented

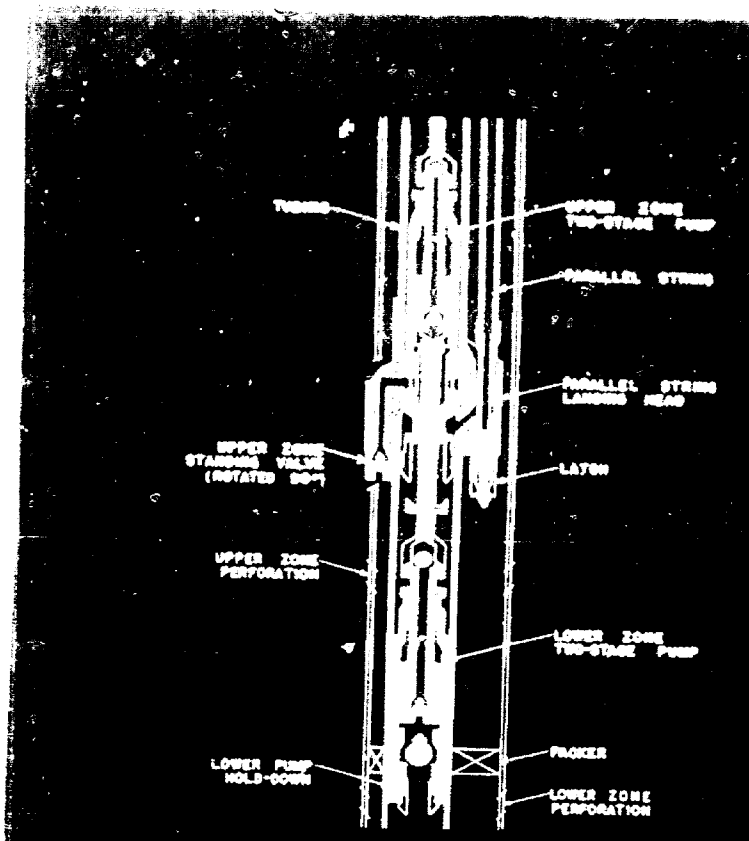


FIG. 4 SINGLE-PACKER DUAL-ZONE-PUMP INSTALLATION WITH DOUBLE-UNCLAMPED-STRINGS—BOTH ZONES PUMPING

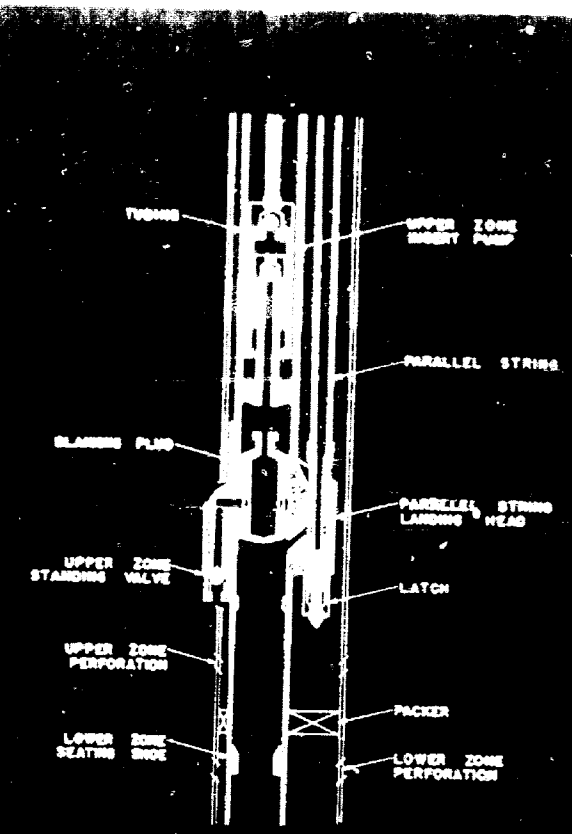


FIG. 5 SINGLE-PACKER DUAL-ZONE-PUMP INSTALLATION WITH DOUBLE-UNCLAMPED-STRINGS—UPPER ZONE PUMPING, LOWER ZONE FLOWING

2-inch models.

This arrangement of subsurface dual-zone pumping equipment was first installed in Well D in April, 1956. The inadvertent installation of a 5 1/2-inch landing head in 7-inch OD casing caused trouble during installation. The clearance between the landing head and the casing permitted the landing sub on the 1-inch macaroni string to miss the landing head and to wedge between the anchor and the casing. Shoulders were welded on the landing head to correct this condition. Before satisfactory operation of this equipment was obtained the rods, pump, and both tubing strings were round tripped once; the macaroni string alone was round tripped once; and the rods and pumps alone were round tripped twice. Since this installation was completed satisfactorily, it has given nearly 2 years of maintenance-free operation.

A similar installation was performed in Well E in July, 1956. This installation was completed without any trouble whatsoever. It has currently given 1-1/2 years of satisfactory service without a single shutdown to service the subsurface equipment.

Most Economical Approach

Many times the most efficient and economical approach to dual-zone pumping is the installation of separately-landed, parallel-tubing strings with appropriate dual-zone equipment during initial well completion. This procedure eliminates the expenditure to kill and re-enter the well at a later date when one or both zones have ceased to flow. The additional investment required at well completion is especially justifiable when the probable life of the flowing zone of the two zones are anticipated to be rather short. Fig. 5 is a subsurface hook-up of an installation of this type. It permits both zones to flow or one zone to pump and the other zone to flow merely by the installation of the proper wireline tool in the crossover shoe. During installation of this equipment, an accurate measurement of the distance between the lower and upper pump shoes must be made and kept available for future reference when tandem pumps are run.

Gulf has six installations of this type. In one well both zones are now pumping; in four wells the upper zone is pumping, and the lower zone is flowing; and in one well the upper zone is flowing, and the lower zone is pumping. Both zones have pumped in Well F since July, 1957. The rods and pumps have been pulled twice to permit servicing of the pumps and packing between the pumps. On one occasion steel shavings damaged the upper pump, and in another instance the metal-to-metal packing between the pumps froze. In wells where only one zone is pumping, the troubles encountered have been common to that of nearby single-zone wells.

Compiled in Table 4 are results from tests on three wells equipped with the single-packer, double-string method of dual-zone pumping.

These single-packer, double-unclamped-string methods are rather versatile and trouble-free because (1) the need for clamps is eliminated, thereby speeding up rig time and removing the hazards associated with clamps, (2) the upper zone can be vented, (3) hot oil, paraffin solvents, and corrosion inhibitors may be injected into the casing, (4) static fluid level measurements can be taken for the lower zone, (5) the tubing strings may be run in and pulled [illegible] independently, but only in

Production Tests - Table 4

Well No.	Pay	Depth Feet	Date	Hours Tested	Production - Bbls. Oil	Production - Bbls. Water	GOR	Pump Efficiency Percent	Remarks
D	5600	5750	8-1-56	24	48.8	5.4	3074	30.1	Vented
	5600	5750	9-27-57	3	9.5	0	2000	55.0	Vented
	Clearfork	6239	8-1-56	15	23.1	0	1312	24.3	Unvented
	Clearfork	6239	8-1-57	12	9.7	2.0	2062	16.1	Unvented
E	5600	5683	9-27-56	24	23.1	0	5195	17.4	Vented
	5600	5683	9-28-57	5	9.7	0	2063	35.1	Vented
	Clearfork	6246	9-8-56	24	13.2	0.6	5303	9.9	Unvented
	Clearfork	6246	7-26-57	24	5.5	0	11455	3.9	Unvented
F	Tubb	4900	9-11-57	24	80.1	21.2	325	66.1	Vented
	Tubb	4900	12-5-57	24	79.7	28.0	289	70.0	Vented
	Wolfcamp	6300	9-11-57	24	63.4	12.0	804	46.6	Unvented
	Wolfcamp	6300	12-6-57	24	51.2	34.1	645	52.7	Unvented

a certain order: the long string must be run first, while the short string must be pulled first, and (6) one or both zones may be allowed to flow and may be placed on pump at a later date without disturbing the tubing.

SINGLE-PACKER, DOUBLE-UNCLAMPED-STRINGS WITH DOUBLE-BYPASSES

This unique installation is shown schematically as Fig. 6 and was installed in Well G in August, 1956. When this equipment was installed, considerable doubt existed as to whether it would perform satisfactorily; however, the design appeared sound from an engineering standpoint. This design is an adaptation of the usual dual-zone equipment, which permits the shoe for the upper-zone pump to pass into a 5-inch OD (18#) liner in order to attain complete depletion of the upper zone.

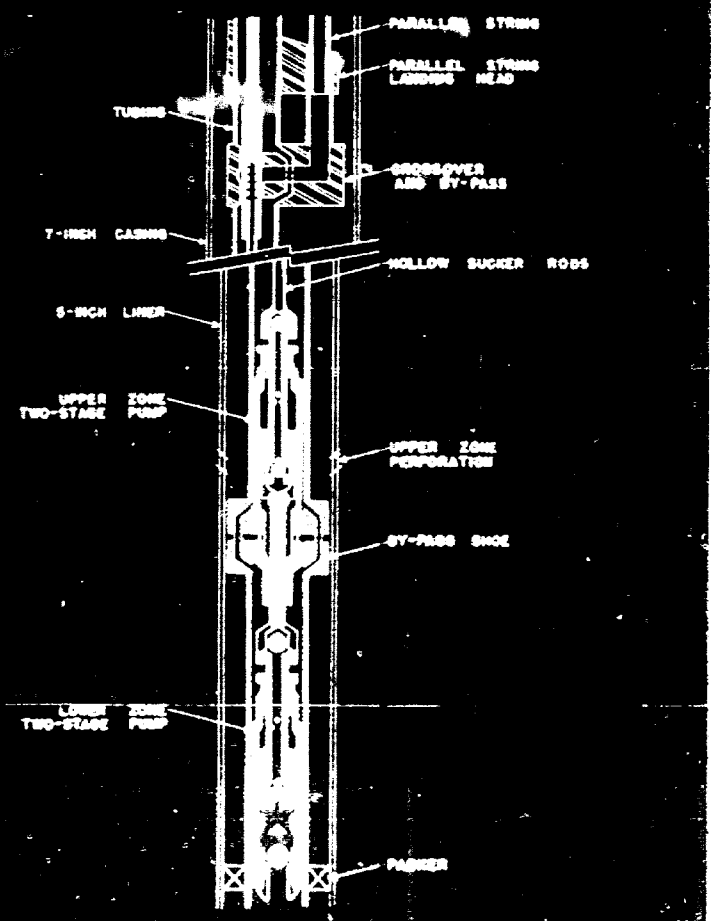
This subsurface arrangement utilizes a double by-pass, 550 feet of hollow sucker rods, one retainer-type packer, and two unclamped tubing strings. The hollow sucker rods act as a conduit for upper-zone fluid to a point just above the 5-inch OD liner where a cross-over directs the production into a 1-inch macaroni string. The lower-zone fluid produces through the 2-inch tubing for the entire distance from the pump to the surface, except that it must traverse two bypass shoes.

The only source of trouble during this installation occurred when the macaroni string, which originally was set in tension, became unlatched. This string was reset and left in compression.

This equipment has not required any repairs since its installation 1-1/2 years ago. Table 5 shows some representative production tests from this well.

The production from Well G is comparable to the production from nearby single-zone producers.

This type of installation would rarely have an application. It is shown merely to illustrate how standard dual-zone equipment can be deviated to suit any unusual conditions existing in a particular well. The [illegible]



[illegible] INSTALLATION
[illegible] BY-PASS,

Production Tests - Table 5

Pay	Depth Feet	Date	Hours Tested	Production - Bbls. Oil	Production - Bbls. Water	GOR	Pump Efficiency Percent	Remarks
5600'	5810	2-15-57	24	46.1	0	5471	65.0	Vented
5600'	5810	8-2-57	24	6.8	0	19118	9.6	Vented
Clearfork	6050	3-5-57	24	15.2	0	4934	15.3	Unvented
Clearfork	6050	7-19-57	17	11.3	0	2566	16.0	Unvented

application of this hook-up would likely be in a well, similar to the one shown, containing a small-bore liner. The "double bypass" arrangement might prove applicable where it is desirable for the lower zone to produce up the long string and for the upper-zone production to divert into the parallel string.

SINGLE-PACKER, TRIPLE-STRING

Fig. 7 is a schematic drawing depicting the latest dual-zone tubing assembly installed in two wells during initial completion. The upper zone is equipped to pump, while the lower zone is flowed. When the lower zone ceases to flow, a second pump will be run and seated in a shoe provided in the tubing string.

This arrangement consists of the standard dual-zone equipment and two parallel strings of 2-inch tubing with 1-inch vent tubing extending beneath the shorter string downward through the packer. The crossover shoe with landing head is run on the long string and a landing sub is run on the bottom of the short string. A ball-and-seat arrangement with a fishing neck attached is installed in a seat on top of the 1-inch vent tubing. This valve remains closed except when the pressure buildup below it exceeds the fluid head. At a later date, should the lower-zone pump gas lock, the ball-and-seat arrangement can be pulled and a 3/4-inch vent string can be substituted inside the shorter tubing string.

In this system the long string conducts upper-zone fluid to the surface. The parallel string conducts the lower-zone fluid from the crossover shoe to the surface, while the 3/4-inch concentric string, when installed, will conduct the lower-zone gas from below the packer to the surface. The casing serves as a vent for the upper zone.

Landing Sub Leaked

In both installations of this type the landing sub on the bottom of the short string leaked. There was considerable money expended to locate the leak in each well and to pull and rerun the short string. The cause of these leaks was apparently not due to faulty equipment but to insufficient weight being set on the short string. This was the only trouble experienced with one installation. In the other installation, however, the sealing elements in the retainer-type packer also leaked. A successful completion of this well was obtained after several months had expired, in which large expenditures were incurred in testing and service work.

Since the single-packer, triple-string method requires an extra string of 2-inch tubing, it is usually more expensive than any of the other methods mentioned. Otherwise this installation has all the advantages of the single-packer, double-string model, plus some additional ones. The advantages of the single-packer, triple-string assembly over all other methods are made possible by the 3/4-inch vent string. This vent string (1) provides a means for venting lower-zone gas, (2) can serve as a conduit for corrosion inhibitor injection to the lower-zone pump when it is not used to vent gas, and (3) permits circulation of lower-zone production if such action is desirable to avoid over-production.

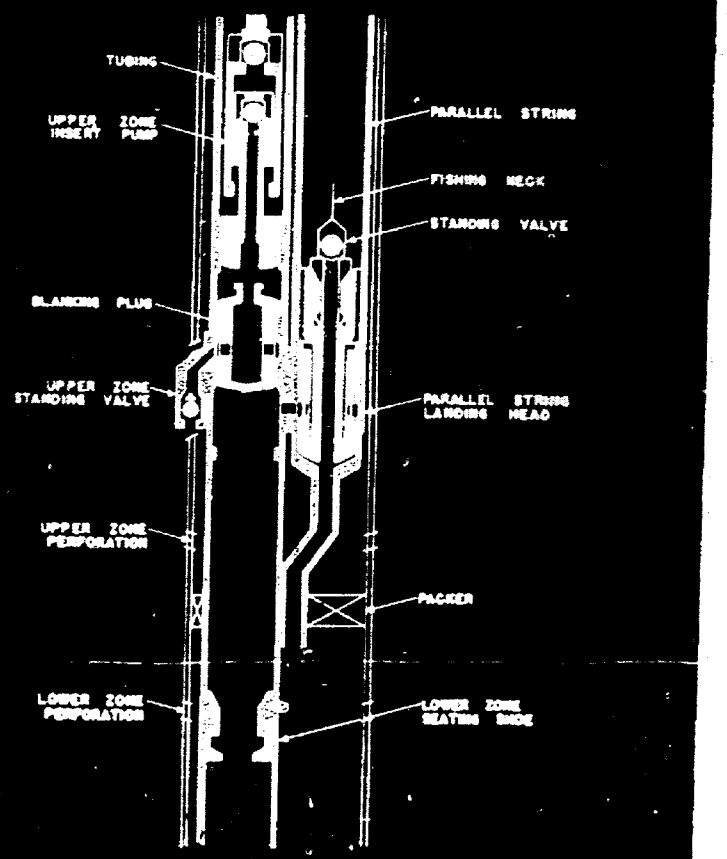


FIG. 7 SINGLE-PACKER, DUAL-ZONE-PUMP INSTALLATION WITH TRIPLE STRINGS OF TUBING — UPPER ZONE PRODUCING THROUGH LONGER ZONE VALVE

DISCUSSION AND CONCLUSIONS

Our experience with tandem pumps indicates that as a general rule this equipment will give satisfactory service. The newer designs should eliminate or minimize some objectionable features of earlier models. However, problems and difficulties are usually inherent qualities of dually completed wells with out without pumping equipment. Dual-zone pumping certainly involves more problems than single-zone pumping.

Most dual-zone pumping equipment problems have occurred during installation or immediately thereafter. In some wells the installation was made without mishap. In other wells random difficulties developed, usually attributable to failure of a latch to lock into place or a seal to hold. Possibly the greatest overall source of trouble was caused by the plugging and sticking action of debris and sand during the cleaning-up period immediately following a dual-zone installation. Thorough circulation of the well bore prior to the installation of dual-zone pumps might minimize this difficulty.

In one well, in which the lower zone and possibly the upper zone produce fluids that contain small amounts of suspended solids, the operational costs have been extremely high. The equipment malfunctions experienced in the operation of dual equipment in this well, and the difficulties resulting from the production of solids during and immediately following the completion of other installations, suggest that a concerted effort should be made to keep the production of sand and debris at a minimum. Newer designs in tubing assemblies and associated equipment have reduced the number of seals exposed to well fluids, which should decrease to a small extent the possibility that sedimentation of solids might stick the pumping equipment.

Subsurface Repairs

Disregarding the aforementioned well in which the production of sand caused excessive repairs, the remaining six wells equipped with tandem pumps have suffered very little downtime for subsurface equipment repairs. These installations, following a short clean-up period, have operated a total of 150 months with only three pulling jobs that were solely the result of equipment malfunctions. Unscrewed rods caused one of these service jobs. These installations, therefore, have averaged 50 months of operation for each pulling job. The rods in two wells, however, were pulled several times for annual bottom hole pressure measurements, and the pumps were serviced on these occasions.

The two-stage pump has proved its value in the production of foamy or gassy fluid. This feature is particularly advantageous when all produced gas must pass through the pump (pumping from beneath a packer). Since the two-stage pump will usually [illegible] with a faulty standing valve, it is also very useful as an upper-zone pump where it may minimize or eliminate the need for a standing valve integral with the tubing string. This pump, however, should not be used in wells where the produced fluid contains suspended sand.

The most logical conclusion regarding pump efficiencies is that tandem pumps will yield efficiencies comparable to single-zone pumps operating under similar conditions. With one exception the wells utilizing tandem pumps have been low producers in which the productivity of each zone has been considerably less than the pump's displacement. Under these conditions the productivity of each zone, and not the pump, usually governs the pump efficiency, accounting for most of the low efficiencies.

Advantages and Disadvantages.

Dual-zone pumping using tandem pumps has distinct advantages and disadvantages. Some advantages are: (1) smaller initial cost in comparison with other methods, (2) compatibility with casing designs in most wells, and (3) elimination of upkeep of two pumping units. The main disadvantages are: (1) lack of simplicity compared to some methods, (2) inability of equipment to handle suspended sand as well as some other methods, (3) loss of production from both zones due to the servicing of down-hole equipment for one zone, (4) pumping depth and quantity of production limited by strength of rods, and (5) lack of flexibility even in the most advanced models.

The flexibility has improved considerably in the last few years mainly through deviations in tubing assemblies; however, the pumping speed, pumping time, and length of stroke are by nature of this equipment still the same for both zones. This condition sometimes makes difficult the regulation of production from the two zones, since one zone may overproduce while the other zone is underproduced. Some means for varying the production from one zone are: (1) changing the pump size, (2) circulating production, (3) unseating pump (applies only to the lower pump), and (4) allowing the pump to pump through itself by use of a traveling overload valve on the pump.

The tandem pumping method has demonstrated its value as a means for producing dually completed wells. Like any type of oilfield equipment, however, it has its limitations, and should be thoroughly engineered to suit conditions existing in each specific well.