Case No.

9 2

Application, Transcript,
Small Exhibits, Etc.

STATE OF NEW MEXICO
OFFICE OF STATE GEOLOGIST
SANTA FE, NEW MEXICO

March 26, 1947

Judge Russell G. Lowe
Gulf Oil Corporation
Tulsa, Oklahoma

IN RE: Cases 92,93 & 94 - Gulf Oil Corporation
Petitions in connection with dual completions.

My dear Judge:

This is simply a precautionary notice to remind you that the hearing in the above captioned cases will be resumed, April 15th.

With kindest personal regards.

Cordially yours,

CARL B. LIVINGSTON
Administrator

CBL:bsp

cc: S. G. Sanderson
Manager of Production
Gulf Oil Corporation
Tulsa, Oklahoma

STATE OF NEW MEXICO
OFFICE OF STATE GEOLOGIST
SANTA FE, NEW MEXICO

March 26, 1947

Col. J. D. Atwood
c/o Atwood & Malone
Artesia, New Mexico

IN RE: Cases 92,93 & 94 -- Gulf Oil Corporation Petitions in connection with dual completions.

My dear Colonel:

This is simply a precautionary notice to remind you that the hearing in the above captioned cases will be resumed, April 15th.

With kindest personal regards.

Cordially yours,

CARL B. LIVINGSTON
Administrator

CBL:bsp

HUMBLE OIL & REFINING COMPANY

POST OFFICE BOX 2180
HOUSTON 1, TEXAS

Case 92-94 inc.

Jan. 16, 1947

File 6-1
New Mexico
Dual Completions

Mr. R. R. Spurrier, State Geologist
Santa Fe, New Mexico

Dear Dick:

Attached please find a tabular analysis of the performance of Humble Company dual-completions as of April 1, 1946. This information will supplement Mr. Dewey's testimony at the hearing of January 10, and I ask that you allow it to be incorporated in the record.

Very truly yours,

W. E. Hubbard

WEH-AS
Attachment

PERFORMANCE OF HUMBLE DUAL COMPLETIONS - Continued

	No. of Dual Completions			Oper. Period	Failures on Dual Completion Equipment*		Workover Jobs		Remarks
	Dual Gas	Gas-Oil	Dual Oil	Years	No.	Cause	No.	Cause	
DIST IV - Continued									
[illegible]	-	1	-	-	-		*	[illegible]	Converted to single-zone produc
[illegible] Hopper	-	2	-	0.9	-		1	[illegible] to single-zone producer. Converted to single-zone pro	
							1	Reduce [illegible] zone gas-oil ratio.	
[illegible]son	-	1	-	0.6	-		-		
	-	-	2	0.2	-		-		
[illegible]n West	-	1	-	2.4	-		-		
	1	-	-	5.7	-		-		
District IV	3	5	4	1.3	1		4		
DIST V									
[illegible]ago	8	-	-	0.5	1	Packer gave way under high differential pressure created by producing Travis Peak.	1	Packer failure.	Likely that high differential pressures during production of some wells will cause additional packer failures.
							2	Casing leak.	
							3		
DIST VI - None									
DIST VII - None									
DIST VIII									
[illegible]rson	-	1	-	2.5	2	Packer failed during completion.	-		
[illegible]Stockton	-	1	-	1.5	-		-		
District VIII	-	2	-	2.0	2		-		
DIST IX - None									
DIST X - None									
Total	17	15	4	1.6	14		20		

*Includes gas-injection well not yet used and 1 dual gas-oil well from which no gas has been produced.
1 Workover packer setting.
2 Lower zone used for gas injection.
3 Packer failures have occurred in Humble wells (multiple and single [illegible]

HPino
4-17-46

PERFORMANCE OF MULTIPLE DUAL COMPLETIONS

	No. of Dual Completions			Oper. Period	Failures on Dual Completion Equipment*		Workover Jobs		Remarks
	Dual Gas	Gas-Oil	Dual Oil	Years	No.	Cause	No.	Cause	
DISTRICT I - None									
DISTRICT II									
[illegible]	-	1	-	3.5	2	Tubing cut out opposite gas zone perforations; rubber-coated tubing used.	2	Replace tubing opposite gas zone perforations.	Continued erosion of tubing opposite gas zone perforations expected.
[illegible]bro	-	1	-	0.5	2	Tubing cut out opposite gas zone perforations.	1	Replace tubing opposite gas zone perforations.	Converted to single-zone producer.
							1	Convert to single-zone producer.	
[illegible] District II	-	2	-	3.0	4		4		
DISTRICT III									
[illegible]nac	-	1	-	6.0	1		1	Annulus filled with mud because of tubinghead leak.	Now produced as single-zone oil well.
	6	-	-	2.6	1	Side door choke stuck; also rubber coating on tubing opposite upper perforation was eroded away.	2	Repair wellhead leak.	Because of known corrosion on side of tubing, it is felt that no flow should be allowed in tubing-casing annulus.
							2	Repair casing leak.	
							1	Convert to single-zone producer.	
[illegible]ill Lake	-	[a]3	-	0.6	1	Packer seal or tubing failure.	1	Convert to single-zone producer.	Packer leakage expected.
[illegible]	-	1	-	0.7			1	Recomplete in new zones.	
[illegible]bee	-	[b]1	-	0.4	2	Packer seal not obtained.	1	Repair dual equipment.	
					1	Packer leakage.			
[illegible] District III	6	6	-	2.0	6		9		
DISTRICT IV									
[illegible]r Bluff	[c]2	-	-	2.7	1	Lead-Coated tubing developed leak.	1	Replace cut-out joint of tubing.	
[illegible]oy Deep	-	-	2	0.7	-		-		

PREPRINT - SUBJECT TO CORRECTION

Paper No. 801-21G

A REVIEW OF PERFORMANCE OF MULTI-ZONE WELLS IN THE WILMINGTON FIELD, CALIFORNIA

By Carlton Beal, Richfield Oil Corporation
and
Read Winterburn, Union Pacific Railroad Co.

(The statements and opinions expressed herein are those of the author, and should not be construed as an official action or opinion of the Institute.)

Pacific Coast District
Division of Production
American Petroleum Institute
Los Angeles, California

A REVIEW OF PERFORMANCE OF MULTI-ZONE WELLS IN THE WILMINGTON FIELD, CALIFORNIA

By Carlton Beal[x] and Read Winterburn[xx]

ABSTRACT

A review has been made of 249 multi-zone wells originally completed in the Ranger, Upper, and Lower Terminal Zones, Wilmington Field, California. This group of wells includes about one-fifth of the present producing wells in the field and about ninety per cent of all the original Multi-Zone completions. Of these wells, forty-seven were equipped to produce separately from three zones, with the balance - or 202 - equipped to produce from two zones. Although the field has been producing for only about seven years, almost forty per cent of the wells have had to be repaired, after producing only 3.2 years, principally because of bad casing and tubing, water encroachment, and cessation of natural flow. All of the original multi-zone wells were completed flowing; of these, forty-two per cent are now pumping. Not one of the Multi-Zone pumping wells is equipped for simultaneous production of two or more zones separately by artificial lift because of mechanical difficulties such as sand production, corrosion of flow strings and packers, and large volume water production. In effect, over forty-five per cent of the original Multi-Zone wells in the field are operated at the present time so that they are single or combination zone wells. Conclusions are that multi-zone development in the Wilmington Field has not been justified except where surface locations are limited and in those cases where an advantage will be gained in a competitive area.

GENERAL DESCRIPTION OF FIELD

The producing horizons in the Wilmington Field comprise a maximum thickness of about 3000 feet divided into six zones, each of which is made up of alternating sands and shales. The field is divided into five separate fault blocks. The zones within these fault blocks (or in some cases combinations of two or three zones) are treated as fourteen separate pools for allocation purposes. The zones differ in oil gravity, physical characteristics of the sand, and productive area.

Horizons Produced in Most Multi-Zone Wells: The horizons that are produced in most multi-zone wells are the Ranger, Upper Terminal, and Lower Terminal Zones on each of the Fault Blocks previously described.(1) (2) Figure 1 shows an electric log of these zones and their characteristics. The oil sands are of generally high permeability (300 to 1000 Md) and high porosity. They are usually soft and unconsolidated, frequently causing sand trouble and cutting out of liners and tubing strings. Original formation pressure in all zones was roughly equal to the hydrostatic head measured from the surface. Originally these zones were saturated with oil and gas in solution and initially produced with gas/oil ratios as low as 200 - 400 cubic feet per barrel. Now,

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[xx] Chief Development Engineer, Union Pacific Railroad Company, Los Angeles, Calif.

in the course of partial depletion, they have increased to 800 - 1500 cubic feet per barrel. Well ratios have reached values in excess of 10,000 cubic feet per barrel in secondary gas caps. Most of the reservoirs in each of the five fault blocks have produced as depletion type pools with frequent instances of local water encroachment near the productive limits of each pool.

TYPES AND CLASSIFICATION OF MULTI-ZONE COMPLETIONS

Definitions: A "multi-zone" well is one that is mechanically equipped to produce two or more zones simultaneously through separate flow strings without commingling the oil. A "combination" well is one that produces simultaneously from more than one zone, causing the commingling of oil within the well bore. A "single zone" well is one that is perforated opposite only one zone and produces from this zone.

Classification of Multi-Zone Wells: Several authors [1][4][5] have described methods of producing "dual" zone (two zones only) wells by means of various types of packer installations. Corey[3] has provided a general description of several types of multi-zone completions in the Wilmington Field, and has described, in general, some of the advantages and disadvantages involved in this type of zone development. For the purpose of analysis, the multi-zone wells in the field have been divided into five general classes, as illustrated in Figure 2. These classifications are based on the location of cemented casing with regard to perforated intervals, flow strings and packer arrangements used to effect zonal segregation. The classes are described below:

Class I — Wells originally equipped with tubing packers set opposite a cemented blank section to obtain zonal separation.

Class II — Wells that were originally equipped with a tubing packer set on a tubing collar located in a cemented section between perforated intervals. These wells may or may not be equipped with casing packers.

Class III — Wells that were originally equipped with casing packers set on a swage in a cemented section between two perforated intervals to effect zonal separation. This class of wells may or may not be equipped with tubing packers.

Class IV — These wells are equipped with casing packers opposite cemented sections with or without tubing packers to effect zonal segregation.

Class V — This group of wells obtains zonal segregation by cementing two or more full strings of casing over perforated intervals. These wells are not equipped with tubing or casing packers.

Table I shows an analysis of 249 original multi-zone completions divided into the five classes. The original multi-zone wells comprised about 19.3% of the producing wells in the field. All of the wells that were included in the review originally produced from the Ranger and Terminal Zones or portions thereof and represent about 90% of all the original multi-zone completions in the field. Corey[3] states that in 1941 there were 264 multi-zone wells in the field which apparently include a small group of Tar - Ranger multi-zone wells.

The Table shows that 171 of the 249 multi-zone completions obtained zonal segregation by means of tubing hook-wall packer installations. These wells produced from two zones while 76 wells in Class II, III and IV obtained zonal segregation by installing casing packers. Of the 76 wells equipped with casing packers, 47 were equipped to produce separately from three zones. Only two wells (Class V) isolated producing zones without the use of tubing or casing packers. Included in the Class I group of multi-zone wells are two unique completions equipped with a dual tubing head which made possible fluid production from two zones through a string of 2" tubing along side a 2" string set on a packer. Also in Class I are two Lower Terminal Zone wells that subsequently developed excessively high gas/oil ratios due to secondary gas cap accumulation in the Terminal Zone and have been deepened to the underlying Union Pacific Zone and completed as dual zone wells.

DEVELOPMENT BY MULTI-ZONE WELLS

In considering the use of multi-zone completions in development programs, it is necessary to consider the three general circumstances in the field which led the operators to multi-zone development; namely, reduced development costs, competitive advantage, and isolation of running sand to obtain maximum oil capacity.

Reduced Development Costs: In some areas dual zone completions were used in the Upper and Lower Terminal Zones on a spacing which was considered adequate for each zone with the principal object of reducing development costs. The oil allocation practice was to give separate oil quotas to the Upper and Lower Terminal Pools and to produce only one zone at a time in each well. The well capacities were sufficient to thus produce the pool allotments determined on a basis of reservoir performance from each of the two zones and, since most of the wells are still capable of flowing from either zone, distribution of withdrawals is readily controlled. In these circumstances simultaneous production of any well from the separate zones has not been necessary and facilities for separate gauging have not been installed.

The continued operation of the two zones as separate reservoirs after cessation of natural flow will require conversion to single zone wells unless it is possible to overcome the several mechanical obstacles to application of special installations permitting artificial lift from the separate zones. If the wells are to be converted to single zone producers, additional

development will be necessary to attain the originally intended well density. In this case the anticipated saving in development costs will not be realized.

Competitive Advantage: The second situation is that existing in several competitive areas in which both Upper and Lower Terminal Zones are productive where wells have been drilled to the closest allowable spacing. All wells in this area have been drilled to the base of the Lower Terminal Zone and perforated through both Upper and Lower Terminal sands. Well density on various properties usually ranges from one to three acres per well. Many of the wells are also perforated opposite the Ranger Zone sands which often have remained shut in behind a packer. Many operators have avoided placing the Ranger Zone on production in these wells because experience has shown that this zone often causes collapse of perforated casing as a result of excessive sand production. Immediate objectives of the operators in development by multi-zone completions were the competitive advantages to be gained from use of all available well locations to produce the most prolific zone and the most desirable oil while providing for eventual depletion of the remaining zones. Gun perforating for later depletion of these zones was not considered because of the sand problems which were encountered in producing through this type of perforation. The well density in these competitive areas is generally such that it will be possible eventually to convert wells to single zone wells and still have an adequate well density in each zone except on some small one or two well properties.

Isolation of Running Sand to Obtain Maximum Oil Capacity: In areas where the Lower Terminal is non-productive and the Ranger and Upper Terminal Zones are both productive of relatively heavy oil, the initial well capacities were below the potential required for top allotment. The majority of wells completed in such areas were perforated opposite both zones. The wells were completed as either combination wells or as Class I dual zone wells with a tubing packer set in a cemented blank section between Ranger and Terminal. The purpose of the latter type of completion was to reduce "sanding up" of the Terminal from the Ranger and occasionally to obtain a better oil gravity. However, soon after completion, it was found that the Ranger Zone was generally incapable of flowing through the annular space between the tubing and 8-5/8" casing or, if it flowed initially, it stopped soon after completion. Over eighty-five per cent of such wells have now been converted to combination wells producing Ranger and Terminal Zones together. For example, in one area noted for its sand trouble (Fault Block I) there were originally 27 Class I wells; 24 of these are now producing as combination Ranger-Terminal wells.

PERFORMANCE OF MULTI-ZONE WELLS

Effect of Allocation Methods on Use of Wells: Utilization of multi-zone completions for the accomplishment of the original purposes has been affected greatly by the method of allocation, the producing characteristics of the wells and the mechanical difficulties encountered. Well allotments prior to 1942 were based on oil potential with a uniform allotment to all wells having a potential in excess of a specified minimum. Under these circumstances wells received no benefit in allotment unless the productive capacity of the more prolific zone by itself was less than the minimum required for top allotment.

At locations where both Upper and Lower Terminal were productive, the productive capacities at the time of completion were generally such that either zone by itself had sufficient potential to earn top allotment.

Since early 1942, allocation has been made on the basis of individual zones in the various fault blocks with the pool allotment distributed to the wells by means of various allocation formulae. However, it has been the practice to allot a well oil production from only one zone at a time so that multi-zone wells have realized no benefit in allotment under the new system of allocation. At the present time most of the wells located in areas of comparatively low Terminal Zone productivity are receiving capacity allotments. These wells generally have perforations opposite both Ranger and Upper Terminal and are nearly all pumping as combination wells.

Selective Production: Selective production from multi-zone wells has proved useful in control of gas/oil ratios, water production and gravity of oil produced, and has been used by operators to gain competitive advantages in some areas. It has also been advantageous selectively to produce intervals of relatively low permeability after high head water had reached the wells in more permeable sands. In pools which receive separate allotments for Upper and Lower Terminal, selective production has permitted proper adjustment of pool withdrawal rates. Of 190 multi-zone wells reviewed, 46 have been changed from one zone to another to obtain optimum production.

A number of wells have been completed with cemented blank sections opposite shale members within the Upper and Lower Terminal, subdividing these zones into two or more subzones, any of which can be produced separately. Selective production from the lowermost interval when it will no longer flow through the tubing has been accomplished by pumping through tubing set on a packer. In eleven instances, upper perforated intervals have been produced separately after they ceased to flow in the annulus by placing a plug in the bottom of the tubing, perforating the tubing above the plug and flowing the upper zone. In other cases an intermediate perforated interval has been produced separately by placing a bridge in the cemented blank section at the base of the interval and producing through tubing set on a packer above the interval to be produced.

Cemented blank sections in multi-zone wells between perforated intervals have facilitated repair work, particularly scabbing and plugging operations designed to eliminate water sands from production. The "scabbing off" of water or gas intervals in all of the seven wells repaired by this method was successful at the time of recompletion.

Mechanical Difficulties: Numerous mechanical difficulties have developed in attempts to operate multi-zone wells. Some of the most prevalent of these are: (1) early cessation of flow from upper zones through the relatively large annular spacing between flow strings, (2) sanding up of upper zones, (3) collapse of casing caused by excessive sand production, (4) development of leaks between zones due to sand blasting, corrosion of flow strings or failure of packers and cement jobs, and (5) inability to lift adequate volumes of fluid when pumping through tubing set on a packer because of poor gas separation. The development of leaks between zones has permitted migration of fluid from one zone to another because of differential pressures developed by

selective production. This has often permitted water from a wet interval to flood the sands around the well in other perforated intervals. Several instances have been found in multi-zone wells which have left the Ranger shut in behind a packer. A leaky cement job behind blank casing opposite the packer has been the source of water flooding of Ranger sands. One multi-zone well was redrilled into the Ranger after abandonment in the Terminal, because of a Ranger "water block".

To date, there has been no uniform procedure for repair work when wells reach the end of the flowing stage. Many revert to combination production of the Upper and Lower Terminal Zones, leaving the Ranger packed off behind a flow string; others continue to pump the lowermost zone through a tubing packer, while in a few cases the wells have been converted to single zone producers in an upper perforated interval after plugging the lower zones because of high water cut.

(a) Reasons for Remedial Work: The chief reasons for remedial work were bad liners, bad casing, water encroachment, cessation of natural flow and leaky tubing. Frequently, liners and tubing failure occurred concurrently with increase in water production owing to corrosion. Continued sand trouble often was the cause of eventual liner collapse. Corrosion and the setting up of differential pressures across packer installations and flow strings was the major cause for leaks. A notable fact is that 32 of the 194 wells reviewed experienced packer or flow string leaks. There were nine failures in 127 Class I wells - or only 7.1%, as compared to 28 failures in 67 casing packer (Class II, III & IV) wells - or 41.9%. These failures often necessitated reentering the multi-zone wells to replace the failure or removing the packers and flow strings completely and recompleting as combination wells.

(b) Types of Remedial Work Done: Of the 102 remedial jobs done on the 249 multi-zone wells, 32 required costly redrilling principally because of collapsed liners or casing and excessive sand trouble. Over 87% of the redrill work was done on Class I tubing packer wells.

(c) Use of Artificial Lift in Multi-Zone Wells; All of the original 249 multi-zone wells were flowing completions. Of these, 104 are now pumping and none is producing on gas lift. Of the original completions, 30 wells have now been repaired as single zone producers and 37 are combination zone producers. Of the 104 original multi-zone wells that are now pumping, 47 wells still maintain zonal segregation by means of casing or tubing packers. However, none of these is equipped to produce two or more zones simultaneously through separate flow strings by artificial lift so that for all practical purposes they are producing as single or combination wells, using the multi-zone installation for the purpose of selective production. Of the 47 multi-zone pumping wells, 19 are now pumping below tubing packers (Class I), 27 are pumping below various combinations of tubing and casing packers (Class II, III & IV), and one Class V well is pumping. Consequently, at least 114 wells, or 45.9%, of the original multi-zone completions are operated at the present time so that they are effectively single or combination zone wells.

Operators have apparently unanimously decided against employment of installations permitting simultaneous production of separate intervals by artificial lift because of the numerous mechanical difficulties previously

cited; furthermore, in the case of the areas of more prolific Terminal Zone production well capacities from a single perforated interval are large. The fact that wells are never given oil allocation in more than one zone has also discouraged experimental work with multi-zone production by artificial lift.

SUMMARY AND CONCLUSIONS

Use of multi-zone completions has been useful in providing for development of several zones where limited surface locations are available and has afforded means of controlling gas/oil ratios, water production, oil gravity and pool production rates by selective production. In some wells repair work has been facilitated by the presence of cemented blank sections. In competitive areas operators have been able to gain advantages through selective production in this type of completion.

However, under conditions obtaining in the Wilmington Field it has been the general practice to revert to single or combination zone production at the end of the flowing life principally because of the many mechanical difficulties encountered which act as serious obstacles to multi-zone production by artificial lift. Leaks developing between zones, and production of wells as combination wells has led to non-uniform and undesirable combinations of zones in many of the wells under conditions which may eventually reduce oil recovery efficiency.

Considering the conditions that exist in the field, and assuming that it is desirable to develop and produce all zones simultaneously, it is concluded that development could have been more economically effected and the various zones more efficiently produced if uniform development had been accomplished by single wells to each zone (or in some areas to a combination of two zones) throughout each fault block. Wells drilled on this basis could be equipped with cemented blank sections if it were anticipated that selective production of a zonal subdivision might eventually become necessary. As far as obtaining the maximum economic recovery from the field is concerned, the competitive advantages gained by most of the operators who have completed multi-zone wells have not contributed to over-all recovery efficiency and greater recovery might have resulted from single zone development using cemented blank sections where necessary to control production. It is emphasized that conclusions in regard to Wilmington are in no way intended to reflect on decisions to use multi-zone completions in other fields where mechanical problems are less serious, drilling more expensive, and recovery from individual zones relatively low.

ACKNOWLEDGMENTS

The authors extend their appreciation to the operators in the Wilmington Field for providing the data used in this report.

REFERENCES

1. Dean, C. J.; "Drilling and Production Problems in the Wilmington Field" - Drilling and Production Practice, A.P.I., 1938.

2. Winterburn, Read; "Effect of Faulting on Accumulation and Drainage of Oil and Gas in the Wilmington Oil Field" - American Institute of Mining Engineers, T. P. 1154, February 1940.

3. Corey, Robert F.; "A Review of Multi[illegible]ne-Zone Production in California" - Proceedings 22nd Ann[illegible]al Meeting, A.P.I. November 1941.

4. Bennett, E. O.; "Multizone Completions" - Drilling and Production Practice, A.P.I., 1942.

5. Alcorn, I. W. and Alexander, W. A.; "A Review of Multizone-Zone Well Completions" - Drilling and Production Practice, A.P.I., 1942.

TABLE I

ANALYSIS OF MULTI-ZONE WELL COMPLETIONS IN THE RANGER & TERMINAL ZONES, WILMINGTON FIELD

AS OF SEPT. 1944

		CLASS OF COMPLETION - SEE FIGURES 2A & 2B					
		I	II	III	IV	V	TOTAL ALL CLASSES
I	ORIGINALLY COMPLETED MULTI-ZONE WELLS (1)	171	35 (3)	26 (3)	15 (3)	2	249 (2)
II	PRESENT METHOD OF PRODUCTION						
	1. Pumping	66	16	13	7	2	104
	2. Flowing	105	19	13	8	0	145
III	PRODUCING ZONES ALTERNATED TO OBTAIN OPTIMUM PRODUCTION						
	1. Wells reviewed	125	26	24	13	2	190
	2. Wells changed over from one zone to another	28	14	1	2	1	46
	3. Wells never changed	97	12	23	11	1	144
IV	EFFECTIVENESS OF SEPARATION						
	1. Wells reviewed	127	30	24	13	0	194
	2. Wells known to have had leaks in packers or flow strings	9	8	10	5	0	32
V	WELLS IN WHICH REMEDIAL WORK HAS BEEN DONE	72	11	5	7	1	96
VI	AVERAGE PRODUCING TIME OF REPAIRED WELLS FROM ORIGINAL COMPLETION TO FIRST REMEDIAL WORK, YEARS	3.2	4.3	2.8	4.0	1.2	3.2
VII	NUMBER OF REMEDIAL JOBS DONE ON ORIGINAL MULTI-ZONE WELLS	77	12	5	7	1	102
	1. Types of recompletions						
	a. Multi-zone	23	2	1	5	0	31
	b. Ranger zone only	11	2	2	0	1	16
	c. Terminal zone only	10	2	2	0	0	14
	d. Combination of more than one zone	32	4	0	1	0	37
	e. Unclassified	1	2	0	1	0	4
	2. Reasons for remedial work						
	a. Bad liner or casing	23	1	1	1	0	26
	b. Water encroachment	16	8	2	2	1	28
	c. Well stopped flowing	17	1	2	0	0	20
	d. Tubing went bad	5	0	0	1	0	6
	e. Sand trouble	7	0	0	0	0	7
	f. High gas-oil ratio	7	0	0	0	0	7
	g. Miscellaneous	3	2	0	3	0	8
	3. Types of remedial work done						
	a. Redrilled	28	0	1	2	1	32
	b. Packer pulled	20	1	0	3	0	24
	c. Plug	9	3	3	1	0	16
	d. Scab off water or gas	5	2	0	0	0	7
	e. Plug and perforate tubing above tubing packer	6	4	1	0	0	11
	f. Repair hole in tubing string with tubing patch	3	2	0	1	0	6
	g. Redrill and redeepen to another zone	2	0	0	0	0	2
	h. Miscellaneous	4	0	0	0	0	4

(1) In Ranger and Terminal zones only, which represent approximately 90% of the multi-zone completions in the field. A small number of multi-zone Tar-Ranger wells are not included in this review.

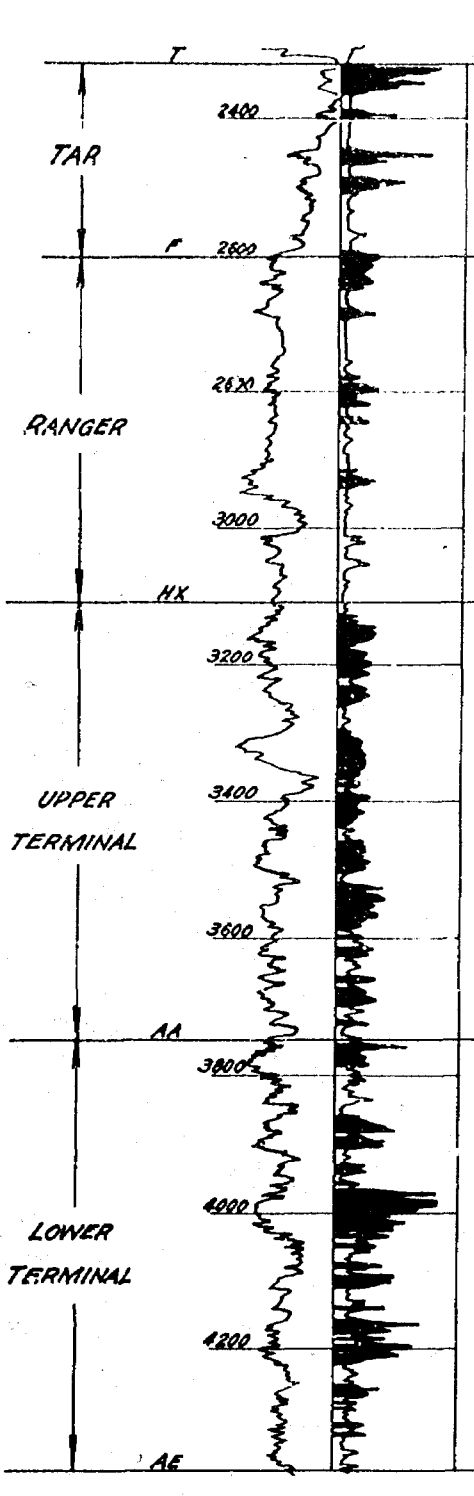
(2) Represents 19.3% of the producing wells in the field.

(3) Of the 76 class II, III and IV wells, 47 were equipped to produce separately from 3 zones.

FIGURE 1

THE PRODUCING ZONES IN MOST MULTI-ZONE WELLS

WILMINGTON FIELD



ELECTRIC LOG	ZONE THICKNESS (FT.)	PERCENT SAND (%)	OIL GRAVITY (°A-P-I)
T to F — TAR	250-400	40	12-15
F to HX — RANGER	400-600	15-30	12-15
HX to AA — UPPER TERMINAL	400-600	50-70	14-25
AA to AE — LOWER TERMINAL	700	50-70	26-31

FIGURE 2A

CLASSIFICATION OF MULTI-ZONE WELLS, WILMINGTON FIELD

CLASS I WELLS

Tubing Packers Only

CLASS II WELLS

Tubing Packer Set on Collar With or Without Casing Packer

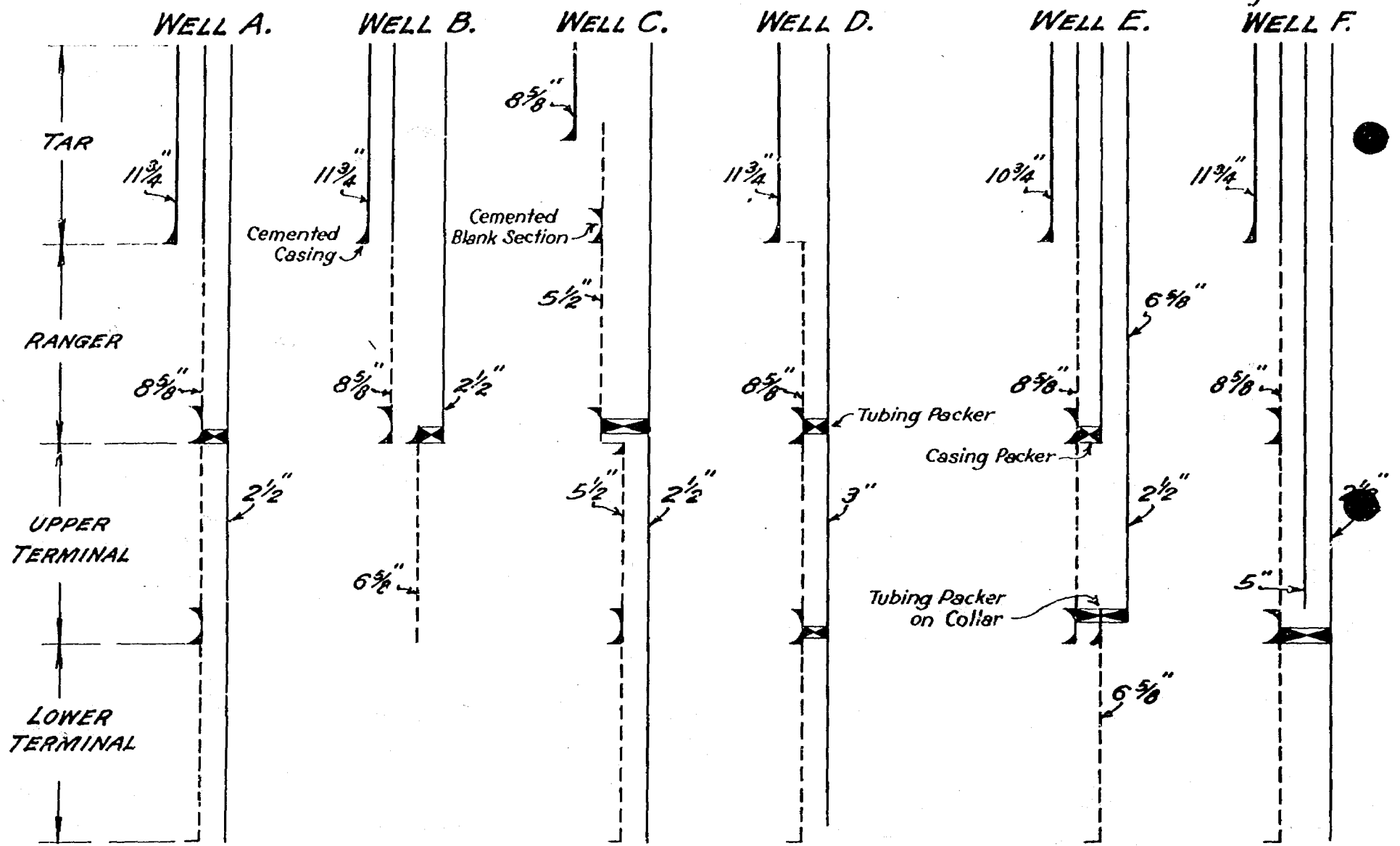
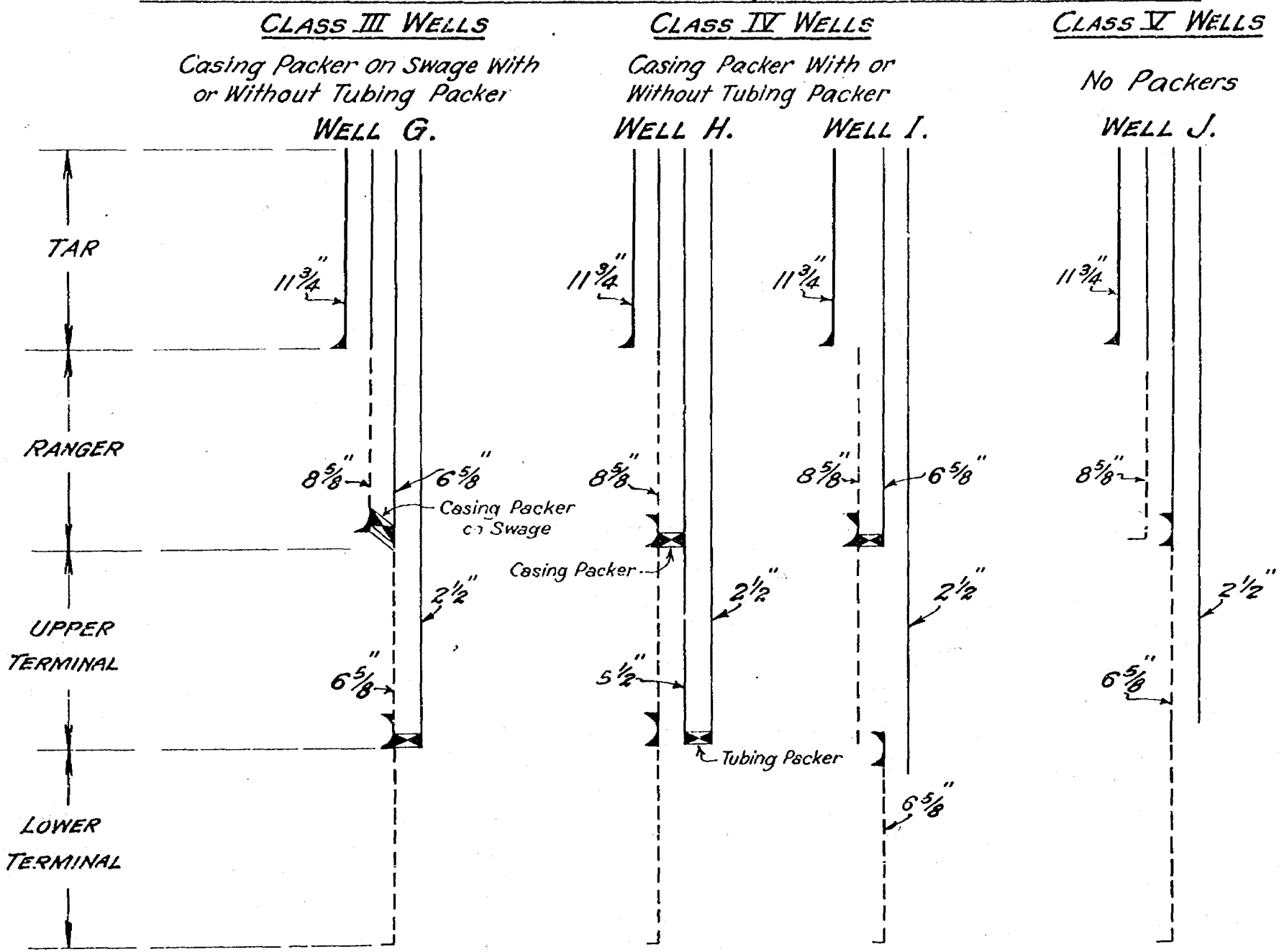


FIGURE 2B

CLASSIFICATION OF MULTI-ZONE WELLS, WILMINGTON FIELD - Cont.



Mechanics and economics of dual completions

By **HUBERT C. LAIRD**

Otis Pressure Control, Inc.*

FROM the mechanical standpoint, dual completion of a well is largely an outgrowth of the practice of controlling ratios by blocking off a part of the gas-bearing portion situated above oil-bearing portion of a producing formation. Correctly placing the packer to admit the desired amount of gas into the tubing was often very difficult. The packer had to be reset several times in many instances before the desired results were obtained.

EXCLUSIVE

This difficulty led to the development of equipment that made it possible to admit the gas into the tubing at the desired rate from the annulus above a packer that was set near the gas-oil contact or opposite a break between the oil-gas sections of the pay. This type of completion was practiced in the Jefferson field in the latter part of 1935 or early in 1936, followed by its application in Rodessa and Hobbs. This type of completion received some publicity in September, 1936.†

With equipment available for the type of completion just described, it was a simple matter to set a packer between two separate formations and utilize the gas from an upper zone to produce oil from a lower zone. At the same time gas could be produced at the surface from the casing. Some of the earlier dual completions were of this type, that is, upper gas and lower oil.

● **Dual completions in California.** Due to the fact that many of the fields in California have from five to seven productive formations, California operators were among the first to dually complete. In 1939 approximately 100 wells were dually completed in the Montebello field alone. It is estimated that to date there have been more than 300 wells dually completed in California, including wells in the Long Beach Harbor, Paloma, Kettleman Hills, Coalinga, Riverdale, and other fields. These dual completions do not include wells in which more than one formation is produced from the well bore without maintaining separation.

Inasmuch as there is no state regulatory body in California having jurisdiction over the drilling and producing of oil and gas wells, some operators in that state produce a number of formations through a single bore without any attempt to separate one pay from another. Other operators in California, however, have recognized that it is to their advantage in some instances to maintain separation between the productive formations and have utilized the practice of dually completing. Due to sand conditions, however, some operators feel that dual completions are not desirable, because of difficulties encountered in pulling packers when large quantities of sand settle out in the annulus above them.

● **Dual completions in the Mid-Continent.** For the last five years operators in the Mid-Continent and Gulf Coast areas have practiced dually completing oil and gas wells. Deeper drilling and the penetration of more than one economically productive pay with one well bore has induced many operators to dually complete. Critical shortages of steel and manpower coupled with urgent needs for oil during the war led to a much quicker adoption of the practice than could have been expected during normal times.

The State of Texas, because of its leading position in oil production, has the greatest number of such applications. Data from this State indicate how extensively and in which fields this type of completion has been used.

Table 1 presents a summary of such information showing the chronological progress of dually completing oil and gas wells in Texas. Table 2 shows the dual completions granted in the major fields, and Table 3 is a tabulation of the dual completions granted in all fields in Texas.

Table 4 shows that 63,098 oil and gas wells were completed in Texas, Louisiana, and Oklahoma since 1940 and that 1123 of these, or 1.78 per cent, were dual completions. Although most of the dual completions were in Texas, a slightly larger percentage of Louisiana's new wells were dually completed.

Louisiana had 153 dually completed wells. Most of these wells are of the dual oil type and are found in the Neale Hackberry, Pine Prairie, Lisbon, White Lake, and other fields. In Oklahoma approximately 50 wells have been dually completed. These are located in the Cement, Chickasha, New Garber, Pauls Valley, and West Moore fields.

The tables do not reflect the number of wells that have changed status due to the abandonment of one or more pays, as this data was not readily available. Due to the newness of production represented by dual wells, however, it is believed that the figures are fairly repre-

*Temple P. Hoffer, petroleum engineer, Otis Pressure Control, Inc., assisted in the preparation of this article.

†"Progress in Bottom Hole Choking," by H. C. Otis, *The Petroleum Engineer*, September, 1936.

TABLE 1

Chronological progress of dually completing oil and gas wells in Texas.

Period	Number of dual completion permits granted by the Texas Railroad Commission			
	Dual oil	Dual gas	*Combination oil and gas	Total
Year 1940	...	1	24	25
Year 1941	...	29	17	46
Year 1942	...	36	34	70
Year 1943	110	17	18	145
Year 1944	238	29	36	303
Year 1945	159	77	28	264
January 1 to April 15, 1946	41	10	16	67
Grand totals	548	199	173	920

*Indicates upper gas and lower oil, or vice versa, dual wells.

Notes: (1) In preparing the above table, gas-condensate pays were classed as gas pays.
(2) The above table includes only wells in which both pays are productive. Some 15 dual wells in which one or both pays are used for gas injection purposes are not listed.

TABLE 2

Summary of dually completed oil and gas wells in Texas.

Field	County	Number of permits granted by the Texas Railroad Commission through April 15, 1946			
		Dual oil	Dual gas	*Combination oil and gas	Total
Seeligson	Jim Wells	144	..	6	150
Stratton	Nueces	39	31	5	75
Agua Dulce	Nueces	20	35	11	66
Wimberly	Jones	60	..	..	60
Stowell	Jefferson	46	2	2	50
Carthage	Panola	3	42	3	48
New Hope	Franklin	33	..	..	33
Reddin	Jones	25	..	..	25
Garcia	Starr	20	..	..	20
West Ranch	Jackson	15	..	3	18
Old Ocean	Matagorda	17	..	..	17
Placedo	Victoria	13	..	1	14
Mayo	Jackson	11	..	2	13
Sheridan	Colorado	..	12	..	12
East White Point	San Patricio	11	..	..	11
LaRosa	Refugio	..	1	9	10
121 other fields		91	76	131	298
Grand totals		548	199	173	920

*Indicates upper gas and lower oil, or vice versa, type completions.

Notes: (1) Gas-condensate pays are classed gas pays.
(2) Only dual wells with both pays productive are listed.

sentative of the number of dual wells now producing in these three states.

● **Dual completion presents problems.** The dual type well presents problems during completion and production that are not encountered with single formation wells. Drilling, running casing, and cementing dual wells present no problems other than those encountered in drilling deep single pay wells. The well becomes a dual type after the casing has been perforated opposite the two pays selected. Common completion practice is to control hydrostatically the pays while running the tubing and tubing-casing type packer.

Many makes and several types of packers are used in dual wells. In many cases packers used in dual wells are the same casing-tubing packers used in single zone wells to seal the casing-tubing annulus from the pay section.

● **Duals require sub-surface equipment.** In completing and producing a dual type well, however, it is necessary that equipment be used that will permit placing the tubing in communication with the casing-tubing annulus at will. This communication is required to relieve the upper pay of hydrostatic heads after the tubing has been run and the packer set.

The upper pay is ordinarily brought in by circulating or swabbing the tubing. Also, this communication is required, if it is desired to subject the upper pay to hydrostatic heads and control after the pay is brought in.

Several makes of packers are designed to permit placing the tubing and tubing-casing annulus in communication by moving the tubing to open either circulation holes or valves. These packers generally perform satisfactorily so long as the tubing and component parts of the packer remain free to move and no foreign matter lodges in the seat to prevent re-closing.

● **Dual packers have to withstand pressure differentials.** Another service requirement of packers used in dual wells is to withstand variable pressure differentials between the two pay zones. Frequently the pays produce with much different pressures opposite the formations and thereby subject the packer to very low or very high differential pressures. It follows that the sealing elements of the packer should be designed to withstand these pressure differentials, however small or great, from either direction.

Further, the design of the packer should be such that there will be no movement of the packer up or down the hole because of pressure differentials. Some packers utilize much of the weight of the tubing to hold them in place. This tends to crook the tubing in the casing, and in some wells has made the installation and removal of production equipment within the tubing difficult.

Fig. 1 shows a packer that was specially designed to meet problems encountered in dually completed wells. A pressure differential from either above or below this packer tends to lock it more securely in the casing. Pressure applied from above the packer will transmit a

TABLE 3

Locale and extent of dually completed oil and gas wells in Texas.

Field	County	Number of permits granted by the Texas Railroad Commission through April 15, 1946			
		Dual oil	Dual gas	*Combination oil and gas	Total
Abell	Pecos	1	..	..	1
Agua Dulce	Nueces	20	35	11	66
Alice	Jim Wells	..	3	..	3
Angleton	Brazoria	..	3	..	3
Bedford	Andrews	1	..	..	1
Benavides	Duval	1	1	..	2
Bethany	Panola	..	3	..	3
Blanconia	Bee	..	..	5	5
Blucher	Jim Wells	2	1	..	3
Blue Lake	Brazoria	..	..	1	1
Bolt	Kimble	..	..	1	1
Bonnie View	Refugio	..	..	1	1
Braytoo	Nueces	..	..	1	1
Burnell	Karnes	..	..	1	1
Calena	Duval	3	..	..	3
Cameron	Starr	..	..	1	1
Carthage	Panola	3	42	3	48
Cayuga	Anderson	..	1	7	8
Chapel Hill	Smith	..	2	7	9
Chesterville	Colorado	..	1	..	1
Cold Springs	San Jacinto	..	..	2	2
Coletta Creek	Victoria	..	..	1	1
Columbus	Colorado	..	..	1	1
Conroe	Montgomery	2	..	..	2
Daboval	Wharton	..	..	1	1
Dickinson	Galveston	1	2	..	3
Dyersdale	Harris	..	..	1	1
East Longhorn	Duval	1	..	..	1
East White Point	San Patricio	11	..	..	11
Edna	Jackson	..	1	..	1
El Campo	Wharton	..	..	2	2
Embar	Andrews	1	..	..	1
Emperor	Winkler	..	..	2	2
Estes	Ward	..	..	1	1
Fig Ridge	Chambers	3	..	..	3
Fitzsimmons	Duval	..	..	1	1
Fort Stockton	Pecos	..	..	1	1
Francitas	Jackson	..	5	..	5
Gandy	Nueces	..	..	1	1
Garcia	Starr	20	..	..	20
Goebel	Live Oak	..	..	1	1
Green Branch	McMullin	..	..	1	1
Greta	Refugio	..	..	2	2
Hamman	Matagorda	..	..	1	1
Hardin	Liberty	..	1	1	2
Harmon	Jackson	..	..	1	1
Hendricks	Winkler	..	..	1	1
Hildreth	Montague	1	..	..	1
Hull	Liberty	1	..	..	1
Humble	Harris	1	..	..	1
Humble Light	Harris	..	..	1	1
Jim Neal	Coleman	..	..	1	1
Joyce Richardson	Harris	1	..	3	4
Katy	Waller	..	4	..	4
Kelsey	Brooks	3	..	..	3
Kermit	Winkler	..	..	1	1
Keystone	Winkler	..	..	1	1
LaBelle	Jefferson	..	..	1	1
LaGloria	Jim Wells	..	15	..	15
Lake Creek	Montgomery	..	7	1	8
LaRosa	Refugio	..	1	9	10
League City	Galveston	8	..	1	9
Livingston	Polk	2	..	..	2
Lolita	Jackson	1	..	4	5
Long Lake	Anderson	..	..	20	20
Lovell Lake	Jefferson	..	..	1	1
Magnolia City	Jim Wells	1	..	..	1
Maniposa	Brooks	..	..	1	1
Maseho	Andrews	..	..	1	1
Maurbro	Jackson	..	..	1	1
Mayo	Jackson	11	..	2	13
McFaddin	Victoria	..	2	1	3
Minnie Bock	Nueces	..	..	2	2
Murray	Young	1	..	..	1
R. Musques Survey	Jackson	..	..	1	1
Needville	Fort Bend	5	..	2	7
New Hope	Franklin	33	..	..	33
New Refugio	Refugio	..	..	1	1
New Ulm Area	Colorado	..	1	..	1
North Houston	Harris	..	3	..	3
North Magnolia	Jim Wells	6	..	2	8
Odem	San Patricio	2	..	..	2
Old Ocean	Matagorda	17	..	..	17
Old Refugio	Refugio	..	..	1	1
Opelika	Henderson	..	1	1	2
Piedras Pintas	Duval	1	..	..	1
Pinehurst	Montgomery	1	1	..	2
Placedo	Victoria	13	..	1	14
Plymouth	San Patricio	..	..	1	1
Quinto Creek	Jim Wells	..	..	1	1
Reddin	Jones	25	..	..	25
Rodessa	Jefferson	1	..	..	1
Rooke	Refugio	2	..	..	2
Runge	Karnes	1	..	..	1
San Caja	McMullen	..	1	..	1
Sand Hills	Crane	4	..	..	4
San Salvador	Hidalgo	..	5	..	5
Saroo Creek	Goliad	..	1	..	1
Satsuma	Harris	..	..	6	6
Saxet	Nueces	1	..	2	3

*Indicates upper gas and lower oil, or vice versa, type completions.

Notes: (1) Gas-condensate pays are classed gas pays.
(2) Only dual wells with both pays productive are listed.

TABLE 3 (Continued)—Locale and extent of dually completed oil and gas wells in Texas.

Field	County	Number of permits granted by the Texas Railroad Commission through April 15, 1946			
		Dual oil	Dual gas	*Combination oil and gas	Total
Sayles	Jones	1			1
Scott & Hopper	Brooks			1	1
Seeligson	Jim Wells	144		6	150
Sejita	Duval			3	3
Sheridan	Colorado		12		12
Silsbee	Hardin			1	1
South Caesar	Bee	2		1	3
South Esperson Dome	Liberty			1	1
Stowell	Jefferson	46	2	2	50
Stratton	Nueces	39	31	5	75
Sweden	Duval	1			1
Taft	San Patricio			1	1
Thomas Lockhart	Duval		1	1	2
Tijerina	Jim Wells	3			3
Von Blucher	Jim Wells		1		1
Wade City	Jim Wells		1	4	5
Ward	Ward			1	1
Washburn	LaSalle	4		3	7
Waskom	Harrison		1	1	2
Wasson	Gaines	4			4
Weiner	Winkler			1	1
West Beaumont	Jefferson		2	2	4
West Columbia	Brazoria	5			5
Westhoff	Jackson		1		1
West Port Neches	Orange			1	1
West Ranch	Jackson	15		3	18
Wheeler	Winkler	7			7
White & Baker	Pecos			1	1
White Creek	Live Oak			1	1
Willamar	Willacy	1		1	2
Williams	Coleman	2			2
Wilson	Jim Wells		1		1
Wimberly	Jones	60			60
Winnsboro	Wood	1			1
Woodsboro	Refugio		1		1
Unnamed field	Archer		1		1
Unnamed field	Hidalgo		1		1
Grand totals		549	199	173	920

*Indicates upper gas and lower oil, or vice versa, type completions.

Notes: (1) Gas-condensate pays are classed gas pays.
(2) Only dual wells with both pays productive are listed.

force from the upper packer element through the body of the packer to the slip mandrel, thence to the slips, and finally into the walls of the casing. Pressure from below will exert a downward force on the slip mandrel, because of the difference in areas of sections represented by the diameters of the polished collar and the outside of the main mandrel. This pressure locking feature permits the secure installation of the packer in the casing without applying any force from the tubing. If an operator wishes to support part of the weight of the tubing string on the packer, however, the packer is designed to stand it. In practice, the tubing is landed so that the polished collar is resting the desired amount on the slip mandrel.

The opposed-cup type packing elements are very effective in sealing against high and low pressure differentials. This packer also possesses a feature not found in all packers; that is, the only operation necessary to pull the packer is to pull up the tubing. Rotation of the tubing or feeling for J-slots is not necessary. This packer like some others is constructed with a by-pass for running, pulling, and, in the case of two-zone wells, washing in the well.

● **Removable subsurface equipment used in dual wells.** The necessity of placing the tubing in communication with the casing-tubing annulus during dual well completion operations has been stated. In order to open the annulus to the tubing by means of packers it is necessary to move the tubing. In production operations this is both time consuming and costly once the tubing has been landed and surface connections made. Efficient production of two-zone wells requires that equipment be used that will readily and positively open and close the tubing to the annulus. Removable subsurface equipment is being used to meet both completion and production problems.

Fig. 2 represents a bottom-hole choke that is installed and removed on a wire line. The side door choke assembly consists essentially of three parts; namely, the landing nipple, the side door choke, and the check valve. The landing nipple has four ports in the wall and is made up in the tubing string at the time the tubing is run. Whereas, the side door choke and check valve are run and pulled under pressure on an ordinary steel measuring line. The choke proper consists of a pack-off section and a locking device.

The packing is arranged so that flow around the pack-off section is prevented regardless of whether the greater pressure is from the upper or lower zone. The purpose of the check valve is to prevent flow from the upper zone, through the landing nipple, and into the lower zone. This equipment is ordinarily installed immediately above the packer in a two-zone well and has provided an effective means for operators of dual wells to perform the following completion and production operations.

1. Acidize either zone independently of the other.
2. Take pressures of each zone independently of the other, even though the upper zone possesses a higher formation pressure.
3. Kill the well by circulating through the side ports.
4. Circulate above and wash loose sticky packers that have to be pulled.

Fig. 3 shows an application of side door chokes to independently acidize zones in duel gas wells in the Carthage, Texas, gas field*. This application is considered unique, because the side door choke in conjunction with a second packer enabled the selective acidizing of certain sections of the lower pay zone.

● **Landing nipple used in testing packer setting.** Fig. 4 represents a type of landing nipple that is being used with the type of side door choke shown in Fig. 2. This nipple is equipped with a lead washer and washer support that will withstand excessive pressure differentials provided the higher pressure is applied on the annulus side of the nipple. If the higher pressure is applied inside the tubing, however, a very small differential will shear the lead washer and connect the tubing and annulus. Once the washer is sheared the nipple and choke function in the same relation as that shown in Fig. 2.

The main purpose of this tool is to expedite testing the packer for leakage. The packer is set and pressure applied immediately in the annulus. If the packer is not leaking, then pressure is applied inside the tubing and the side ports in the landing nipple opened for subsequent completion and production operations. The above procedure enables the operator to test the packer prior to bringing in the upper pay. If the packer is not sealing, the operator does not have to kill the well again to remove, re-run or re-set the packer.

● **Zones switched without removing choke.** Another type of side door choke that is being used successfully in certain areas permits switching either upper or lower pay into the tubing without removing the choke from the well. The assembly consists essentially of a landing nipple that is made up as a part of the tubing string, the side door choke, and a removable plug. The nipple contains two sets of side ports rather than the

*"Selective Acidizing Increases Well Capacity" by Paul L. Shelton and J. M. Clark, *The Petroleum Engineer*, May, 1946, Pg. 236.

TABLE 4—Number of oil and gas wells completed in three states by years.

Year	Texas	Louisiana	Oklahoma	Total
1940	9,775	1,704	1,747	13,226
1941	9,827	1,664	2,110	13,601
1942	4,688	872	1,158	6,726
1943	4,421	673	1,184	6,278
1944	5,696	786	1,791	8,273
1945	7,650	1,167	2,445	11,262
1946 (to May)	2,558	411	763	3,732
Totals	44,615	7,284	11,199	63,098
Dual completions	920*	153	50	1,123
Percentage of total	2.06	2.10	0.45	1.78

*The 920 dual completions in Texas were made in 137 fields by 159 operators.

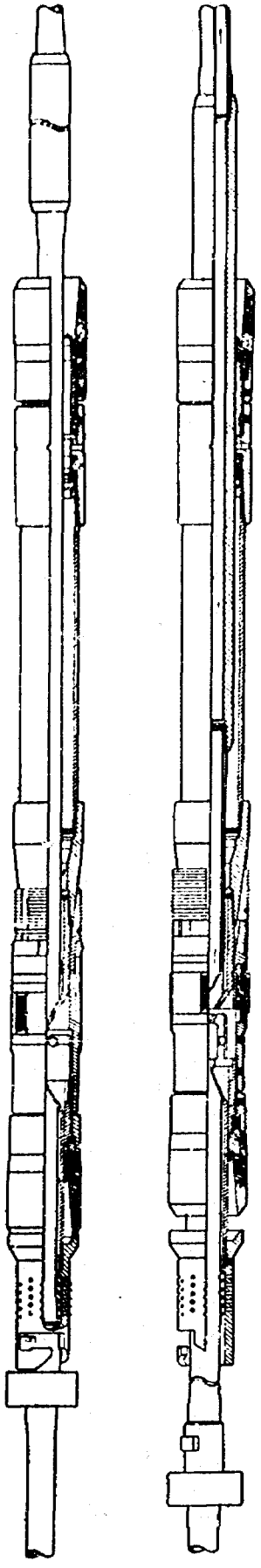


FIG. 1

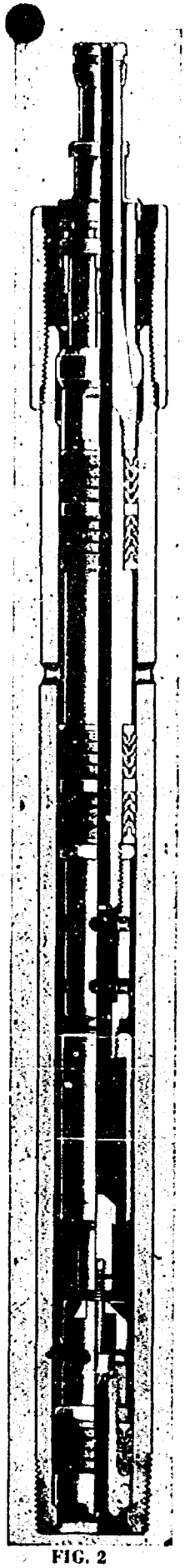


FIG. 2

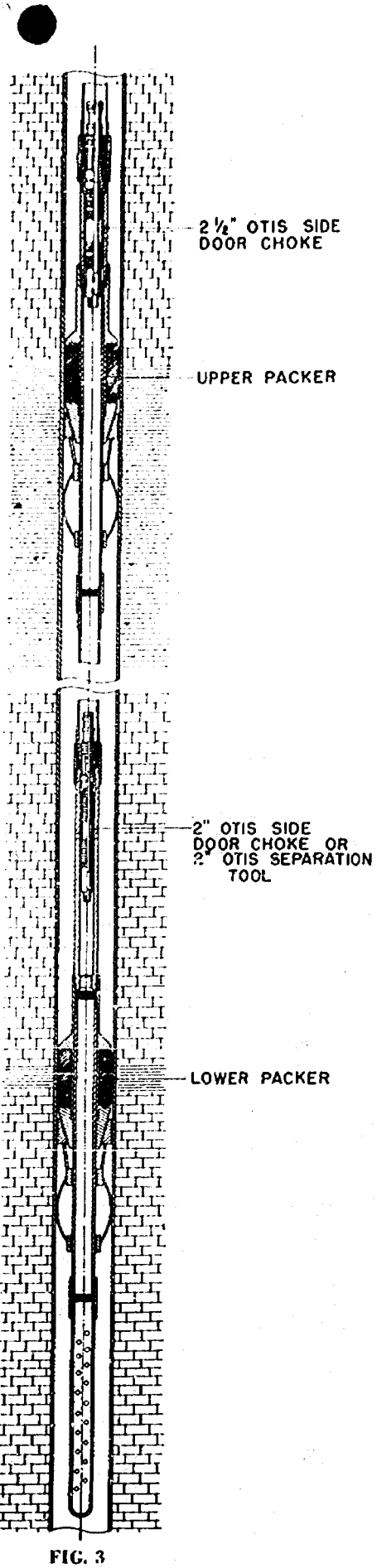


FIG. 3

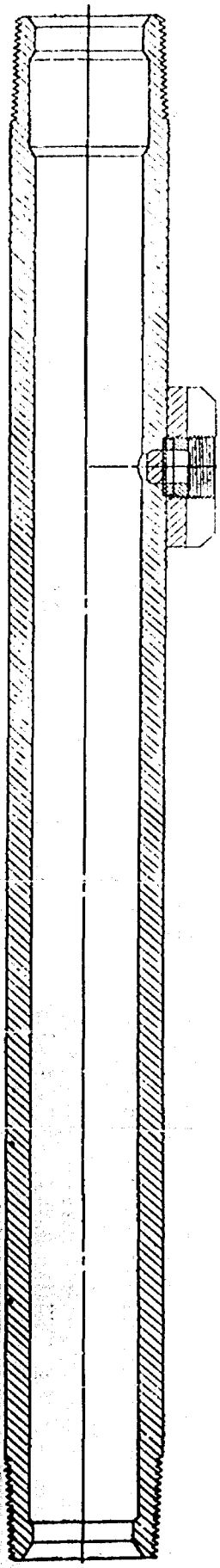


FIG. 4

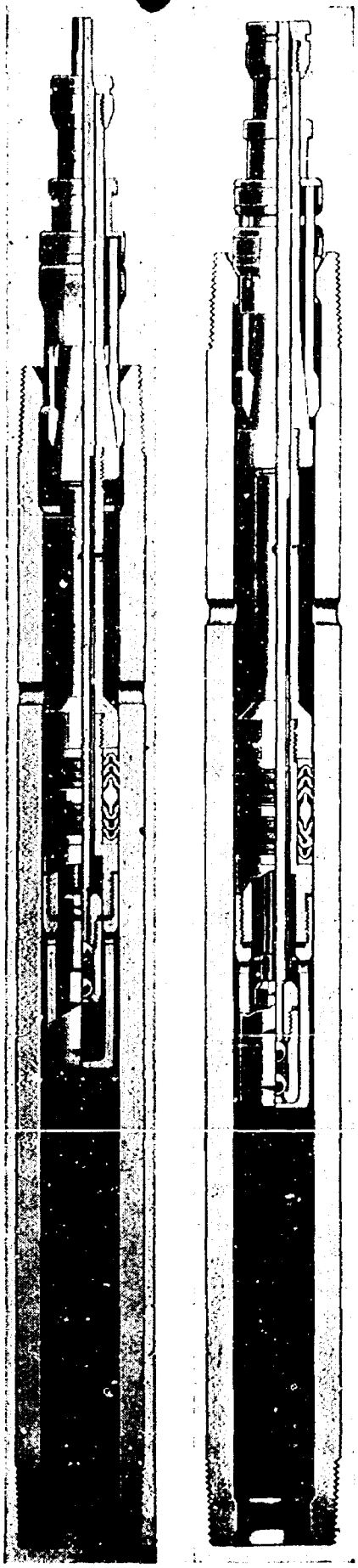


FIG. 5

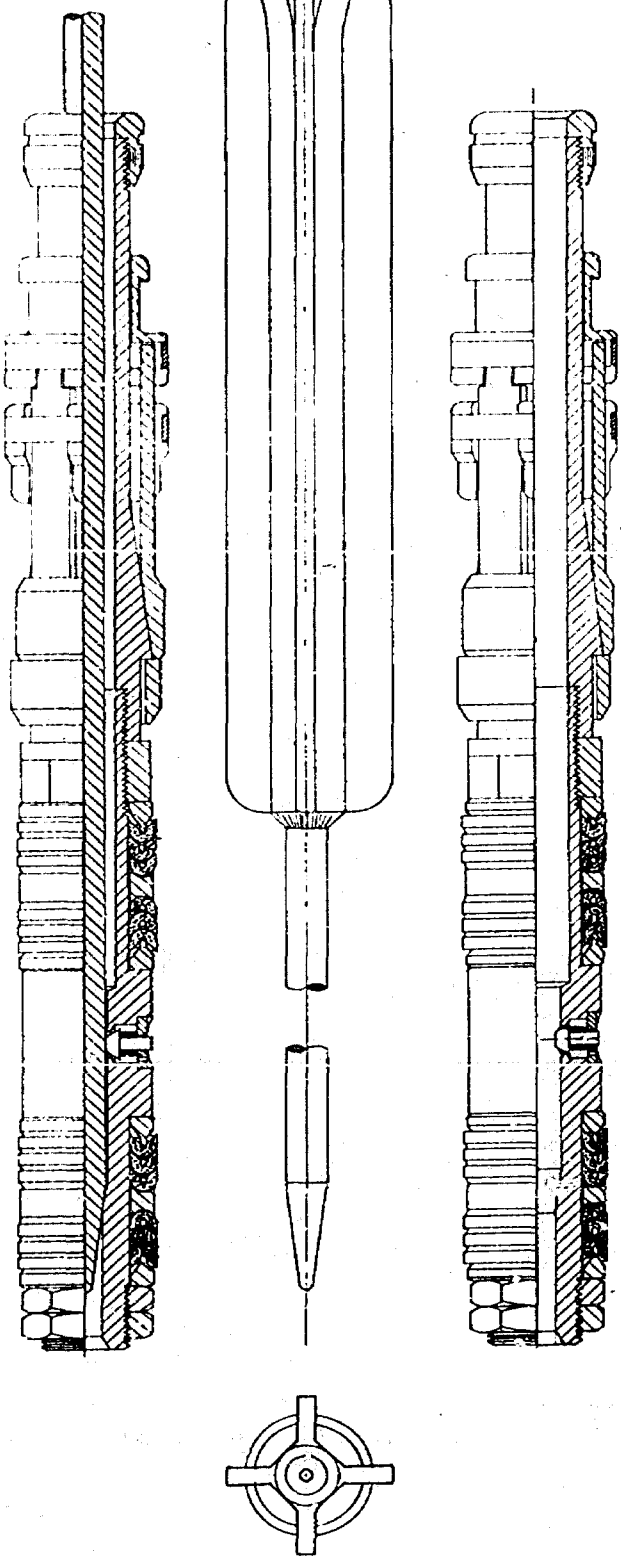


FIG. 6

one set shown in Fig. 2, the lower set of ports being enclosed by an enlarged section of tubing that connects these ports into the tubing rather than the annulus. The removable plug is locked into an extension of the landing nipple, which extends into the enlarged section of tubing beneath the lower set of side ports. The choke is run and pulled and landed in the nipple under pressure on a steel measuring line.

The side door choke is made up of a locking mechanism that will permit the choke to move within the nipple and a packoff section on which are mounted eight sets of vee-type packing. When the choke is in its uppermost position within the nipple opposed sets of packing completely block off the upper set of side ports and the lower set of side ports are left open. When the choke is moved to its lowest position in the nipple the lower set of side ports is blocked off by the vee packing leaving the upper pay connected into the tubing through the upper set of side ports.

By means of small tools run under pressure on a steel measuring line the choke may be driven to its lower position or raised to its upper position in the nipple in order to connect either the upper or lower pay into the tubing as is desired. This choke makes it possible to perform the following operations without removing the choke from the nipple and connecting the two pays.

(1) Take bottom-hole pressures or flow potentials of each zone independently of the other.

(2) Establish circulation to kill the well or wash out above a packer.

(3) Swab in either pay through the tubing.

The purpose of the removable plug, which is located in the nipple below the lower ports, is to provide a means for opening the lower end of the nipple in the event the annular space surrounding the lower ports should become blocked with sand or trash.

● **Separation tool used for testing upper pay.** Fig. 5 illustrates a tool that is frequently used in the type landing nipple shown in Fig. 2. This equipment is known as a separation tool and is used to test the upper pay of dual wells for pressure, potentials, kind of fluids, etc. The assembly consists essentially of two parts; namely, the landing nipple and the separation tool proper. The nipple has side ports and is run in the tubing string. The separation tool consists of a locking device, a mandrel on which is mounted opposite sets of vee-type packing, a prong, and a valve and shear washer component.

One view in Fig. 5 shows the tool in the "up" position with the lower pay closed off. The upper pay is opened into the tubing. When testing of the upper pay is completed, the prong and tool are driven with wire line tools to the position shown in the second view. In so doing a metallic washer is sheared, permitting the pressure of the two pays to equalize across the tool. The tool is then ready to be removed by means of small tools run and operated on an ordinary

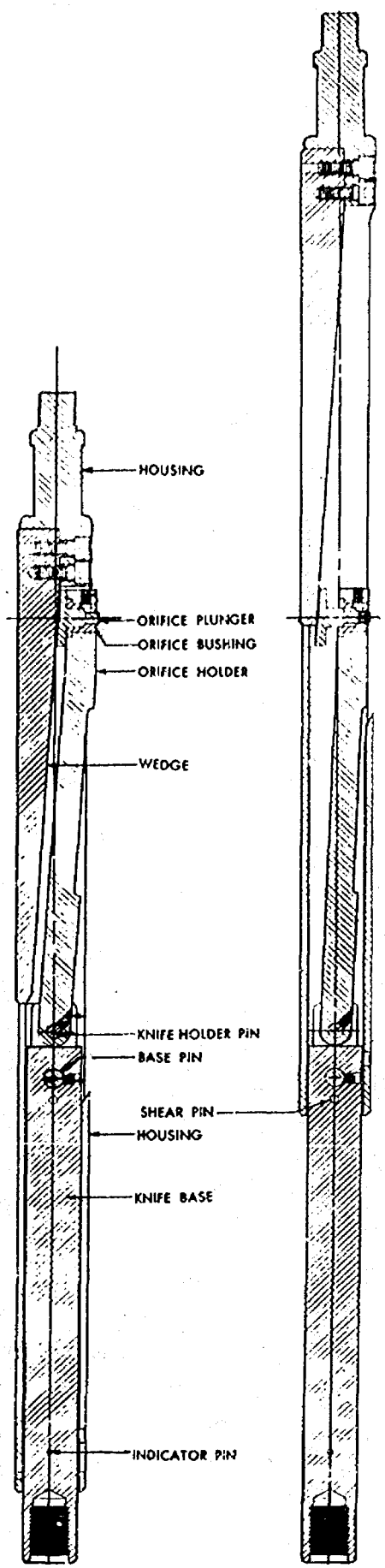


FIG. 7

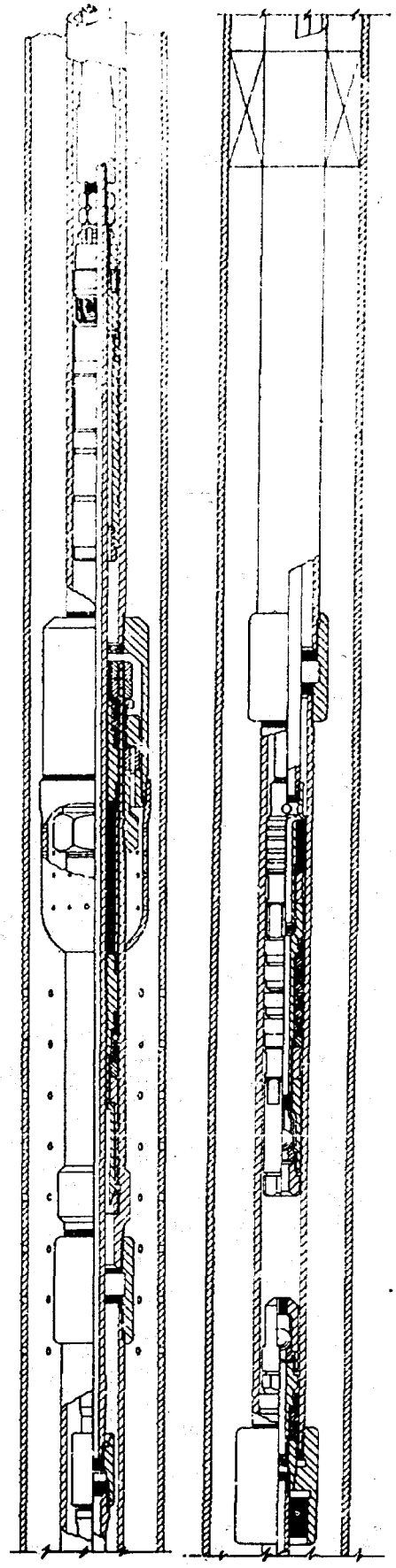
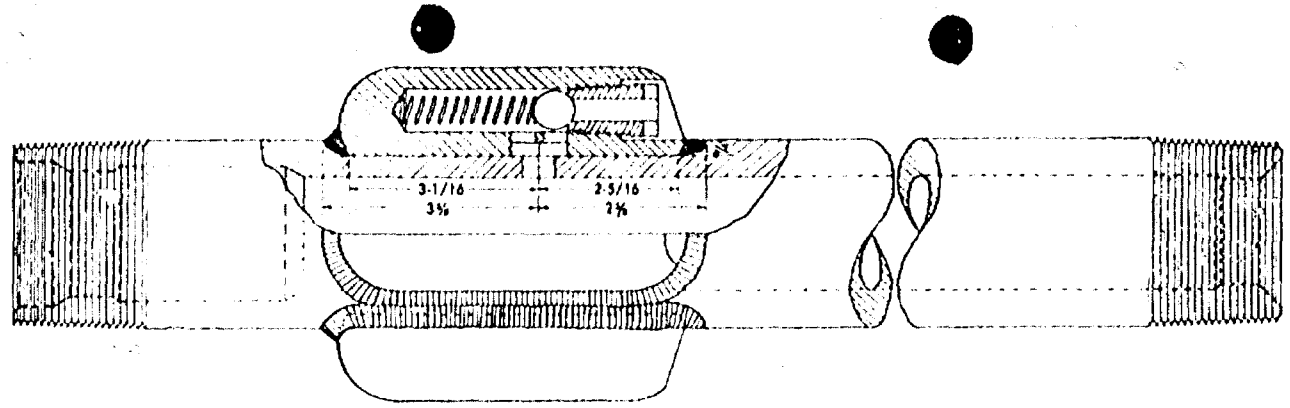


FIG. 8



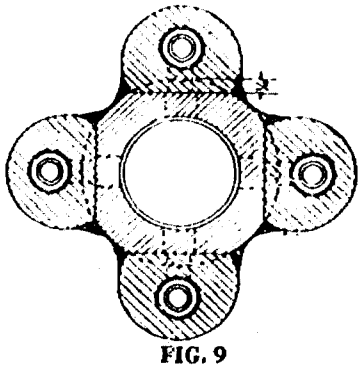


FIG. 9

steel measuring line. After removal of the tool, a side door choke of the type shown in Fig. 2 is placed in the well and separate production of the two pays resumed.

Shown in Fig. 6 is another type side door choke that is used to take pressure of the upper pay, without pulling the choke, when its pressure is greater than that of the lower pay. The right view shows the choke as it would normally be used in a dually completed well. In the picture can be seen a valve installed in the mandrel of the choke, and near the bottom of the mandrel can be seen a valve seat. To take the pressure of the upper pay, the prong tool is run on a wire line into the choke as shown in the left view. The guided prong functions to open the mandrel valve into the tubing and also close off the lower pay by seating in the bottom of the mandrel. This equipment is effective in some wells that produce sand with the oil.

● **Wire line tubing perforator used.** Some wells were not equipped at the time the tubing was run so that communication between the tubing and tubing-casing annulus could be established by removing or shifting equipment in the well. In removing the tubing and packer from the hole for work-over purposes it is very often necessary that the well be killed before unseating the packer. Fig. 7 shows equipment that has helped operators solve this problem.

This wire line tubing perforator is a mechanically-operated tool that is run on an ordinary steel measuring line into the tubing of a well, under pressure, to drive ½-in. diam. holes through the wall of the tubing. The perforator consists essentially of a housing, a tapered wedge, a base, and a perforator punch assembly. The perforator with auxiliary tools is run in the tubing to the position in the tubing string that circulating holes are desired using a wire line stuffingbox and lubrication. Then, by manipulating the wire line on the surface, as many holes as desired may be punched through the tubing. With a removable check valve placed beneath the perforations, the operator can circulate the desired fluid to control hydrostatically the upper and lower pays before disturbing the tubing or packer.

● **Macaroni tubing reduces ratios in dual wells.** Many operators of dual wells have experienced high gas-oil ratios when flowing the upper pay through the annulus. In many of these cases the excessive ratios are due to the inefficient flow string represented by the tubing-casing annulus, because the large flow area permits much gas slippage. Excessive ratios have been reduced effectively by the use of a macaroni string of tubing run inside the regular tubing and having a packoff assembly that lands in a side door choke landing nipple. The packoff assembly, which is run on the lower end of a macaroni string, is provided with a valve that closes the lower end of the string to allow its being run under pressure. When the packoff lands in the nipple the weight of the macaroni string opens the valve and the packing is so placed in the nipple that flow from the lower zone is through the macaroni string and flow from the upper zone is admitted through the side ports in the nipple into the annular space between the macaroni string and the regular tubing. The upper pay is afforded a much more efficient flow string. Also, in some wells, the macaroni string connected to the lower pay might yield more desirable ratios.

● **Pumping assembly for dual oil wells.** In some fields upper and lower oil pays have ceased to flow, thus creating the need for pumping equipment to separately and simultaneously produce the pays. In Fig. 8 is shown a dual pump that has effectively pumped dual wells less than 3000 ft. deep. The assembly consists of the following: a hollow pumping string (¾-in. upset tubing has been used), an upper pump, a lower pump, and a pack-off section separating the two pumps. The upper pay is produced through the tubing-pumping string annulus, and the lower pay is produced inside the hollow pumping string. The writer understands that this equipment is being used to pump simultaneously both zones of about 20 dual wells that have an average depth of about 2800 ft.

● **Advantages of dual completion.** Although there are some factors unfavorable to dual completion, there are other factors favorable to the practice. Dual completion permits a well to receive two allowables to pay out such major expenditures as cost of hole, casing, and producing equipment that formerly had to be paid out of one allowable. In shallow fields the pay out time for a dually completed well is much shorter than for wells singly completed to the same producing formations. In deeper fields the added depth necessary to reach a second productive pay is hardly appreciable when compared to the depth required to reach the first productive horizon. It is in the deeper fields that the initial investment savings are the greatest, and many operators are of the opinion that it would not be economically feasible to drill some wells to one pay alone.

Regardless of depth, the initial expense of drilling a dual well is usually much less than, for example, drilling twin wells to the producing formations, or waiting until the depletion of the upper pay, and then drilling the well deeper to produce the lower pay. Most operators acknowledge the initial savings to be had, but some state that money spent subsequent to completion in the form of work-overs and remedial operations more than offsets the savings effected, inasmuch as the expense of reworking dual wells has been very high in some cases.

These expenses are sometimes necessi-

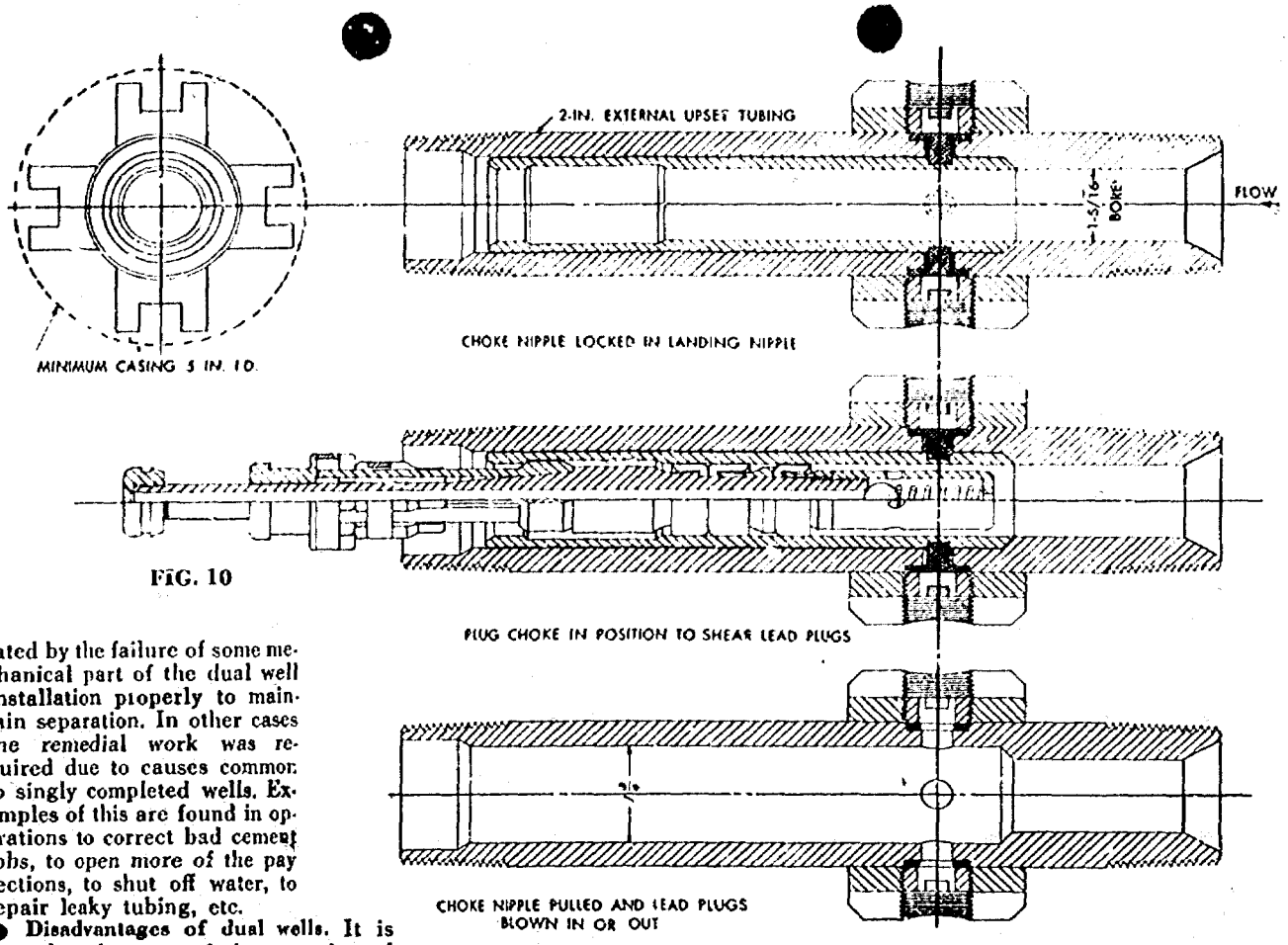


FIG. 10

tated by the failure of some mechanical part of the dual well installation properly to maintain separation. In other cases the remedial work was required due to causes common to singly completed wells. Examples of this are found in operations to correct bad cement jobs, to open more of the pay sections, to shut off water, to repair leaky tubing, etc.

● **Disadvantages of dual wells.** It is true that, because of the necessity of taking care of two formations, workover time on dual wells is usually longer than on singly completed wells.

Sometimes, however, operators may charge expenses and troubles to the fact that the well is a dual producer, when the troubles are actually the same that would be encountered in a single producer.

● **New equipment being developed.** News tools and equipment are being designed and developed to enable operators to cope with the problems involved in producing dual wells. A new type packer that departs from the use of conventional hook wall slips and large unsupported packing elements has been designed especially for use in dual wells. This packer lands in a nipple that is a part of the casing string. The inside diameter of the landing nipple is machined to a definite diameter within close limits and has a fine machined finish. This nipple provides a definitely located precision seat for the packer. The packer itself carries heavy locking lugs, which are expanded beneath the lower end of the landing nipple by a special joint of tubing through the packer to lock positively the packer in place. The packer is provided with vee-type asbestos base packing, which is a close slide fit in the bore of the nipple and is capable of withstanding high bottom-hole temperatures and pressure differentials.

The side door choke arrangement shown in Fig. 2 is so constructed that flow from the upper into the lower pay is prevented when the choke is removed from the nipple. The check valve will not prevent the flow from the lower into the upper pay with the choke removed, however. To prevent flow of lower pays into upper zones, a side door choke landing nipple with external check valves on the side ports has been designed (Fig. 9).

A side door type choke has been designed to establish communication between the tubing and tubing annulus without the necessity of removing the choke from the nipple with a wire line. The ports in the nipple are opened by applying pressure to the tubing. This pumps the choke to its down position in the landing nipple, placing all the packing below the side ports, thus opening them into the tubing and annulus. This tool should be very useful in cases of emergency when it is necessary to kill the annulus pay safely and rapidly. The necessary pressure could be applied by connecting a pump to the flow line of the tubing pay.

In Fig. 10 is shown an assembly designed to provide a means for establishing communication between the pays. It consists essentially of three parts; namely, a landing nipple, a sleeve fit within the nipple, and a special plug choke. The special nipple and sleeve, as seen in the upper view, will be made up in the tubing string just above the packer. The well will be produced normally through the nipple and sleeve as shown in this view. The inside diameter of the sleeve is large enough to pass greater flow volumes than some other chokes. When it becomes necessary to connect the annulus with the tubing, the plug choke is run on an ordinary steel measuring line or dropped into the tubing and seated in the sleeve as shown in the center view. The running tools are removed from the well and the tubing opened to flow. When a pressure differential of approximately 200 lb. per sq. in. is established across the plug choke, pressure will blow the sleeve and choke from the nipple by shearing the ends of lead plugs. Then pressure differential across the lead plugs will shear and displace them, connecting the tubing and annulus. The plugs may be easily sheared by applying pump pressure if necessary. The side ports can be quickly opened without use of wire line equipment or moving the tubing, and should prove useful for circulating above a packer in single completions as well as duals.

Many wells in many fields have been dually completed with satisfactory results, both economically and mechanically. It is true that many problems remain unsolved, but it must be recalled that dual completions are relatively new, and that many of the problems became apparent at a time, during the war, when neither the operators or equipment manufacturers were in a position to meet the problems. Both the operators and the manufacturers have made considerable progress, however, in developing technique and equipment to meet the requirements of this type well. The economic advantages of dual completion practice in many instances is expected to foster continued development of improved equipment and production practices. ★★★

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ECONOMICS OF MULTIPLE COMPLETIONS

The aspects of multiple completion of wells in New Mexico as effects conservation are as follows:

1. Since it is a basic fact that as much oil can be produced from one well bore by dual or multiple zone completions as can be produced from two or more individual wells, most states have approved rules and regulations permitting such operation, under proper supervision.

2. It will be generally agreed that in certain instances the production from one pool only will be economically impractical whereas simultaneously producing from two pools through a common well bore will result in a pay-out on investment and a profit to the operator. The right to so complete a well is, therefore, definitely a conservation measure since lack of the right would undoubtedly result in the failure of the operator to drill a well to one or both pools, leaving many barrels of oil in place which would otherwise be recovered. The production obtained from zones which would not allow individual well completions due to economics would definitely benefit both the royalty owner and the State.

3. The arguments for dual completions are based almost entirely on an economic consideration which is undisputedly the principal consideration in conservation. The additional cost of dually completing a new well will increase the cost of the well by some 20 to 25 per cent. It is rather obvious therefore that less attractive pools can be exploited than would be possible if multiple development was required.

Following are detailed cost estimates showing the economic advantage of dual completion:

SUMMARY OF TOTAL SAVINGS BY DUAL COMPLETION

Combination Zone	Bbl Recovery	Example	At Average Cost of Drilling to Date	At Present Cost
Drinkard & Ellenberger	280,000	1-A	$65,287	$43,094
	560,000	1-B	44,287	22,094
	360,000	1-C	59,287	37,094
	480,000	1-D	50,287	28,094
Holt & Ellenberger	320,000	2-A	46,671	20,822
	600,000	2-B	25,671	--178
	520,000	2-C	31,671	5,822
	400,000	2-D	40,671	14,822
Holt & Drinkard	360,000	3-A	34,053	18,184
	200,000	3-B	46,053	30,184
	280,000	3-C	40,053	24,184

MULTIPLE COMPLETION PRACTICE

Most multiple zone completions involve only two producing horizons, although a comparatively small number of wells have been completed with three producing horizons being produced separately. In a majority of instances all the horizons flow although there are numerous cases where one zone flows and one zone is lifted artificially, and a few cases where two zones are pumped simultaneously. One or two instances have been reported where two horizons were produced simultaneously by gas lift.

The practice of pumping two zones alternately reached considerable proportions in Kansas but was recently discontinued. In this type of completion it was necessary to raise and lower tubing through a packer in order to pump each zone alternately. This practice caused an excessive amount of leakage, or failure of the packer seal between tubing and packer.

Texas has the greatest number of multiple completions of any mid-west state.

Most dual completions utilize the annulus between tubing and casing for producing the upper horizon and utilize the tubing for producing the lower zone. A standard packer, run on tubing and set between the two zones, and a side door choke, to facilitate completion and permit access to either formation, is all the special equipment required. This procedure lends itself readily to artificially lifting the lower zone. The principal drawback is the relative inefficiency and difficulty of sustaining flow through the annulus. As an aid in overcoming this difficulty, a double side door choke has been devised which permits both zones to be flowed alternately through the tubing. Vertical movement of four inches is required to change the ports in the tool. This movement is accomplished by a wire line attachment for raising and lowering the choke.

A device known as the Lewis valve has been used to unload condensate or fluid from the annulus. In this arrangement a packer and the Lewis valve are run on tubing, usually 4". A macaroni string of tubing is run inside the production string and attached to the Lewis valve. Time and pressure actuated surface equipment automatically raises and lowers the macaroni string periodically, permitting the annulus to unload through the macaroni string when the valve is in the raised position. The lower zone produces through the production string at all times and can unload through the macaroni string when the valve is lowered.

The usual procedure of producing the upper zone through the annulus and the lower zone through the tubing may be reversed, if desirable, by using two packers, one of which is a "cross-over" type. In one type of installation both packers are run on tubing and set simultaneously. In another type of installation, the bottom packer is non-removable and is run on drill pipe or tubing prior to running the upper or "cross-over" packer, which is run on the production tubing. The lower packer is set between the producing zones and the cross-over packer is set above the top zone. A section of flush joint tubing extends through the lower packer.

FORMATION CHARACTERISTICS - DRINKARD AREA

	Paddock (Holt)	Blinbry	Tubb	Drinkard Vivian	Drinkard Andrews	Drinkard Ellenberger
Initial BHP	2120 lbs @ -1825'	2300 plus*		2660 @ -3050'	2212 @ 3525'	3150 @ -4650'
Original Sol. GOR, Diff.	771			1178	1117	1132
Flash	951			1402	1385	1349
Sat. Press.	2000			1959	2326	2918
Viscosity, Cp. Sat. Pr.	.76			.54	.63	.29
Residual	2.48			2.9	2.58	2.0
BHT	102° F			104°	106° F	130° F
Oil Gr.	36 - 38			41-42	43	41
Perm. Range	0-300 MD			0-700 MD	0-40 MD	0-220 MD**
Por. Range	4-22%			3-21%	1-13%	1-16%
H_2S	yes	no	no	no	no	no
Well	Paddock #1			Vivian #1	Watkins #1	Sticher #2
Flowing Test	5-3-45			3-4-46	3-10-46	9-30-46
Rate Bbl/Day	99			155	79	110
GOR	475			4222	1263	948
Csg Pr	975			1600	-	615
Tub Pr	580			1240	625	925
BHP	2024 (-1874)			2024	2370	3008
Rate Bbl Day	453			509	259	552
GOR	461			3258	1240	1037
Csg Pr	1010			975	1175	615
Tub Pr	330			700	600	925
BHP	1331			1169	1437	2920
P.I.	.537			.411	.24	5.16
Static Pr.	2137			2407	2495	3027
Static Pr.	1832 12-1-45		2561 5-13-46	2216 5-14	2312 5-14-46	2990 11-13-46
Static Pr.	1765 2-20-45		2510 8-24-46	2180 8-22	2107 8-22-46	
S Static Pr.	1525 5-20-46		2094 9-22-46	2213 11-14	1903 11-30-46	
Static Pr.	1386 9-6-46					
Static Pr.	1344 11-13-46					

* 15 min. build up pressure in DST was 2300 lb.

** Permeability occurs mostly in fractures, which are not measured in laboratory tests.

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ECONOMICS OF MULTIPLE COMPLETIONS IN MARGINAL PAYS

Although multiple completions show an improved payout and overall profit in most instances, the practice appear particularly applicable to pays which are marginal in nature.

In the Drinkard area there are two pays, the Blinbry and Tubb, which on the basis of present information appear to be gas-distillate zones. Although data are inadequate for making accurate estimates of recovery, it appears that recovery will probably not exceed 25,000 Mcf gas and 500 bbl of distillate per acre. On this basis, net revenue, after taxes and royalty would amount to $1,050* per acre or $42,000 for a 40-acre well. Assuming $75.00 per month operating expense and a twenty-year life, total operating expense would be $18,000 leaving only $24,000 to pay drilling and equipment expense. Since drilling and equipping wells in these formations will cost approximately $65,000 for Blinbry and $70,000 for Tubb wells, it is obvious that these pays could not be exploited on 40 acre, or even 80-acre spacing. However, the exploitation of these formations would be profitable in a dually completed well and, in cases where the other pays are doubtful the possibility of making a dual completion might well be the deciding factor in determining whether or not to drill a well.

It also appears that the Paddock, Drinkard and Ellenberger pays will be marginal over certain portions of the area, and the use of dual completions in such cases may have a definite bearing upon the completeness of development and the overall efficiency of recovery. A case in point is Gulf's L. I. Baker, Section 5-22S-37E, currently being drilled to the Ellenberger pay. This well appears to be near the edge of the Ellenberger pay and will probably have a thin pay section and produce water early in its life. Overall recovery is expected to be approximately 100,000 bbl, and due to early water production, operating expense will undoubtedly be above average, possibly amounting to 20¢ per barrel. Estimated life of the wells is 8½ years of which 6 years will be required to pay out the drilling cost and net profit will amount to only $17,000. Considering the risk involved, cost of tank batteries, etc., this is a rather poor investment. However, if the Drinkard pay, which in this area appears to be fairly productive, can be exploited through the same well, the Ellenberger oil can be recovered for total additional expense of $62,000 and total profit of $67,000. In the case of the Baker well the Ellenberger pay will be exploited regardless of dual completions but it is doubtful if very many wells of this type would be drilled and certainly wells which might recover only 50,000 or 75,000 barrels could not be drilled.

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* Gross income $.02 per M for gas & $1.55 per bbl for distillate.

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PRORATION ASPECT OF MULTIPLE COMPLETIONS

The general rules and regulations now in effect in New Mexico concerning proration are adequate and will be applicable to multiple completion wells as outlined in the Gulf application.

A duly authorized representative of the Oil Conservation Commission may make such tests as he deems advisable to determine that segregation of the pools producing in a multiple completion well exists.

RESERVOIR ASPECTS OF MULTIPLE COMPLETIONS

In the Drinkard area there are five pay horizons below a depth of 5000'. These pays and their approximate depths are tabulated as follows:

Paddock (Holt)	- 5100'
Blinbry	- 5500'
Tubb	- 6150'
Drinkard	-6500-6900'
Ellenberger	- 7900'

The principal oil productive zones are the Paddock, Drinkard and Ellenberger pays. Characteristics of these pays are shown on the attached summary. The Blinbry and Tubb pays are primarily gas-distillate zones and very little reservoir information has been developed. However, from the standpoint of multiple completions these formations are considered quite important both because the economics of single completions in these pays are questionable and because they may occur principally in areas where the other pays are marginal.

Although it is anticipated that production from the various pays will be produced separately, the possibility of accidental or temporary commingling does exist, and the effect of such commingling has been considered. With the possible exception of the Ellenberger zone, which may prove to be a water-drive reservoir, the other reservoirs are similar in characteristics and there is little or no possibility of damage. At present the Ellenberger pay has a considerably higher pressure than the other pays, and should this condition continue after water encroachment becomes serious, the segregation of this pay might become more important. Even in this eventuality, however, there are compensating factors which reduce the possibility of damage resulting from commingling. There is already evidence of declining pressure in the Ellenberger and even though a water drive is present, it may occur only at reduced pressure. Also, the greater depth of the Ellenberger formation reduces the effect of the differential pressure. Further it is considered that even though water temporarily entered any of the other pays, no permanent damage would be done. Water is commonly used to kill wells without any resulting damage.

The matter of ascertaining whether or not segregation is actually accomplished will undoubtedly be important insofar as enforcement regulations are concerned. The Paddock oil contains sulphur and is the only pay so affected. Consequently the commingling of Paddock production with that of any other zone could be easily detected. Under present conditions the commingling of Ellenberger oil with that of any other formation would be indicated by pressure effects and if the formations produce water, analysis of the water would be indicative. The commingling of Blinbry or Tubb production with any other pays would, in all probability, be reflected in gas-oil ratios.

Multiple completions would probably complicate, to some extent,

the problem of obtaining reservoir data. It is considered inadvisable at this time to make definite or specific recommendations regarding taking bottom-hole pressures, etc. in such wells. In general, it is believed that multiple completions will be more applicable to marginal or small wells, which are frequently unsuitable for use in obtaining reservoir data, and that in any particular area there will ordinarily be enough single completions to permit obtaining essential data. As long as all zones flow, the taking of reservoir data can be accomplished either by the use of side door chokes or by using fluid level determinations, and it is considered that reservoir data, subsequent to the installation of artificial lift equipment is of secondary importance.

The probability of oil produced from one zone being credited to another zone has also been considered. It is believed that segregation under the proposed rules, with reasonable enforcement of regulations will eliminate any commingling other than a negligible amount which may occur accidentally or temporarily. Even though commingling should be permitted during the extreme later life, a large majority of the production will have been obtained and the total production of any particular reservoir can be determined accurately enough for any but strictly academic purposes. Such academic accuracy is seldom of any practical value and is considered to be of negligible importance as compared to obtaining the greatest possible economic recovery.

The production of two zones, both of which flow, or the production of one flowing horizon and one requiring artificial lift, has been accomplished in numerous instances, and appears entirely practicable from a mechanical standpoint. Some difficulty has been encountered due to packers leaking, sanding up and sand cutting, but these do not appear to be serious. Also, it may be anticipated that special conditions such as extremely high differential pressures, high temperatures or extreme paraffin conditions might require special consideration and might, in some instances, make dual completions impractical.

The production of two zones both of which require artificial lift has had a rather limited application. Some 80 completions, designed to permit alternate pumping of two zones, were made in Kansas during the war period when material shortages and spacing regulations restricted drilling. These installations were not successful in preventing co-mingling due to packer failures, and have been discontinued by order of the Corporation Commission. In almost every case failure occurred at the seal between tubing and packer. It is considered that improvement could be made in the method of sealing off the tubing which would largely overcome the difficulties that were encountered.

An installation designed to permit pumping two zones simultaneously has been used to a very limited extent in Texas. This method utilizes tubular sucker rods as the production tubing for the lower horizon and regular tubing for the upper horizon. A packer run on the tubing separates the two horizons and a "packer" pump is utilized to separate the production.

Only one instance of gas-lifting two zones simultaneously has been ascertained. In this case, two concentric strings of tubing are utilized, the outer string being equipped with casing flow valves and the inner string being equipped with tubing flow valves. Further details of this installation are not known but it appears that a non-removable packer and a section of flush joint tubing would be required and that a side door choke on the inner tubing string would be helpful.

Other possible methods of artificially lifting two zones include (1) the use of parallel strings of tubing, or the use of concentric strings of tubing, the inner string of which could be utilized for gas lift and the other for pumping and the outer string could be utilized for gas injection for lifting the upper zone.

Undoubtedly the matter of artificially lifting two producing zones will encounter some difficulties and numerous problems will have to be solved. However, it is considered that the problems are by no means insurmountable, and that the necessity for reducing the cost of producing oil and of obtaining all possible oil at an economic cost will be incentive for such mechanical improvement as may be necessary.

COMPARATIVE DRILLING COSTS, SINGLE COMPLETION VS. DUAL COMPLETION

A. COST OF SINGLE COMPLETIONS

Paddock Pool Wells	Estimated	Actual	
Paddock #1	$95,463	$91,642	
Paddock #2	79,694	81,162	
Paddock #4	72,427	66,304	
Eaves #3	57,813		
Eaves #4	56,013		
Average estimated cost per well	$72,282	based on drilling 5 wells	
Present estimated cost per well	56,413	based on present drilling costs	

Drinkard Pool Wells			
Andrews #1	$109,351	$111,353	
Vivan #1	138,120	129,958	
Boyd #2	120,523	115,476	
Boyd #3	75,233	80,201	
Drinkard "B" #1	117,795	114,746	
Drinkard "B" #2	91,976		
Gutman #1	154,328	138,047	
Higgins #1	126,054	125,583	
Hugh #1	97,795	99,670	
Lineberry #1	118,421	103,312	
M. Owen #3	91,303	81,454	
M. Owen #4	64,795		
Scarborough #1	125,871	127,690	
Watkins #1	92,900	89,491	
Ella #1	91,593		
Vivian #2	93,220		
M. Owen #5	71,027		
McCormack #9	71,640		
E. King #4	56,013		
Carson "C"	63,524		
Mark #2	70,682		
Average estimated cost per well	$97,193	based on 21 drilling wells	
Present estimated cost per well	75,000	based on present drilling costs	

Brunson Pool Wells		
Sticher #2	113,109	
Baker #3	87,210	
Average cost per well	$100,156	based on 2 drilling wells
Estimated drilling cost per well	87,210	based on present drilling costs

B. ESTIMATED DRILLING COSTS FOR COMBINATION ZONES

Drinkard & Ellenberger Zones	Average	Present
Estimated drilling cost for Drinkard well	$97,193	$ 75,000
Estimated drilling cost for Ellenberger well	100,156	87,210
Total Cost	$197,349	$162,210

Holt & Ellenberger Zones		
Estimated drilling cost for Holt well	$ 72,282	$ 56,413
Estimated drilling cost for Ellenberger well	100,156	87,210
Total Cost	$172,438	$143,623

Holt & Drinkard Zones		
Estimated drilling cost for Holt well	$ 72,282	$ 56,413
Estimated drilling cost for Drinkard well	97,193	75,000
Total Cost	$169,475	$131,413

Estimated Additional Cost Due to Dual Completions	
10 Days Additional Rig Time @ $450/Day	$ 4,500
Perf. Casing w/6 shots per ft for 100 ft	1,800
Equipment & material (packer, chokes, & etc.)	2,000
Other expense	3,700
Total	$ 12,000

COMPARISON OF DRILLING COST

Example No. 1 - Drinkard & Ellenberger Completion

Single Completions

	Drinkard		Ellenberger	
	Average	Present	Average	Present
Drill & Completion Cost	$ 97,193	$ 75,000	$100,156	$ 87,210
Equip to Flow Cost	3,915	3,915	4,500	4,500
Total	$101,108	$ 78,915	$104,656	$ 91,710

Total Cost - 2 Wells

Average Cost - $101,108 plus $104,656 o4 $205,764
Present Cost - $78,915 plus $91,710 or $170,625

Dual Completions

		DRinkard & Ellengerger	
		Average	Present
Drill & Completion Cost		$100,156	$ 87,210
Additional Expense		12,000	12,000
Equip to Flow Cost			
Present avg. ETF Cost	$4,500		
Incr. due to 3" tbg	2,221		
Dual flow line	600		
Sub-Total	$7,321	7,321	7,321
Total Cost		$119,477	$106,531

Initial Drilling & Completion Savings Due to Dual Completion Practice

Average $205,764 - $119,477 or $86,287

Present $170,625 - $106,531 or $64,094

COMPARISON OF DRILLING COST

Example No. 2 - Holt & Ellenberger Completion

Single Completions

	Holt		Ellenberger	
	Average	Present	Average	Present
Drill & Completion Cost	$ 72,282	$ 56,413	$100,156	$ 87,210
Equip to Flow Cost	3,210	3,210	4,500	4,500
Total	$ 75,492	$ 59,623	$104,656	$ 91,710

Total Cost - 2 Wells

Average Cost - $75,492 plus $104,656 or $180,148
Present Cost - $59,623 plus $91,710 or $151,333

Dual Completions

		Holt & Ellenberger	
		Average	Present
Drill & Completion Cost		$100,156	$ 87,210
Additional Expense		12,000	12,000
Equip to Flow Cost			
Present avg ETF Cost	$4,500		
Incr. due to 3" tbg	2,221		
Incr. due to dual flow line	600		
Sub-Total	$7,321	7,321	7,321
Total Cost		$119,477	$106,511

Initial Drilling & Completion Savings Due to Dual Completion Practice

Average $180,148 - $119,477 or $70,671

Present $151,333 - $106,511 or $44,822

COMPARISON OF DRILLING COST

Example No. 3 - Holt & Drinkard Completion

Single Completions

	Holt		Drinkard	
	Average	Present	Average	Present
Drill & Completion Cost	$ 72,282	$ 56,413	$ 97,193	$ 75,000
Equip to Flow Cost	3,210	3,210	3,915	3,915
Total	$ 75,492	$ 59,623	$101,108	$ 78,915

Total Cost - 2 Wells

Average Cost - $75,492 plus $101,108 or $176,600
Present Cost - $59,623 plus $78,915 or $138,538

Dual Completions

		Holt & Drinkard	
		Average	Present
Drill & Completion Cost		$ 97,193	$ 75,000
Additional Expense		12,000	12,000
Equip to Flow Cost			
Present avg Etf Cost	$ 3,915		
Incr. due to 3" tbg	1,839		
Incr. due to dual flow line	600		
Sub-Total	$ 6,354	6,354	6,354
Total Cost		$115,547	$ 93,354

Initial Drilling & Completion Savings Due to Dual Completion Practice

Average $176,600 - $115,547 or $61,053

Present $138,538 - $93,354 or $45,184

92-93-94

PROPOSED REPORTS TO NEW MEXICO OIL CONSERVATION COMMISSION

COVERING MULTIZONE COMPLETIONS

Under the present Rules and Regulations four reports are submitted to the New Mexico Conservation Commission when a well is drilled and later reconditioned:

Form 101 - Notice of Intention to Drill.
Form 102 - Miscellaneous Notices.
Form 103 - Miscellaneous Reports on Well.
Form 105 - Well Record.

INITIAL MULTIPLE ZONE COMPLETION

Dual or multiple completion of a well initially would necessitate only a slight change in these reports. Form 101, Notice of Intention to Drill, would be submitted as usual. At the same time, Form 102, Miscellaneous Notices, would be submitted. Under "Additional Information" on Form 101, it would be specified that the well is to be a dual or multiple zone completion. Form 102 would include a description of the work to be performed, such as zones to be exposed, procedure to be followed in completion, proposed packer setting depth, etc.

Reconditioning of a multiple zone producer would be submitted as usual on Form 103.

In lieu of the regular Well Record, Form 105, a special completion report would be submitted showing information on production from the various zones, gas-oil ratios, depth perforated, etc. A proposed well record form for dual or multiple zone wells is attached and could be designated as 105-A.

RECOMPLETION TO MAKE MULTIZONE COMPLETION

If the well is originally completed as a single well, but it is desired to recomplete it as a multizone well, it would be necessary to submit Form 102, Miscellaneous Notices, and Form 103, Miscellaneous Reports on Well. Form 102 would include information on pays to be produced, proposed packer setting and the production test as well as other pertinent data on the pay producing at the time the report is filed. Form 103 would show the work performed together with production data on each zone, packer setting, etc., similar to that reported on the special completion report for initial multiple zone completion.

In summary, the practice of multizone production will require only one additional report over and above those used for single well completion.

C-105-A

(Proposed Form)

NEW MEXICO OIL CONSERVATION COMMISSION
Santa Fe, New Mexico

WELL RECORD
For Multizone Producer

(PLAT)

Area 640 Acres
Locate Well Correctly

Mail to Oil Conservation Commission, Santa Fe, New Mexico, or its proper agent not more than twenty days after completion of well. Follow instructions in the Rules and Regulations of the Commission. Indicate questionable data by following it with (?). Submit in triplicate, Form C-110 will not be approved until Form C-105-A is properly filled out.

Company or Operator _____ Address _____

Lease _____ Well No. ____ in ____ of Sec. _____, T _____,

R _____, N.M.P.M., _____ Field, _____ County.

Well is ____ feet south of the North line and ____ feet west of the East line of ____.
If State land the oil and gas lease is No. _____ Assignment No. _____
If patented land the owner is _____, Address _____
If Government land the permittee is _____, Address _____
The Lessee is _____, Address _____
Drilling commenced _____ 19__. Drilling was completed _____, 19__
Name of drilling contractor _____, Address _____
Elevation above sea level at top of casing ____ feet. Derrick Floor _____
The information given is to be kept confidential until _____, 19__

Formation Tops: Anhydrate _____; Base Salt _____; _____ ____; _____
_____ _____; _____ _____; _____ _____.

Pays Producing Name & Depth	Initial Prod. Oil & Water	Date	G.O.R.	Oil Gr.	How Produced

Types of Well Logs Taken: _____
Tubing Record: Size _____. Depth _____.
Packer Record: Type _____. Depth Set _____
Type _____. Depth Set _____
Special Equipment: _____
_____
Other Information: _____
_____

IMPORTANT WATER SANDS

Include data on rate of water inflow and elevation to which water rose in hole.

No. 1, from _____ to _____ feet. _____
No. 2, from _____ to _____ feet. _____
Nos. 3, from _____ to _____ feet. _____

CASING RECORD

Size	Weight Per Foot	Threads Per Inch	Make	Amount	Kind of Shoe	Cut & Filled From	Perforated From	Perforated To	Purpose

MUDDING AND CEMENTING RECORD

Size of Hole	Size of Casing	Where Set	No. Sacks of Cement	Methods Used	Mud Gravity	Amount of Mud Used

RECORD OF SHOOTING OR CHEMICAL TREATMENT

Date	Quantity of Acid or Explosive	Pay Section Treated	Results of Each Treatment

PLUGS AND ADAPTERS

Heaving plug - Material_____ Length_____ Depth Set_____
Adapters - Material_____ Size_____

RECORD OF DRILL STEM AND SPECIAL TESTS

If drill-stem or other special tests or deviation surveys were made, submit report on separate sheet and attach hereto.

TOOLS USED

Rotary tools were used from_____ feet to_____ feet, and from_____ feet to_____ feet
Cable tools were used from_____ feet to_____ feet, and from_____ feet to_____ feet

EMPLOYEES

_____, Driller _____, Driller
_____, Driller _____, Driller

FORMATION RECORD ON OTHER SIDE

I hereby swear or affirm that the information given herewith is a complete and correct record of the well and all work done on it so far as can be determined from available records.

Subscribed and sworn to before me this_____ day of_____, 19____

_____ Notary Public

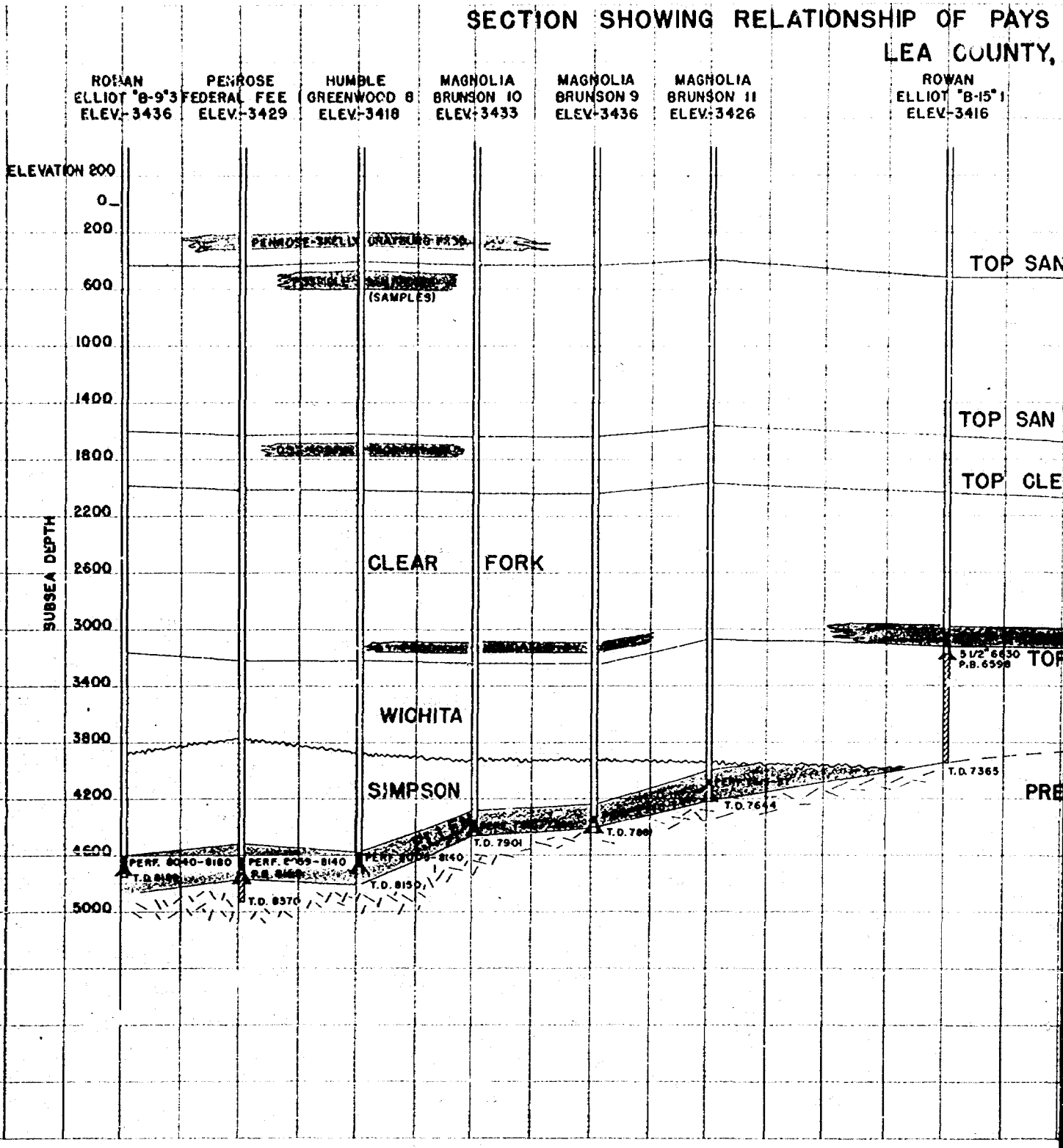
My Commission expires_____

_____ Place _____ Date

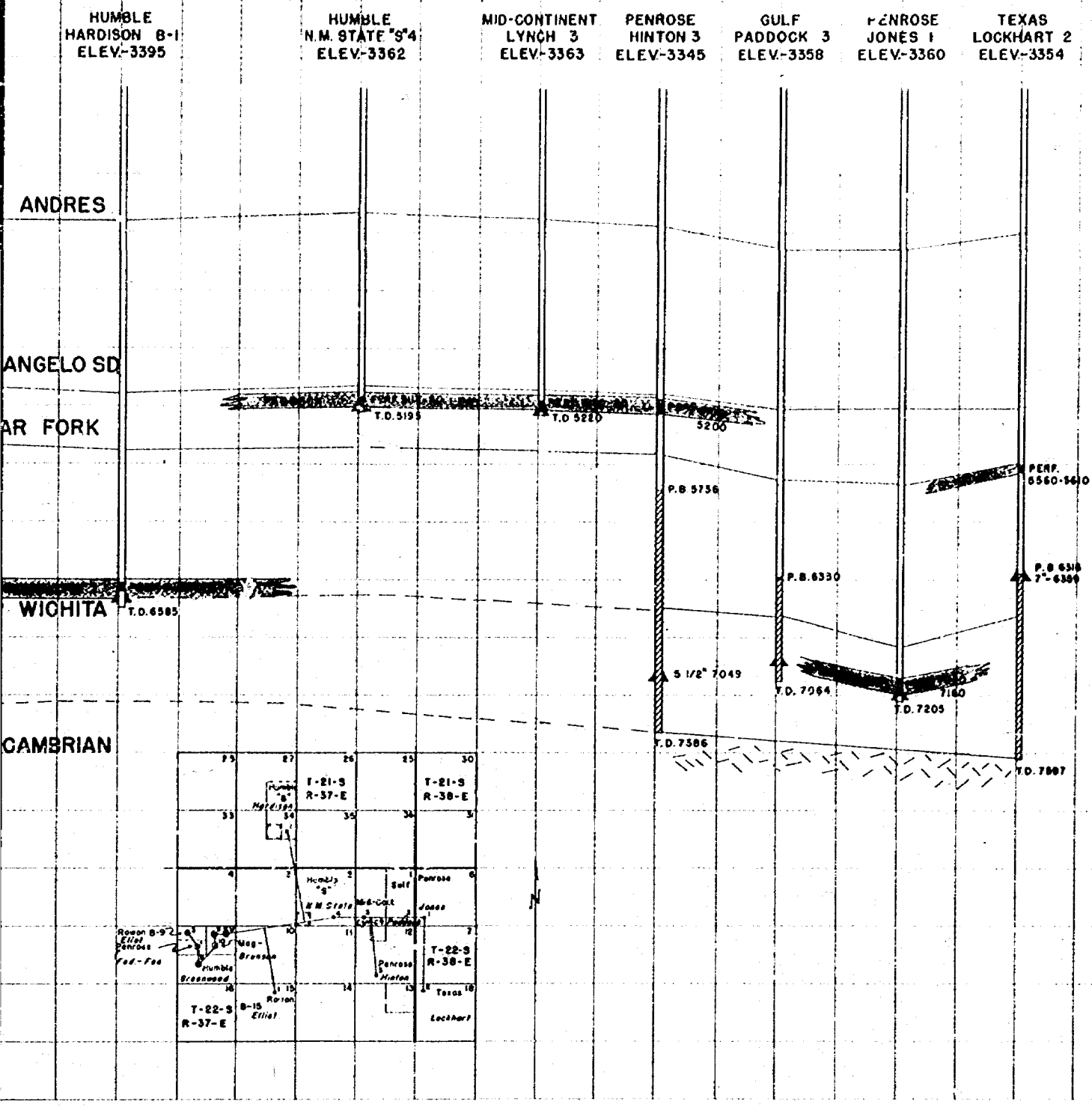
Name_____
Position_____
Representing_____
Address_____

Over-sized Map

Map Filmed As Follows:


SECTION SHOWING RELATIONSHIP OF PAYS
LEA COUNTY,
ROWAN ELLIOT "B-9"3 ELEV.-3436
PENROSE FEDERAL FEE ELEV.-3429
HUMBLE GREENWOOD 8 ELEV.-3418
MAGNOLIA BRUNSON 10 ELEV.-3433
MAGNOLIA BRUNSON 9 ELEV.-3436
MAGNOLIA BRUNSON 11 ELEV.-3426
ROWAN ELLIOT "B-15" 1 ELEV.-3416
ELEVATION 200
0
200
600
1000
1400
1800
2200
2600
3000
3400
3800
4200
4600
5000
SUBSEA DEPTH
PENROSE-SKELLY GRAYBURG PROD.
(SAMPLES)
TOP SAN
TOP SAN
TOP CLE
CLEAR FORK
WICHITA
SIMPSON
PRE
5 1/2" 6630
P.B. 6598
TOP
T.D. 7365
T.D. 7644
T.D. 7901
T.D. 8130
T.D. 8370
PERF. 8040-8180
PERF. 8059-8140

IN BRUNSON-DRINKARD-PADDOCK AREA,
NEW MEXICO



PE-C-134

PETROLEUM AND ITS PRODUCTS

GULF OIL CORPORATION

P. O. BOX 661 · TULSA 2, OKLAHOMA

GYPSY
DIVISION

April 25, 1947

Case #92
file

New Mexico Conservation Commission
Santa Fe, New Mexico

Attention: Mr. R. R. Spurrier

Gentlemen:

Attached is a sample order covering the proposed dual completion of the Gulf West Grimes No. 4 in the Hobbs Pool. It is believed that this sample order may be used as a guide in issuing additional future orders of this nature.

We have attempted to include in the order the conditions which must be satisfied before the dual completion is permitted as well as the data which will be needed to definitely prove that production from the two horizons is not being commingled in the well bore.

For your information we are attaching the various forms used by the operators in submitting data to the Texas Railroad Commission before and after the wells are dually completed. We can see no objection to the employment of forms of this nature but believe that development of the forms can be deferred until a later date. However, we do intend to submit all pertinent data to you upon completion of the well. Further, since other operators are interested in this experimental installation, it is planned to insert the following data in the Lea County Operators Committee engineering report:

1. Mechanical features of installation.
2. Pressure test of casing before perforating the Bowers.
3. Production, gas-oil ratio, and reservoir pressure tests of each zone at time of completion.
4. Any other data which may become pertinent.

Subsequent to the hearing in Santa Fe you inquired as to dual completions in Oklahoma. Since adoption of rules and regulations governing dual completions in Oklahoma approximately two years ago, in only one instance has there been any objection offered by offset operators to the applications and none have been denied. During this period approximately thirty applications have been approved.

Yours very truly,

S. G. Sanderson
Manager of Production

EH:MDW
Encls

SAMPLE ORDER

THE OIL CONSERVATION COMMISSION
OF THE STATE OF NEW MEXICO

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

CASE NO. 92

ORDER NO. _____

THE APPLICATION OF GULF OIL CORPORATION FOR THE ISSUANCE OF A SPECIAL ORDER PERMITTING THE PRODUCTION OF MORE THAN ONE HORIZON THROUGH A SINGLE WELL BORE IN THE WEST GRIMES NO. 4, HOBBS POOL, LEA COUNTY.

ORDER OF THE COMMISSION

BY THE COMMISSION:

This cause came on for hearing at ten o'clock A. M. on January 10 and April 15, 1947, at Santa Fe, New Mexico, before the Oil Conservation Commission of New Mexico, hereinafter referred to as the "Commission".

NOW, on this _____ day of _____, 1947, the Commission, having before it for consideration the testimony adduced at the hearing of said case, is of the opinion and finds that mechanical devices are available which are designed to permit the concurrent production of fluids from two different strata without commingling the fluids from the two separate strata within the bore of the well; and that said application should be granted as herein provided.

IT IS ORDERED that:

1. Effective _____, 1947, Gulf Oil Corporation be and is hereby granted permission to dually complete and produce its West Grimes No. 4, located in the NE NE NW Section 32-18S-38E, in the Hobbs Pool, Lea County, New Mexico, in such manner that gas may be produced from the Byers gas sand from 3630' to 3700', and that oil and gas or gas may be produced from the Bowers sand from approximately 3150' to 3170'.

PROVIDED that said well shall be completed and produced in such manner that there is no commingling within the well bore of the well of fluids produced from the two separate strata.

PROVIDED further that said well must be equipped in such manner that reservoir pressures may be determined on each of the two specified strata separately, and further that said well must be equipped with all necessary connections required to permit recording meters to be installed and used at any time, so that when such meters are installed all natural gas produced from each separate stratum may be accurately measured and the gas-oil ratio determined.

PROVIDED further that operator shall make any and all tests or determinations at any such times and in such manner as is deemed reasonably necessary by the Commission.

PROVIDED further that segregation tests to determine that seal between the two strata is being maintained shall be conducted and reported to the Commission at intervals not to exceed one year.

PROVIDED further that prior to the time said well is dually completed the operator shall supply the Commission for its approval with a plat or drawing showing the proposed method and manner of completion, together with an electrical or radio activity log showing the location and extent of each separate stratum and the proposed perforations.

PROVIDED further that upon completion of the well operator shall submit to the Commission a diagramatic sketch of the mechanical installation which was actually employed to produce the well from both zones, showing type and location of packers, other devices used, location of perforations, name and depth of each producing horizon, together with report of production, gas-oil ratio and reservoir pressure determinations of each horizon at time of completion. & pool

It is further provided that the failure of the operator to comply with any provision or provisions of this order shall immediately terminate this order and all permission granted hereunder in its entirety.

It is further ordered that this case be held open for such other and further orders that may be necessary.

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

OIL CONSERVATION COMMISSION

T. J. Mabry, Chairman

John E. Miles, Member

R. R. Spurrier, Secretary

SEAL

DATA TO BE SUPPLIED THE COMMISSION ENGINEERING DEPARTMENT
FOR THE ENTERING OF A FORMAL ORDER ON DUAL COMPLETION

1. Full scale electrical log of the well with items (a), (b), (c), and (d) written thereon.

(a) Names of the two horizons involved in the dual completion.

(b) Upper limit and lower limit of each of the two horizons in which dual completion was made.

(c) Perforated interval in each horizon.

(d) Depth at which packer was set to separate the two horizons involved and the type of packer that was used.

2. Diagrammatic sketch of the mechanical installation which will be employed to produce the well from both zones.

3. Statement as to what kind of completion was effected; that is dual oil, dual gas, or dual oil-gas. If completion is dual oil-gas indicate from which horizon each product is produced,

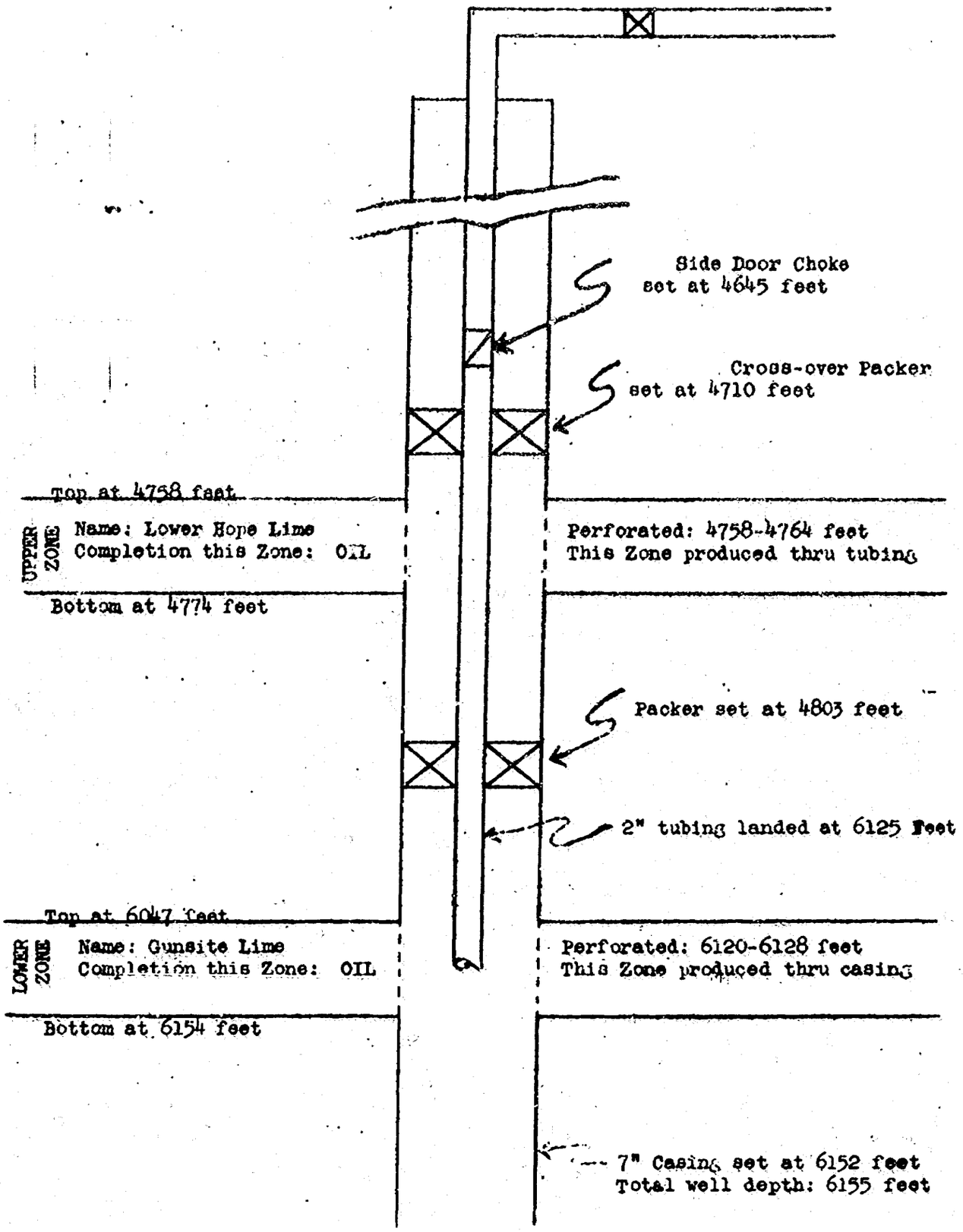
4. State which horizon is to be produced through the tubing and which through the annular space.

NOTE: If electrical log was submitted at hearing to consider your application to dually complete this well, then the information requested in (a), (b), (c), and (d) above, which information should also appear on your diagrammatic sketch, will be sufficient and no additional log need be filed.

A sample diagrammatic sketch to which reference is made in (2) above is shown on the reverse side hereof. It is presented for the purpose only of pointing out the type of information that should be shown on the sketch.

The data requested hereon should be transmitted by letter and reference should be made to the purpose for which it is submitted.

DIAGRAMMATIC SKETCH SHOWING DUAL COMPLETION INSTALLATION



COMPANY: _____

LEASE : _____ WELL No. ___

FIELD : _____

DATE : _____

PACKER SETTING AFFIDAVIT

I, _____, being of lawful age and
Name of Party Making Affidavit
having full knowledge of the facts hereinbelow set out do state:

That I am employed by _____ in the capacity of _____, that on _____, 194__, I personally supervised the setting of a _____
Date
Make and Type of Packer
in _____, _____,
Operator of Well
Lease Name
Well No. _____ located in the _____, _____
Field
County, Texas, at a subsurface depth of _____ feet, said depth measurement having been furnished me by _____; that the purpose of setting this packer was to effect a seal in the annular space between the two strings of pipe where the packer was set so as to prevent the commingling, in the bore of this well, of fluids produced from a stratum below the packer with fluids produced from a stratum above the packer; that this packer was properly set and that it did, when set, effectively and absolutely seal off the annular space between the two strings of pipe where it was set in such manner as that it prevented any movement of fluids across the packer.

STATE OF TEXAS §
COUNTY OF _____ §

Before me the undersigned authority, on this day personally appeared _____, known to me to be the person whose name is subscribed to this instrument, who after being by me duly sworn on oath, states that he has knowledge of all the facts stated above and that the same is a true and correct statement of the facts therein recited.

_____

Subscribed and sworn to before me on this the _____ day of _____, 194__.

_____
Notary Public in and
for _____ County, Texas

RAILROAD COMMISSION OF TEXAS
OIL AND GAS DIVISION

Packer Leakage Test

Operator: _____ Lease: _____ Well: ____
Field: _____ County: _____ District: ____
Tested by: _____ Title: _____
Witnessed for operator by: _____ Title: _____

Test No. 1

Date of Test: _____
Length of Test: _____ hours
DATA ON PRODUCING COMPLETION:
Completion producing: _____
Reservoir: _____
Choke Size: _____ inches
Shut-in pressure prior to test: _____ p.s.i.
Stabilized flowing pressure during test: _____ p.s.i.
Shut-in pressure at end of test: _____ p.s.i.
DATA ON SHUT-IN COMPLETION
Completion shut-in: _____
Reservoir: _____
Shut-in pressure prior to test: _____ p.s.i.
Shut-in pressure during test: _____ p.s.i.
Shut-in pressure at end of test: _____ p.s.i.
Maximum pressure change of shut-in completion during test: _____ p.s.i.(decrease
(increase

Test No. 2

Same well bore as in Test No. 1, but with _____ completion producing and _____ completion shut-in.

Date of Test: _____
Length of Test: _____ hours
DATA ON PRODUCING COMPLETION:
Completion producing: _____
Reservoir: _____
Choke Size: _____ inches
Shut-in pressure prior to test: _____ p.s.i.
Stabilized flowing pressure during test: _____ p.s.i.
Shut-in pressure at end of test: _____ p.s.i.
DATA ON SHUT-IN COMPLETION:
Completion shut-in: _____
Reservoir: _____
Shut-in pressure prior to test: _____ p.s.i.
Shut-in pressure during test: _____ p.s.i.
Shut-in pressure at end of test: _____ p.s.i.
Maximum pressure change of shut-in completion during test: _____p.s.i.(decrease
(increase

NOTE: Enclose recording pressure charts with all pertinent information noted thereon.

REMARKS: _____

RAILROAD COMMISSION OF TEXAS
OIL AND GAS DIVISION

OIL AND GAS DOCKET NO. 129

#4 - 10,237

IN RE: CONSERVATION AND PREVENTION OF WASTE OF CRUDE PETROLEUM AND NATURAL GAS IN THE SAXET (DEEP) FIELD, NUECES COUNTY, TEXAS.

Austin, Texas
February 24, 1947

SPECIAL ORDER GRANTING THE CHICAGO CORPORATION PERMISSION TO DUALLY COMPLETE ITS WELL BROS. NO. 5 WELL IN THE SAXET (DEEP) FIELD, NUECES COUNTY, TEXAS.

WHEREAS, After due notice, the Railroad Commission of Texas held a hearing on July 31, 1946, to consider the application of The Chicago Corporation to dually complete its Well Bros. No. 5 well in the Saxet (Deep) Field, Nueces County, Texas. and

WHEREAS, Pursuant to evidence adduced at said hearing, the Commission is of the opinion and finds that mechanical devices are available which are designed to permit the concurrent production of fluids from two different strata without commingling the fluids from the two separate strata within the bore of the well; and that said application should be granted as herein provided.

THEREFORE, IT IS ORDERED By the Railroad Commission of Texas that, effective February 24, 1947, The Chicago Corporation be and it is hereby granted permission to dually complete and produce its Well Bros. No. 5 well in the Saxet (Deep) Field, Nueces County, Texas, in such manner that gas is produced through the tubing from what they have designated the 7400 foot sand between 7393 and 7433 feet, and that oil and gas is produced through the annular space between the tubing and casing from what they have designated the McAllen Sand between 6922 and 6939 feet.

PROVIDED HOWEVER, That said well shall be completed and produced in such manner that there is no commingling within the bore of the well of fluids produced from any two separate strata encountered in said well.

PROVIDED FURTHER, However, that said well must be equipped in such manner that subsurface pressures may be determined on each of the two specified strata separately, and further that said well must be equipped with all necessary connections required to permit recording meters to be installed and used at any time so that when such meters are installed all natural gas produced from each separate stratum may be accurately measured.

PROVIDED FURTHER, However, that the operator shall make any and all tests or determinations at such times and in such manner as is deemed reasonably necessary by the Commission Engineering Department.

PROVIDED FURTHER, However, that prior to the time said well is dually completed that the operator shall supply the Commission Engineering Department for its approval with a plat or drawing showing the proposed method and manner of completion, together with an electrical log showing the location and extent of each separate stratum and the proposed perforations; and that said proposed method and manner of dual completion shall not be approved unless it is deemed by the Commission Engineering Department that said proposed method and manner will effectively and absolutely prevent the movement or migration of oil, gas or water from one stratum to another stratum.

IT IS FURTHER PROVIDED That the failure of the operator to comply with any provision or provisions of this order shall immediately terminate this order and all permission granted hereunder in its entirety.

IT IS FURTHER ORDERED By the Commission that the provisions of this order shall take precedence over any order heretofore entered by the Commission authorizing the dual completion of this well, and that any such order heretofore entered is cancelled hereby and shall have no further force or effect.

IT IS FURTHER ORDERED That this cause be held open on the docket for such other and further orders as may be necessary.

RAILROAD COMMISSION OF TEXAS
Ernest O. Thompson, Chairman
Olin Culberson, Commissioner

(S E A L)
ATTEST:
K. C. Miller, Secretary

BEFORE THE OIL CONSERVATION COMMISSION
OF THE STATE OF NEW MEXICO

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

CASE NO. 92

ORDER NO. 713

THE APPLICATION OF GULF OIL CORPORATION FOR THE ISSUANCE OF A SPECIAL ORDER PERMITTING THE PRODUCTION OF MORE THAN ONE HORIZON THROUGH A SINGLE WELL BORE IN THE WEST GRIMES NO. 4, HOBBS POOL, LEA COUNTY.

ORDER OF THE COMMISSION

BY THE COMMISSION:

This cause came on for hearing at ten o'clock A.M. on January 10, and April 15, 1947, at Santa Fe, New Mexico before the Oil Conservation Commission of New Mexico, hereinafter referred to as the "Commission".

NOW, on this 16th day of July, 1947, the Commission, having before it for consideration the testimony adduced at the hearings aforesaid.

FINDS:

1. That the Commission has jurisdiction of the subject matter.

2. That there is conflicting evidence as to whether or not mechanical devices are available which permit concurrent production of gas and/or oil and gas from two or more different strata or pools from a single well bore without commingling.

3. That additional evidence as to the efficiency of mechanical packers and devices for dual production by single well bore could be had by an experiment under specific control as contemplated by the petition filed herein.

IT IS THEREFORE ORDERED THAT:

Effective the 16th day of July 1947, the Gulf Oil Corporation be and is hereby granted permission to dually complete and produce its West Grimes No. 4 well located in the NE¼NE¼NW¼ of Section 32, Township 18 South, Range 38 East, New Mexico, in the Hobbs pool in Lea County in such manner that gas may be produced from the Byers gas sand from 3630 feet to 3700 feet and that oil and gas or gas may be produced from the Bowers sand from approximately 3150 feet to 3170 feet through the same well bore.

PROVIDED that said well shall be completed and produced in such a manner that there will be no commingling within the well bore of the well of gas, or oil and gas produced from the two or more separate strata, and

PROVIDED further that said well must be equipped in such a manner that reservoir pressures may be determined on each of the two specified strata separately, and further that said well must be equipped with all necessary connections required to permit recording meters to be installed and used at any time so that when such meters are installed all natural gas oil and/or oil and gas from each separate stratum may be accurately measured and the gas-oil ratio determined, and,

PROVIDED further that the operator shall make any and all tests or determinations at any such times and in such manner as is deemed reasonably necessary by the Commission, and,

PROVIDED further that segregation tests to determine that seal between the two strata is being maintained shall be conducted and reported to the Commission at reasonable intervals.

PROVIDED further that prior to the time said well is dually completed the operator shall supply the Commission for its approval with a plat or a drawing showing the proposed method and manner of completion, together with an electrical or radio activity log showing the location and extent of each separate stratum and the proposed perforations, and

PROVIDED further that upon completion of the well the operator shall submit to the Commission a diagramatic sketch of the mechanical installation which was actually employed to produce the seal from both zones, showing type and location of packers, other devices used, location and extent of perforations, name and depth of each producing horizon and a special report of production, gas-oil ratio and reservoir pressure determinations of each horizon at time of completion.

It is further provided that upon failure of the operator to comply with any provision or provisions of this order, then the permission hereinunder shall immediately terminate.

It is further ordered that jurisdiction in this case be retained by the Commission with full authority to issue further special orders as from time to time may be necessary or convenient.

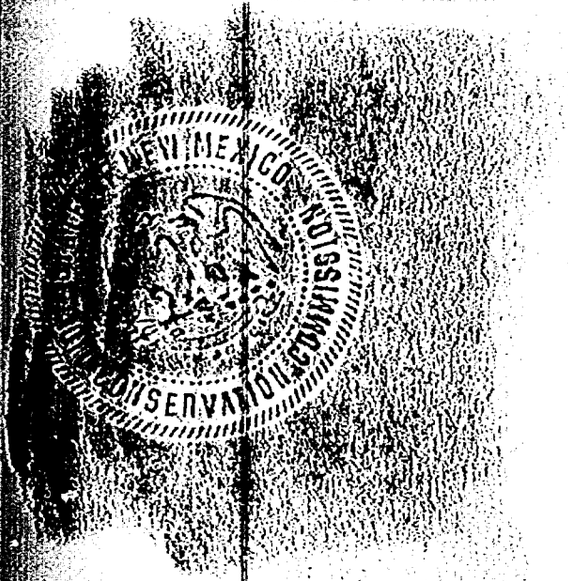
DONE at Santa Fe, New Mexico, on the day and year hereinabove designated.

OIL CONSERVATION COMMISSION

Thos. J. Mabry
CHAIRMAN

John E. Miles
MEMBER

R. R. Spurrier
SECRETARY



April 15, 1947

Register

Cases 92, 93, 94, 95, 96, 97, 98

Name	Company	Address
Russell G. Lowe	Gulf Oil Corporation	Tulsa Okla
Dayton Howard	Shell Oil Co	Midland, Tex
C. W. Faris	Shell	Midland
[illegible]	Gulf Oil Corp	Tulsa Okla
W. E. Hubbard	Humble	Houston
[illegible]	✓	✓
J. W. House	✓	Midland
[illegible]	✓	—
Eugene [illegible]	Gulf Oil Corp	Tulsa
[illegible]	Self	Artesia
Neil B. Watson	attorney	Artesia, N. M.
Emery Carper	Carper Drilling Co	
[illegible]	The Superior Oil Co	Houston, Tex
[illegible] Ballinger	Shell	Hobbs
John [illegible]	Independent	Roswell
Harry J. Gibbons	Skelly Oil Co.	Tulsa.
J. N. Dunlavey	✓ ✓ ✓	Hobbs
G. W. [illegible]	— — —	Tulsa
Chuck Aston	Consultant for Aston & Fair	Artesia
Donald S. Bush	Lawyer	Artesia
Bert Aston	Aston & Fair	Roswell
[illegible]	[illegible] Oil Co.	Artesia
[illegible]	[illegible] Oil Co	Artesia
[illegible]	[illegible]	Artesia N. M.
[illegible]		
W. B. Macey	N. M. Oil Conservation Comm.	Artesia, N. M.
H. C. Laird	Otis Engineering Corp.	Dallas, Texas
[illegible]	[illegible] Oil Corp.	Hobbs, N. M.
E. J. Gallagher	Gulf	Hobbs, N. M.
[illegible] Lowe	Amerada	Ft. Worth
W. G. Ricketts	"	Tulsa
E. H. Gray	Republic	Midland
W. N. Little	Tide Water Assoc.	Midland
D. R. McKeithan	Phillips Pet. Co.	Bartlesville, Okla.
E. H. Foster	" " "	Amarillo, Texas
Burney Braly	Continental Oil Co	Fort Worth
[illegible]	" " "	Ponca City, Okla.
Edgar Kraus	Atlantic Rfg Co	Dallas Tex
A. B. Tarrow	The Atlantic Refining Co	Dallas Texas
S. B. Christy Jr	Sun Oil Co	Roswell
[illegible]	Drilling & Exploration Co	Hobbs
H. T. Beardmore	Barnsdall Oil	Tulsa Okla
[illegible]	Sun Oil Co	Dallas Tx
Martyn A. Row	Sun Oil Co	Dallas, Tex
[illegible]	[illegible]	[illegible]

Name	Company	Address
D. A. Muller	Phillips Petr. Co.	Midland Tex.
H. B. Hurley	Continental Oil Co	Ft Worth, Tex.
M. H. Dubrow	" "	" "
A. L. Decker	" "	" "
Clay H. Perry	Warren Pet. Corp.	Tulsa, Okla.
R. E. McMillan	Ohio Oil Co	Midland, Texas
[illegible]	N.M. Bureau Mines & Min Res.	Artesia N.M.
Roy T. Durst	Rowan Drlg. Co	Midland, Tex.
C. M. Williams	Texas Co	Ft Worth
A. E. Willig	✓ ✓	✓
H. D. Murray		Midland Texas
R. G. Schuehle	Tex. Pac. Coal & Oil Co	Midland Tex
D. S. Goggins	Standard of Texas	Midland
A. E. Worthy	Stanolind Oil & Gas Co	Fort Worth - Tex
N. H. Card	Stanolind Oil & Gas Co	Ft Worth
Lewis Finch Jr.	Stanolind Oil & Gas Co.	Ft. Worth, Tex.
J. O. Seth	" " " "	Santa Fe, N.M.
Ralph L. Gray	" " "	Hobbs, N. Mex.
Glenn Staley	Lea County Operators	
Arch Rowan	Rowan Drilling Co	Ft Worth Texas
R. W. Tesch	T. P. Coal. & Oil Co.	Ft. Worth
Henry Forbes	Continental Oil Co.	Hobbs, N Mex
S. V. McCollum	Continental Oil Co	Midland, Tex
Foster Morrell	U.S. Geological Survey	Roswell, N.M.

NOTICE OF PUBLICATION
STATE OF NEW MEXICO
OIL CONSERVATION COMMISSION

Get exhibit spec. Can.

The Oil Conservation Commission, as provided by law, hereby gives notice of the following hearings to be held at Santa Fe, New Mexico, at 10:00 A.M., April 15, 1947

Case 95

In the matter of the application of V. S. Welch for an order granting an unorthodox well location in the NE NE Section 36, Township 16 South, Range 30 East, N.M.P.M. Eddy County, New Mexico and to be located 990 feet South of the North line and 1300 feet West of the East line of said Section 36.

Case 96

In the matter of the application of The Scheurich Unit for such orders as may be necessary to accomplish the following:

Approval of an operating agreement embracing $S\frac{1}{2}$ of $NW\frac{1}{4}$ and $N\frac{1}{2}$ of $SW\frac{1}{4}$ of Section 32, Township 17 South, Range 30 East, N.M.P.M. containing 160 acres, more or less, Eddy County, New Mexico; amendment of the Loco Hills Pressure Maintenance Order No. 562 in so far as the same applies to said 160-acre tract; the grant of an exception to existing spacing rule so as to permit the location of a well 2310 feet from the North Line and 1260 feet from the West line of said Section 32, and being within the SW/4 of the NW/4 of said section; and the grant of permission to transfer the allowable of Aston and Fair-Scheurich-State No. 4, an input well, upon NE SW of said sections, to one or more other wells or forty-acre proration units within said 160 acre tract.

Case 97

In the matter of the application of the Oil Conservation Commission upon its own motion for an order regarding tank batteries for separate pools and whether one tank battery shall serve one pool only or whether separate tank batteries shall be employed for separate pools.

Case 98

In the matter of the application of the Oil Conservation Commission for an order governing gas-oil ratios for Lea, Eddy, and Chavez counties, New Mexico.

Case 92 Shasler

In the matter of the Application of Gulf Oil Corporation for issuance of a Special Order permitting the production of more than one horizon or pool through a single well bore in the Hobbs Pool, Lea County, N.M.

Case 93

In the matter of the Application of Gulf Oil Corporation for the issuance of a Special Order permitting the production of more than one horizon or pool through a single well bore in the Paddock, Drinkard, Brunson, Jones and Blinbry Pools, Lea County, New Mexico.

Case 94

In the matter of the Application of Gulf Oil Corporation for the promulgation of a General Order permitting and controlling production from more than one horizon or pool through a single well bore.

Note: Cases 92, 93 and 94 were in part heard January 10, 1947 and are continued to April 15th as indicated above.

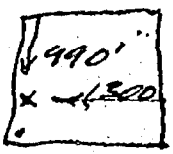
Given under the seal of siad Commission at Santa Fe, New Mexico on March____1947.

OIL CONSERVATION COMMISSION

By: (Signed) R. R. SPURRIER, Secretary

SEAL

10%
14 - 21%
10 - 28%



Saving
2000 - 34%

avg
2166 - Monument - Jordan - 2581
3000 - 14%

Grayburg - Jackson area
72 producing 16.10
6 input
5000/1

77% returned

LEA COUNTY OPERATORS COMMITTEE
March 27, 1947

Phillips

STATEMENT OF PHILLIPS PETROLEUM COMPANY

ON

The Subject of Dual -- Completions in New Mexico

Under ordinary competitive peace-time operations we believe the production of two oil reservoirs by means of a dual-completion is in general unwise and should be definitely discouraged in almost all future instances. There is little doubt but that in a vast majority of cases such practice will lead to smaller ultimate recovery of oil from at least one of the reservoirs involved. In addition we feel that added operating problems are numerous and dangerous and far out-weigh any savings that might be realized in the initial development costs. It is likewise perfectly obvious to us that producing oil through the annulus is inefficient and will certainly result in shortening the flowing life of wells.

We further believe that with proper well spacing it is entirely possible to economically develop each producing oil reservoir in a field on an individual well basis, thus mostly eliminating the need for dual-completions. There are some instances where extremely thin sand sections or lean reservoirs cannot be spaced in a manner to permit individual well development of each oil reservoir. Under such circumstances, if segregation of production is considered necessary, dual-completions might rightly be the solution to the problem.

When development is being carried on in conjunction with a plan of controlled pressure maintenance there are undoubtedly certain other instances where dual oil completions might be amply justified.

Dual oil-gas and dual gas-gas completions are not so susceptible to the many problems consistently found in the dual completion of oil-oil wells. We, therefore, feel that the range of application is considerably broader and should be looked upon with greater general favor. However, it is suggested that even in this type of dual-completion, each case should stand on its own merits.

In conclusion, we would like to urge the Commission to adopt a policy of holding hearings and carefully checking each individual well application for all types of dual-completions and that permits be issued only after suitable evidence has been received.

DIAGRAM OF TYPICAL DUAL COMPLETION

LOWER ZONE THROUGH TUBING
UPPER ZONE THROUGH ANNULUS

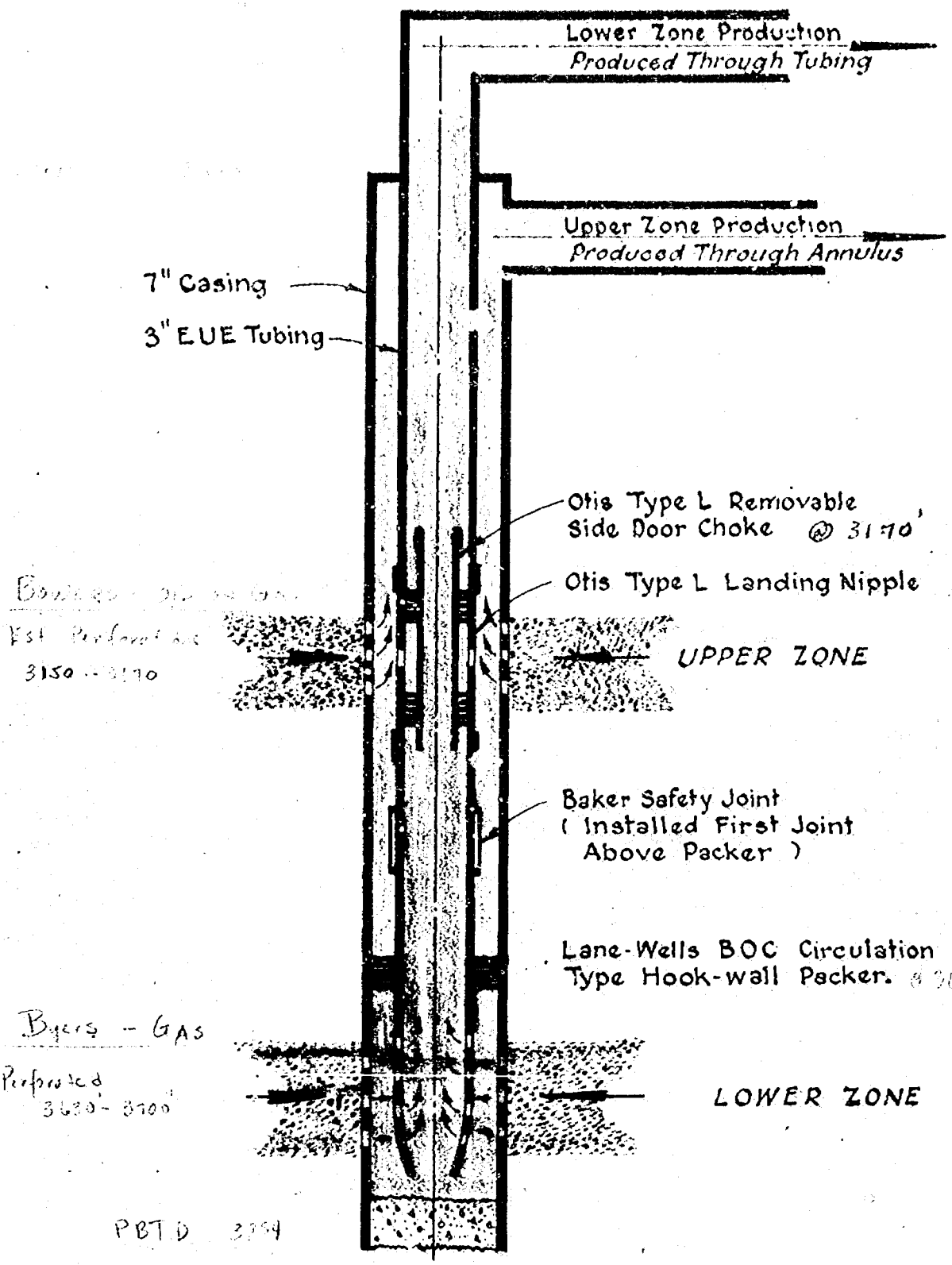


FIG 1

The Atlantic Refining Company does not believe that the Oil Conservation Commission of New Mexico should adopt any state-wide rule prohibiting the dual completion of wells in the State because conditions vary in the different fields.

Our experiences elsewhere with respect to dual completions have been varied in that in some instances we have met with considerable success while elsewhere the success of these operations is doubtful. It is for this reason that the Atlantic Refining Company does not favor the adoption of any state-wide rule with respect to dual completions.

The Atlantic Refining Company does, however, favor a policy with respect to dual completion whereby the dual completion of any well will be permitted by the Commission after the Commission shall have determined, at public hearing held after the issuance of notice to interested parties, that such dual completion is feasible as to such well.

PETROLEUM AND ITS PRODUCTS

GULF OIL CORPORATION

P. O. BOX 661 · TULSA 2, OKLAHOMA

GYPSY DIVISION

March 30, 1948

New Mexico Conservation Commission
Santa Fe, New Mexico

Attention: Mr. R. R. Spurrier

Gentlemen:

Attached is a memorandum summarizing the dual completion of our West Grimes No. 4 located in the Bowers Pool. Since it was necessary to repair a casing leak and some mechanical difficulty was encountered with the special Baker packer, etc., the completion time extended from September 16, 1947, to January 23, 1948. For the sake of clarity, we have summarized the completion procedure. A diagrammatic sketch illustrating the mechanical installation used, a radioactivity log, three bottom-hole pressure charts and six recorder charts are also included herein.

We have attempted to comply with all of the conditions as set forth in your Order No. 731 effective July 16, 1947. The well was dually completed on January 23, 1948, in the Bowers oil sand (upper zone) and the Byers gas sand (lower zone). At the present time, the well is producing its top allowable of 44 barrels of oil per day from the Bowers sand through the annular space between the tubing and casing. Approximately 79,000 cu.ft. of gas per day from the Byers gas sand is being produced through the tubing.

The mechanical installation as illustrated on the sketch shows a Lane-Wells packer set at 3563'.

Results of the three-day segregation tests offer sufficient data to prove that a seal does exist between the two producing zones. Also, a production test of the Byers sand and a production and gas-oil ratio test of the Bowers sand were made during the segregation tests, which data show that production from the two zones is not being commingled in the well bore.

Yours very truly,

S. G. Sanderson
Manager of Production

WEB:JHR
Att.

DUAL COMPLETION OF GULF-WEST GRIMES NO. 4

Gulf Oil Corporation's West Grimes No. 4, located in the NE NE NW of Section 32-18S-38E, Lea County, New Mexico, was dually completed from the Bowers oil sand (upper zone) and the Byers gas sand (lower zone) on January 23, 1948. Prior to September 16, 1947, when the dual completion procedure was started, the well had been producing from only the Byers gas sand through perforations in the 7" OD casing from 3630-3700'. In the New Mexico Oil Conservation Commission's Order No. 731, it is required that the State be furnished with the following information:

1. A diagrammatic sketch of the mechanical installation used.

2. A radioactivity log showing the location and extent of each producing zone and perforations.

3. Data on production, gas-oil ratio, and bottom-hole pressure tests at time of completion.

4. Results of segregation tests conducted to determine that a seal exists between the two producing formations.

A brief summary of the procedure used in dually completing the well is submitted below:

Completion Procedure

1. Well was killed with oil and Dia-Log Casing Survey was run to determine general condition of the 7" OD casing.

2. A Lane-Wells radioactivity log was run from 2500-2864'.

3. Byers gas sand reperforated from 3604-17', 3628-33', 3646-53', and 3662-81' to expose all possible sand and to clean old perforations from 3630-3700'. See attached log.

4. Set Baker size 87, #415-B, continuous double-seal, double-slip production packer with tubing at 3589'. This special packer was used in an attempt to protect the Byers gas sand from mud used to kill the Bowers oil sand, since the formation pressure of the Byers was considerably lower than that of the Bowers.

5. Swabbed and flowed well through tubing to revive the Byers gas sand for test purposes. Casing remained full of oil indicating that the Baker packer was holding.

6. Ran BHP gauge and recorded static bottom-hole pressure of Byers gas sand at 3589'. See BHP Chart No. 1.

7. Killed well with oil through tubing, pulled tubing, leaving packer in place, and spotted mud, plastic and Calseal on top of the Baker packer to protect it from foreign matter.

8. Repaired leaks in 7" OD casing and satisfactorily tested casing at 2000 psi pressure for one-half hour.

9. Perforated Bowers sand section from 3147-65' with six holes per foot and 3186-95' with four holes per foot. See attached log.

10. D.S.T. with packer at 3123' and tool open 6-1/4 hours with 30-minute build-up. Well flowed 2.8 barrels of 39.5° API oil with 1,450 Mcf gas. Recovered 126' of oil, 50' slightly salty water and 5' of clean sand. Bottom-hole flowing pressure 400 to 900 psi with 1500 psi build-up.

11. Cleaned up casing, drilled out Calseal and plastic, and flowed Bowers pay through casing and tubing.

12. Ran BHP gauge and recorded static bottom-hole pressure of Bowers sand at 3550'. See BHP Chart No. 2.

13. Due to mechanical failure of Baker packer, set Lane-Wells circulating type BOC packer at 3563' with tubing. Swabbed and flowed tubing to revive Byers gas sand. Bowers zone being produced through annular space between tubing and casing.

Mechanical Installation

The mechanical installation which was actually used to effect a seal between both zones showing the packer, casing perforations, and the name and depth of each producing horizon is shown on the attached diagrammatic sketch. The well is equipped in such a manner that recording meters can be installed at the surface at any time to measure the gas, oil and/or oil and gas from each separate producing zone.

Production, GOR and BHP Tests

	Bowers Sand		Byers Sand
Date Taken	12-24-47	1-22-48	1-23-48
Oil - B/D	49	37.8	-
Water - B/D	0	0	-
Gas - Mcf/D	668.4	401.10	436.69
GOR - CF/B	13,641	10,620	-

The tests taken 1-22-48 and 1-23-48 were made during the segregation tests. The Bowers sand has produced its allowable of 44 bpd since the well was completed and the current production from the Byers sand is approximately 79 Mcf gas per day.

Static bottom-hole pressure determinations of the two producing formations are tabulated below:

	Bowers	Byers
Date	11-18-47	10-6-47
Depth of Gauge	3550'	3589'
Static BHP	1818 psi (BHP Chart No. 2)	720 psi (BHP Chart No. 1)

The Byers subsurface pressure was recorded before the Bowers sand was tested. The bottom-hole pressure of the Bowers sand was determined just prior to reviving the Byers gas sand.

Segregation Tests

Dual recorders were installed on the casinghead connections at the surface in order to measure the oil and gas produced. The segregation tests as conducted at the completion of the mechanical installation illustrated, prove that a seal does exist between the two producing zones. The procedure followed in making these segregation tests is as follows:

1-20-48 - Both tubing and casing shut-in and dual surface pressure recorder installed at 9:00 AM. Within approximately four hours, the tubing pressure had leveled off at 560 psi and within approximately three hours, the casing pressure had leveled off at 1025 psi to 1035 psi. See attached Dual Recorder Chart No. 1.

1-21-48 - Both zones shut-in until 3:30 PM, at which time the casing was opened to produce the Bowers zone. Shut-in casing pressure 1045 to 1050 psi, tubing pressure 550 to 570 psi. After opening the casing, the tubing pressure varied from 550 to 525 psi which was probably due entirely to a small surface leak in the testing equipment. The casing pressure dropped from a static pressure of 1050 psi to a flowing pressure of approximately 930 psi for a short period and then varied from 890 to 960 psi. See attached Dual Recorder Chart No. 2. Gas-oil ratio test started at 4:30 PM on Bowers zone (casing) with a 3/4" Orifice Well Tester Plate and a recording meter. See attached Chart No. 5.

1-22-48 - Tubing remained closed. Casing remained open until 4:30 PM, at which time it was closed. Shut-in tubing pressure varied from 525 to 550 psi. Flowing casing pressure varied from 890 to 935 psi. Casing pressure raised rapidly from 915 to 1025 psi after closing the casing. Shut-in casing pressure remained fairly constant at 1030 psi. See attached Chart No. 3. During gas-oil ratio test, Bowers sand produced 37.80 barrels of oil in twenty-four hours with 401.10 Mcf gas (3/4" plate w/28 psi). See attached Chart No. 5.

1-23-48 - Casing remained closed to completion of segregation test at a fairly uniform pressure of 1040 psi. At 9:00 AM, the tubing was opened with a very rapid decrease in pressure to approximately 25 psi. See attached Chart No. 4. After flowing the Byers gas sand (tubing) for approximately five hours, it produced gas at the rate of 436.69 Mcf per day (1" plate - 12.5 psi). See attached Chart No. 6.

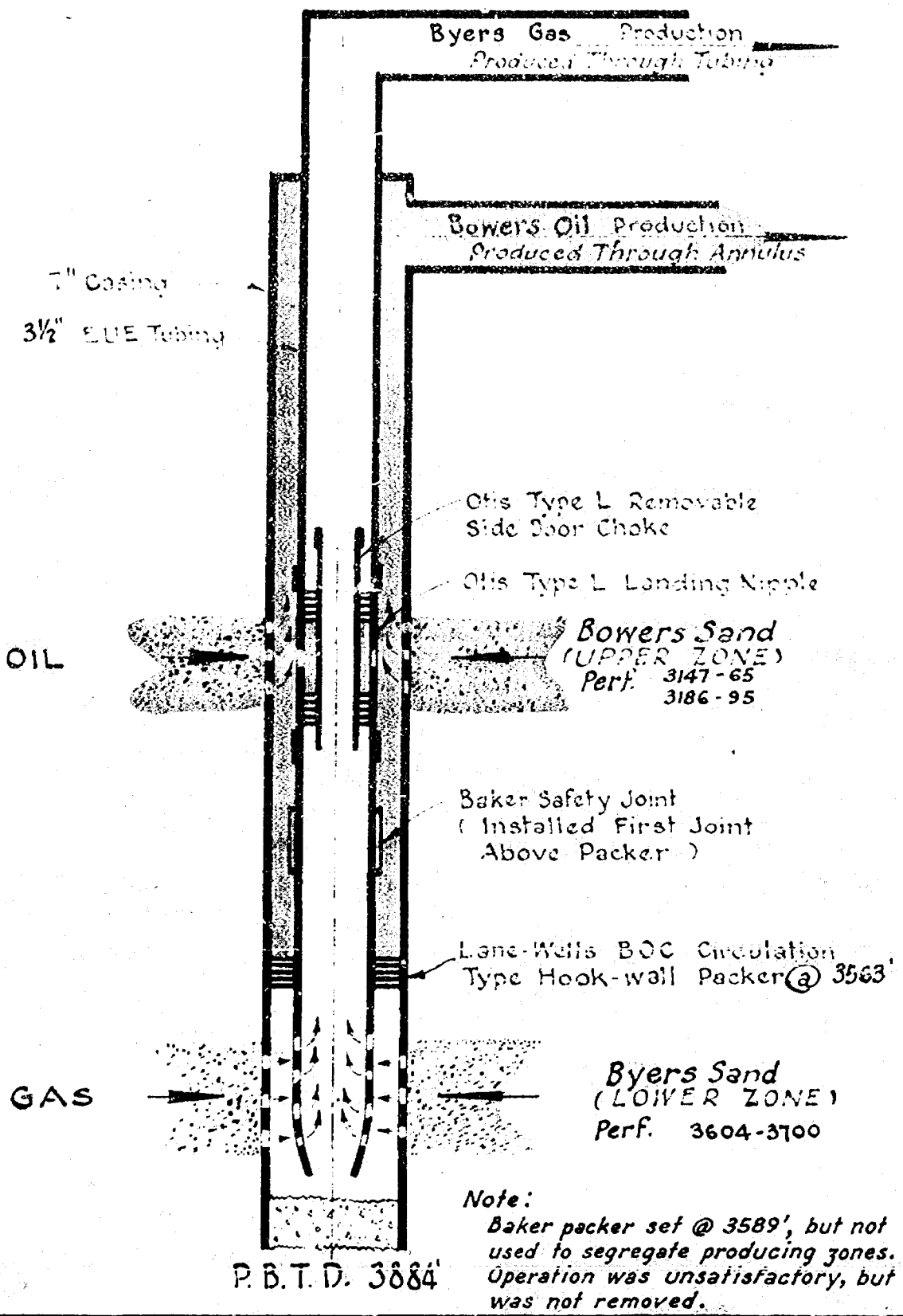
Also attached is a bottom-hole pressure chart indicating the subsurface tubing pressure during the segregation tests. See BHP Chart No. 3.

WEB:JHR
March 30, 1948

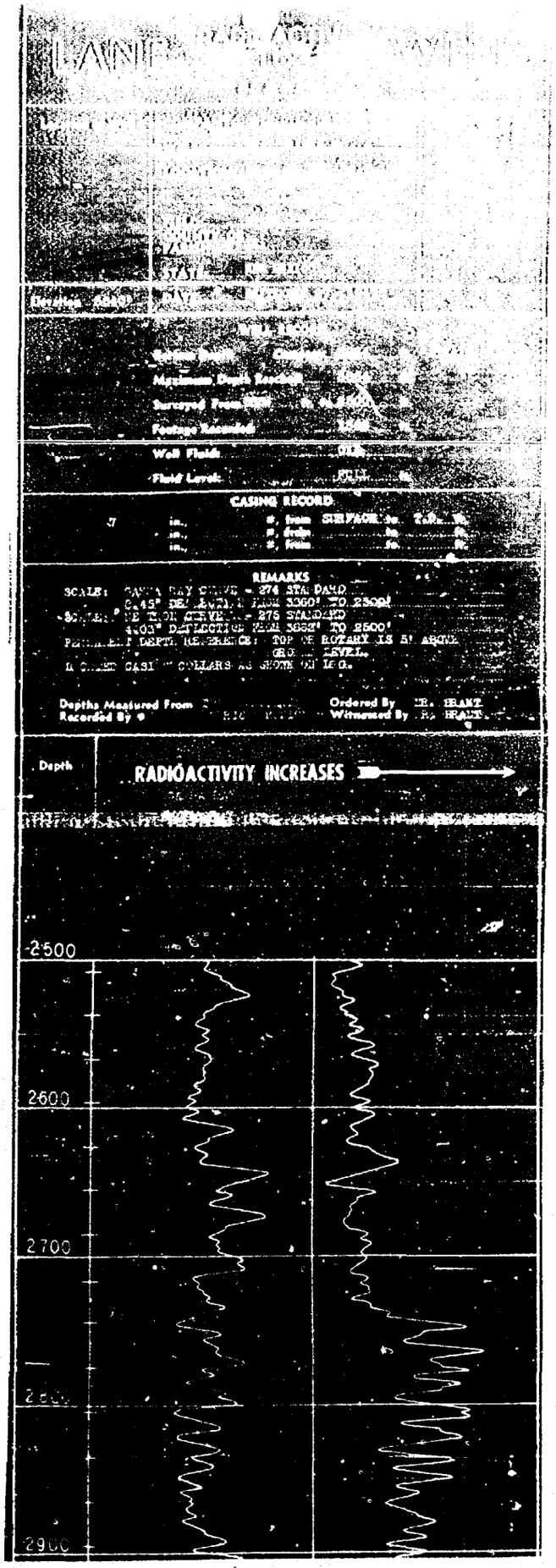
Att. 11:
1 Radioactivity Log
3 BHP Charts
6 Recorder Charts
1 Diagrammatic Sketch

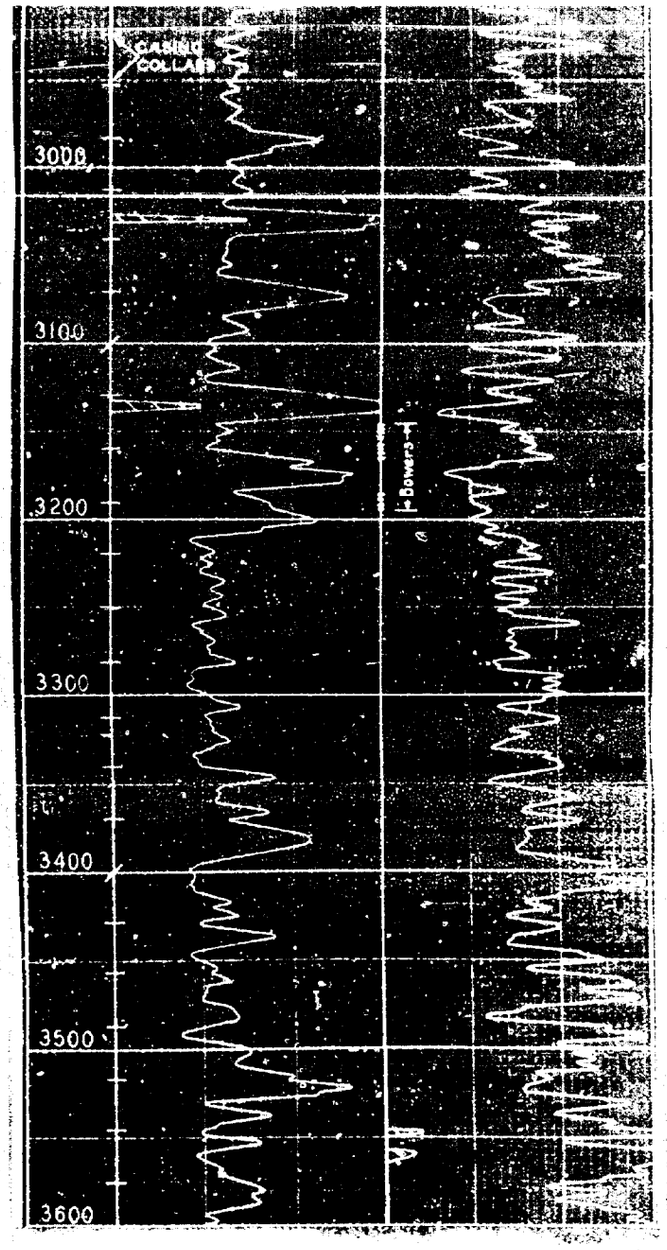
DIAGRAM OF DUAL COMPLETION - GULF WEST GRIMES #4

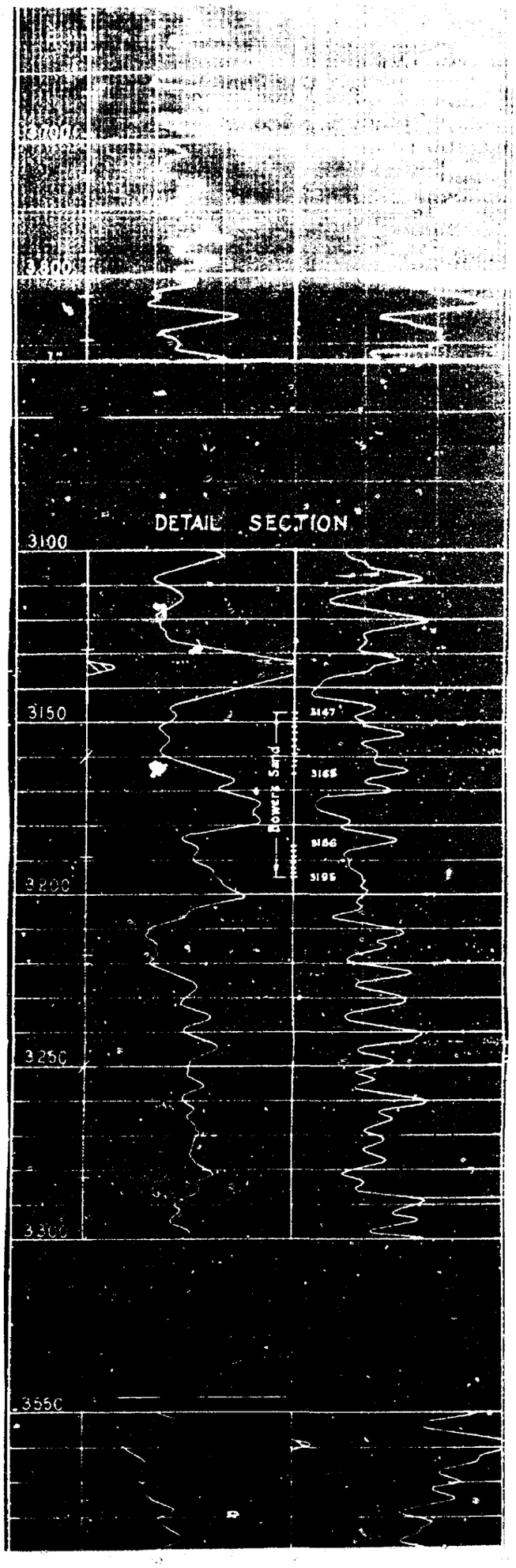
BYERS GAS SAND (LOWER ZONE) THROUGH TUBING
BOWERS OIL SAND (UPPER ZONE) THROUGH ANNULUS

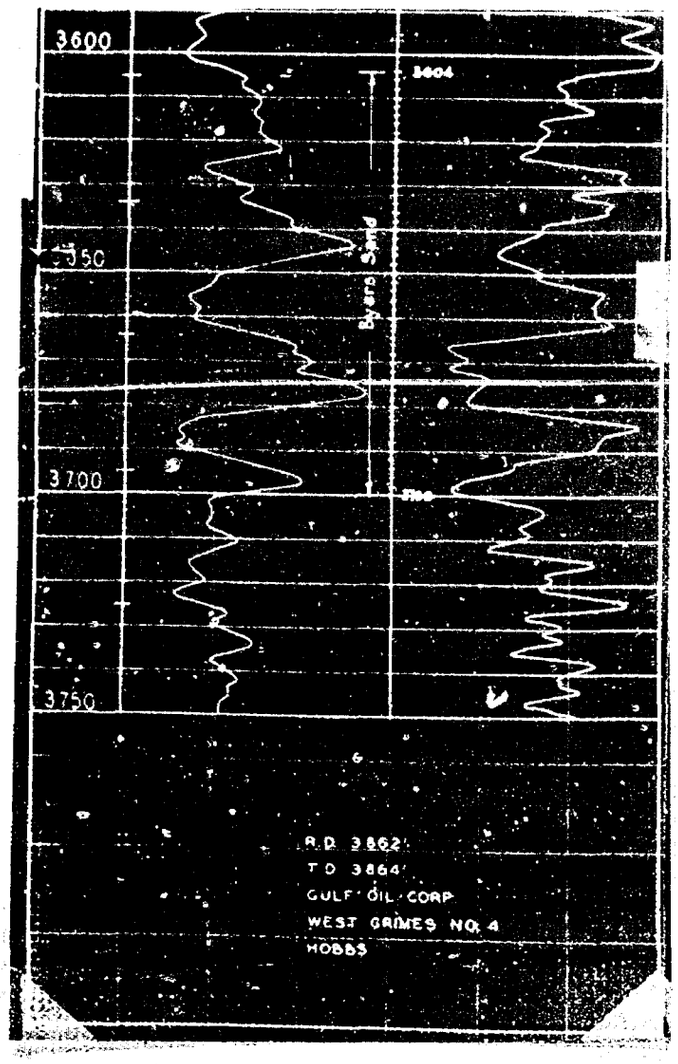


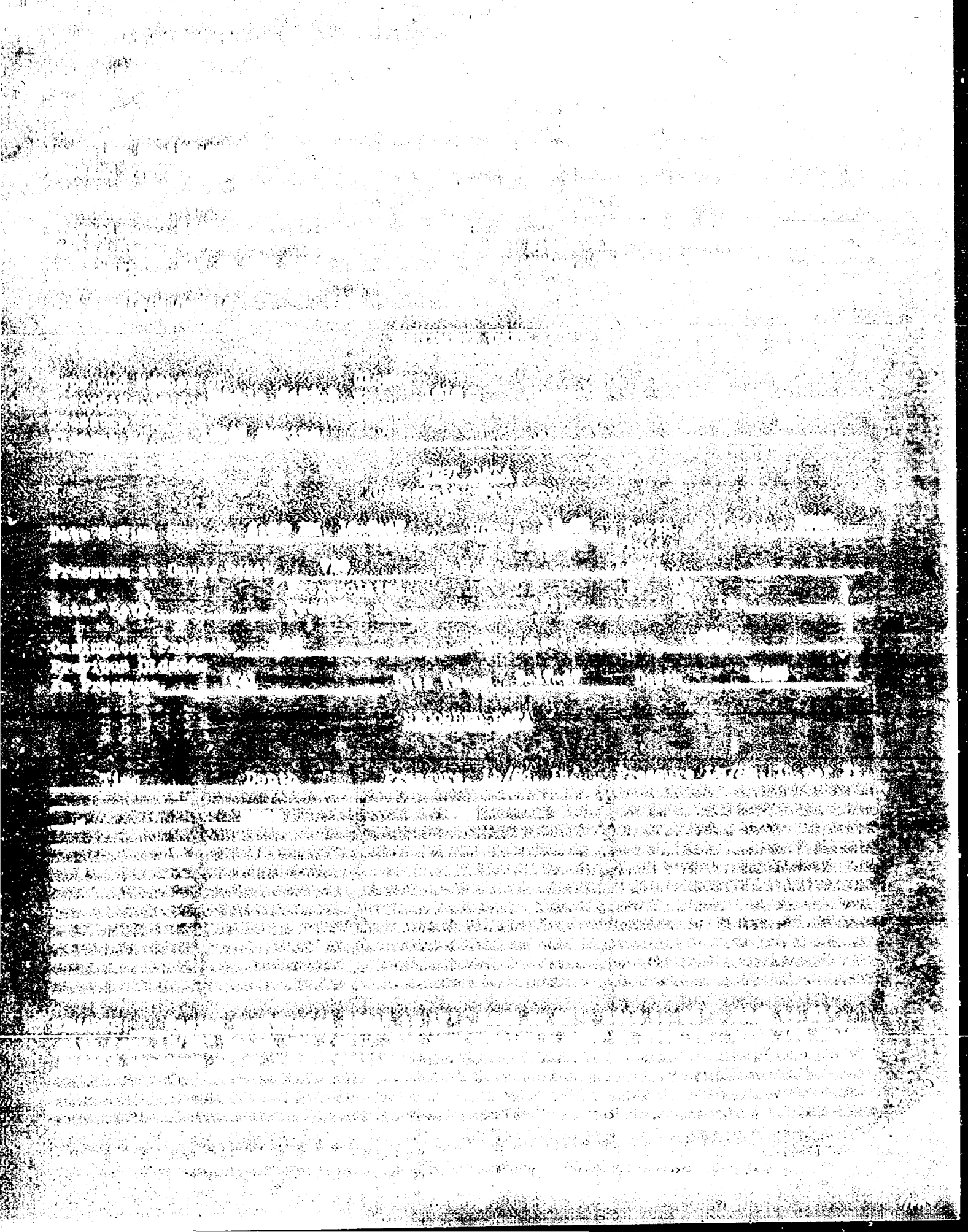
Note:
Baker packer set @ 3589', but not used to segregate producing zones. Operation was unsatisfactory, but was not removed.








3600
3650
3700
3750
Byers Sand
3804
R.D. 3862'
T.D. 3864'
GULF OIL CORP.
WEST GRIMES NO. 4
HOBBS



Date & Time Shut In [illegible] Hours [illegible] Depth of Gauge [illegible]

Pressure at Gauge Depth [illegible] P.S.I.

Water Level [illegible] Ft. [illegible] In.

Casinghead Pressure 660 Tubinghead Pressure 660

B.H.P. CHART No. 1

Date & Time Shut In_____

Pressure at Gauge Depth_____

Water Level_____ Pressure_____

Casinghead Pressure_____ Tubing Pressure_____

Previous Closed-
In Pressure_____ Hour_____ Date Taken_____

Time	Depth	Pressure

Remarks:_____

Gauge Run By_____

SURFACE PRESSURE DATA

Oil Producer

Type and Number of Recording Gauge
Pressure
Element No. 4000 Capacity

Date & Time Shut In 11-14-47 @ 4 P.M. Hours 60 Depth of Gauge 3800 Ft.

Pressure at Gauge Depth 1818 B.H.P. Extrapolated

Water Level Pressure at Ft. Sq. In.

Casinghead Pressure 1480 Tubinghead Pressure 1440

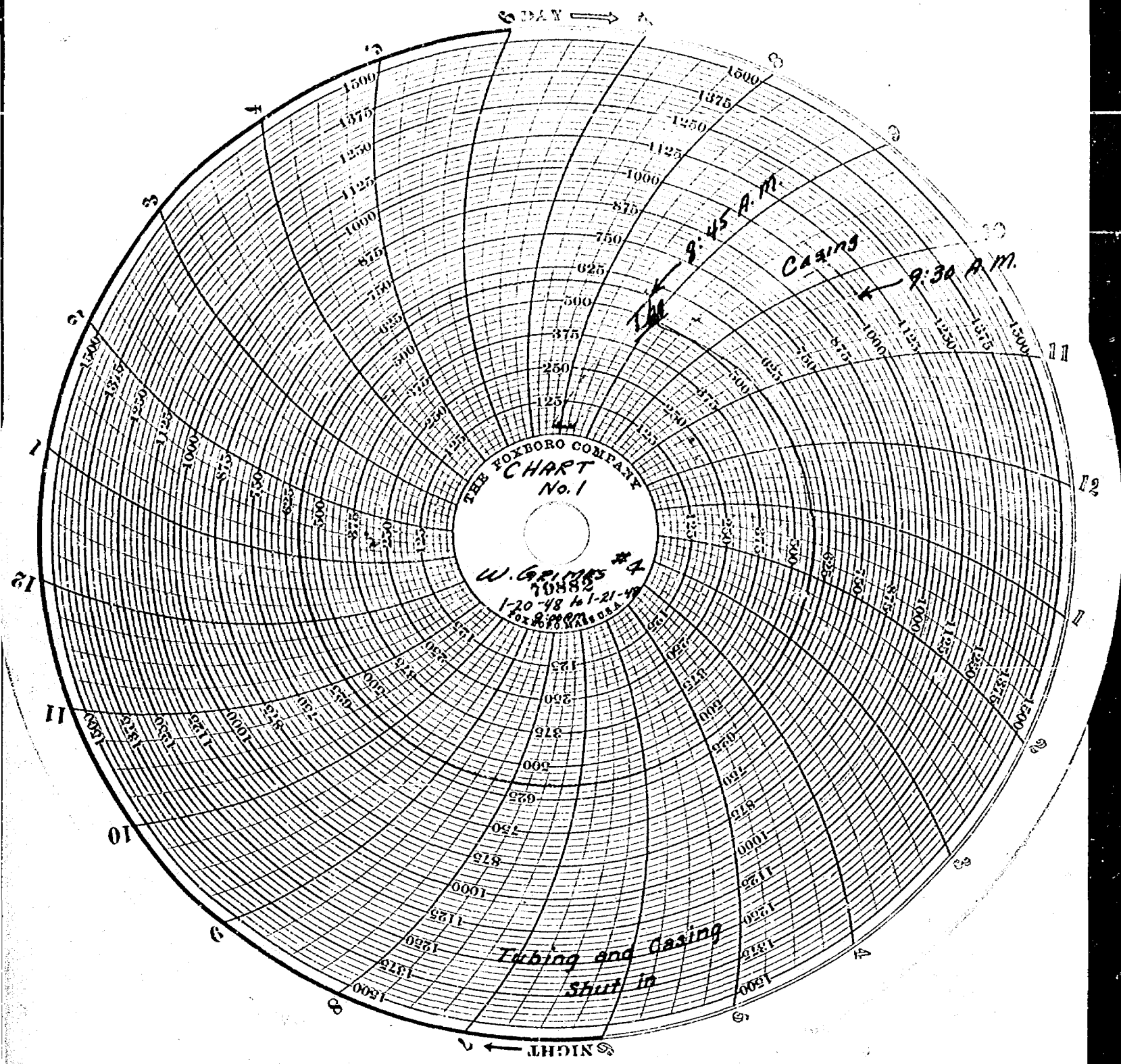
Previous Closed-In Pressure None Date Taken Depth

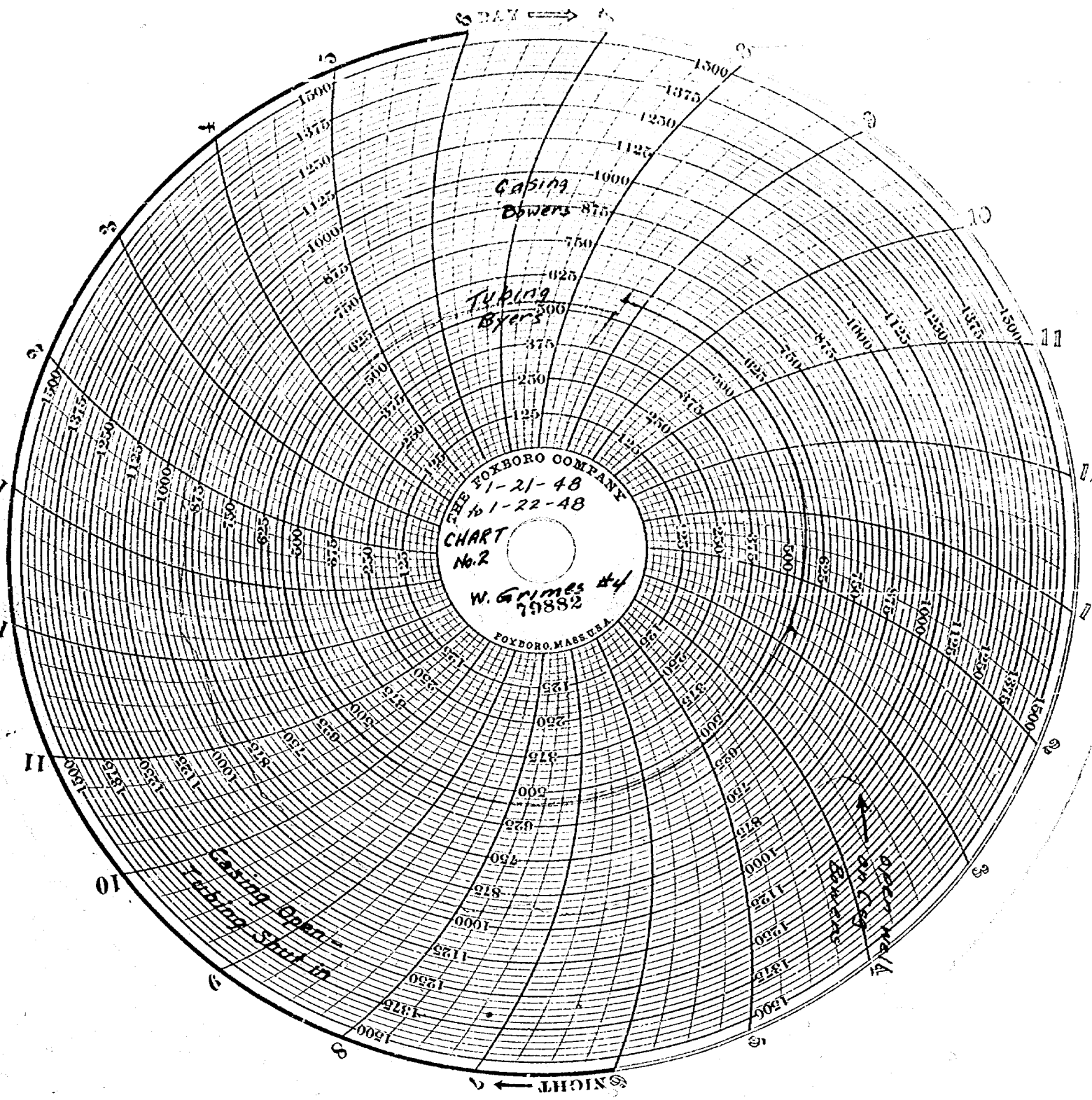
B.H.P. CHART No. 2

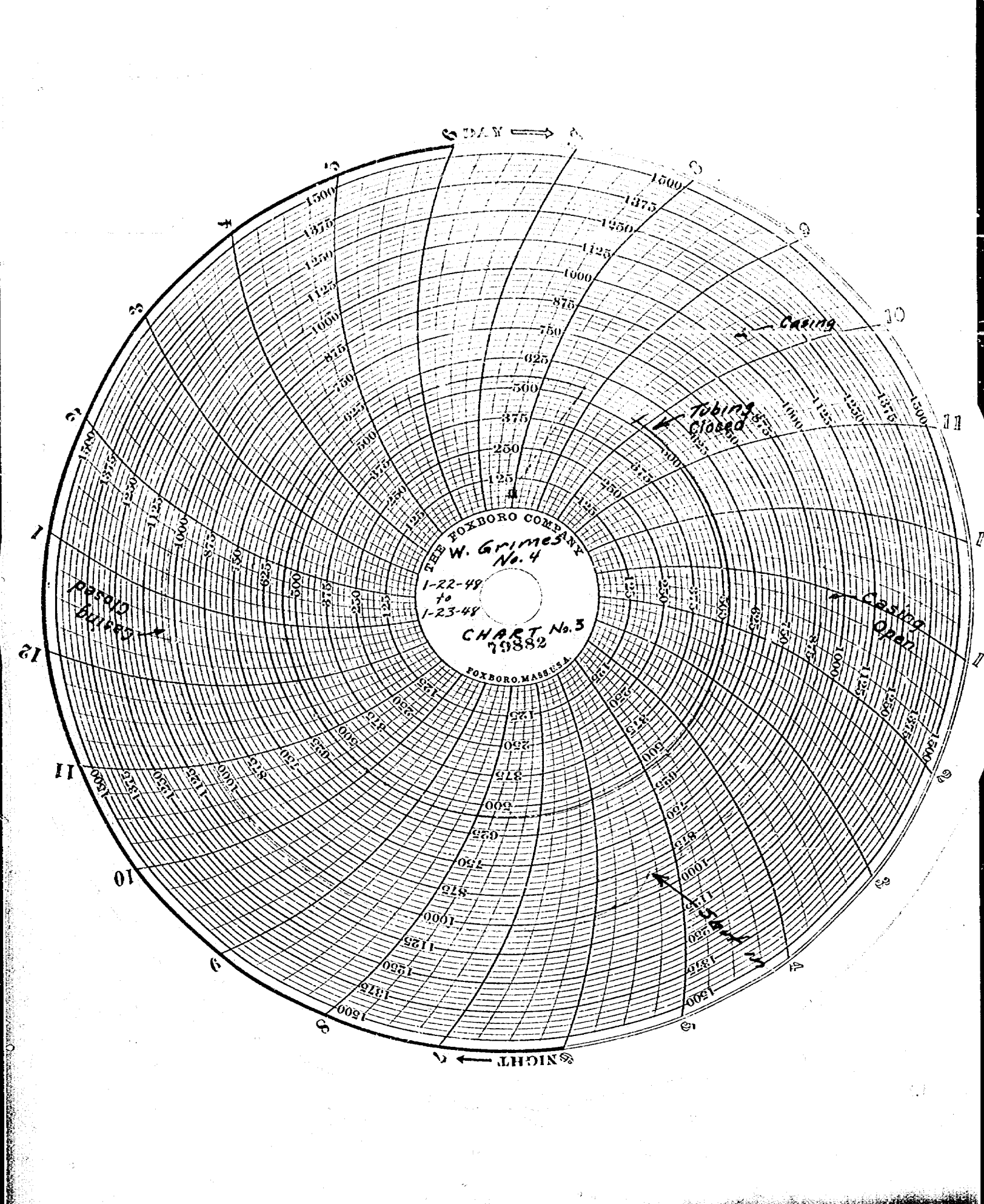
Gauge Run By

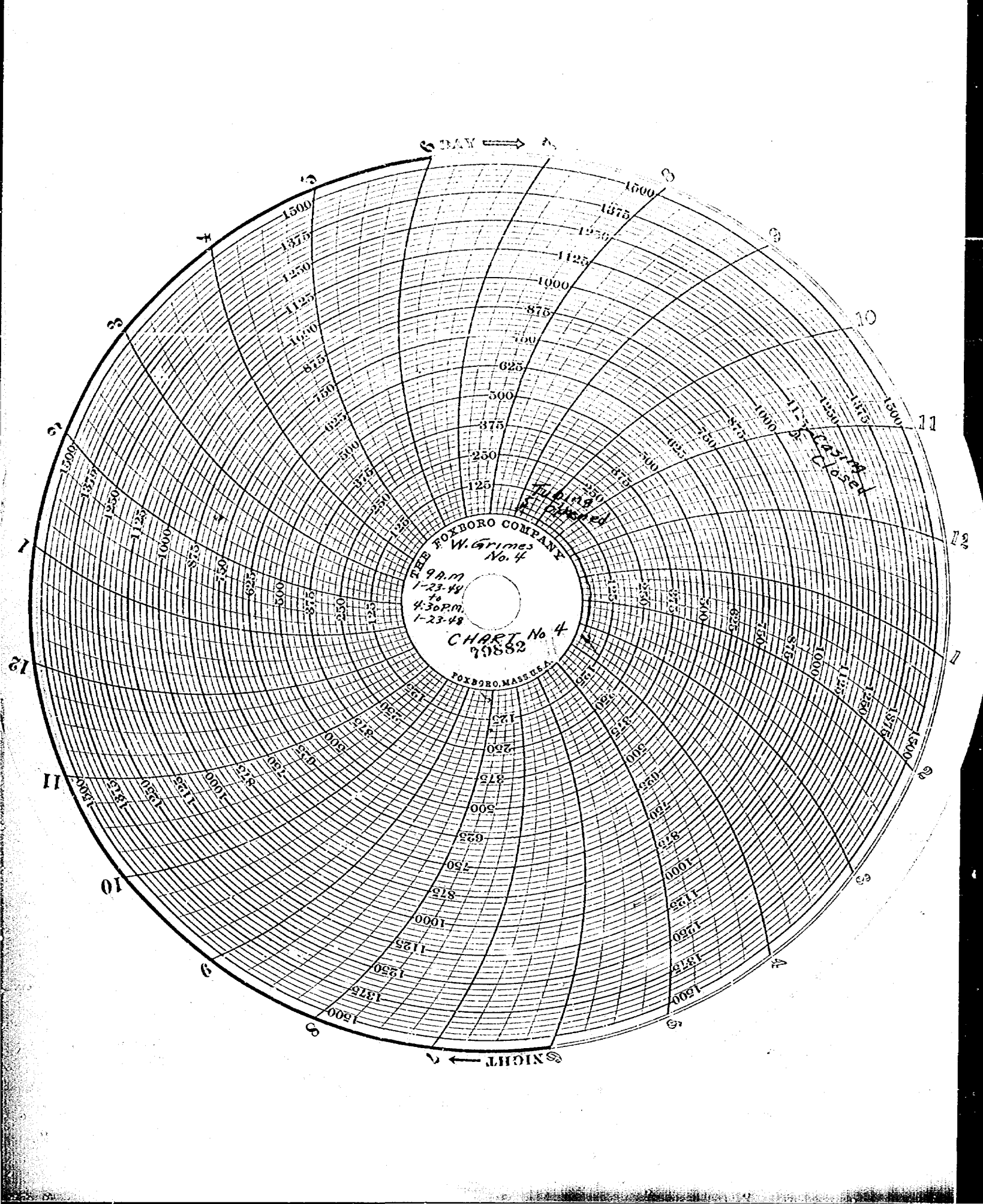
B.H.P. Chart No. 3
West Grimes # 4
January 21 to 23, 1948
Segregation Test
Pressure Element @ 3500'

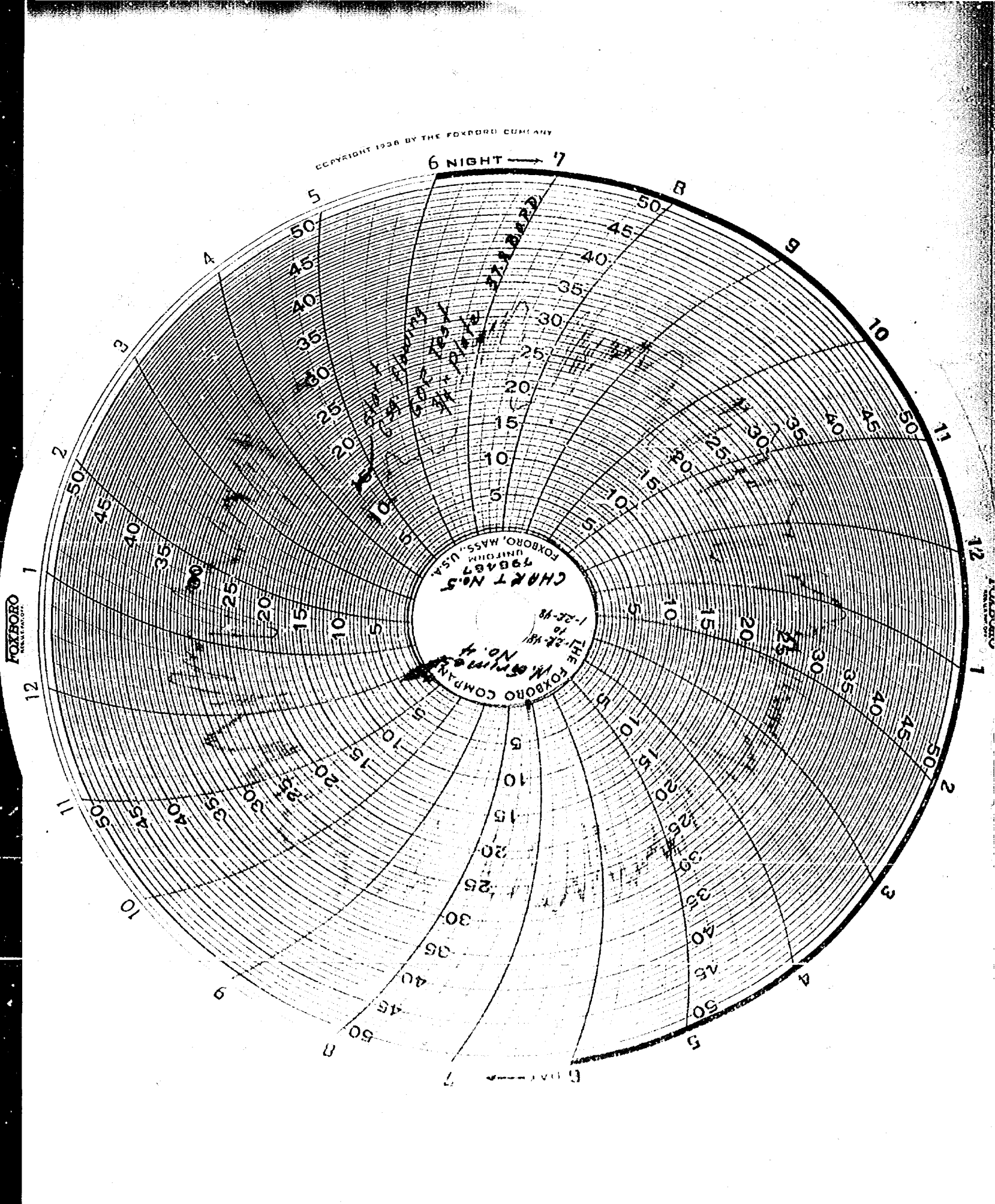
610" 610" 705"

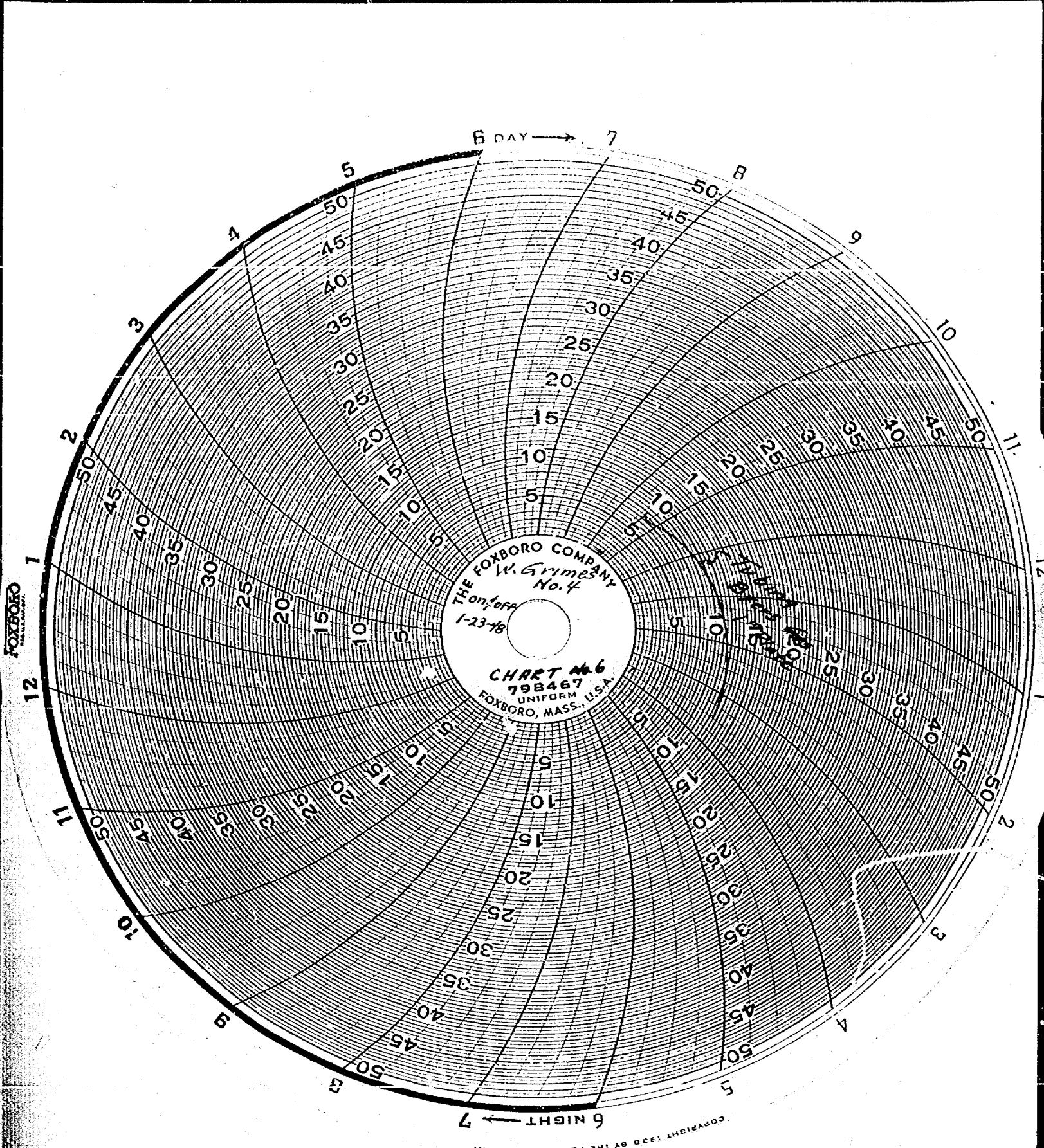

DAY
NIGHT
THE FOXBORO COMPANY
CHART
No. 1
W. Grimes #4
10882
1-20-48 to 1-21-48
9:45 A.M.
Casing
9:30 A.M.
Tubing and Casing
Shut in


DAY
NIGHT
Casing
Bowers
Tubing
Bowers
THE FOXBORO COMPANY
1-21-48
to 1-22-48
CHART
No. 2
W. Grimes #4
79882
FOXBORO, MASS. U.S.A.
Casing Open—
Tubing Shut in
Tubing Open
Casing Shut in


DAY
NIGHT
THE FOXBORO COMPANY
W. Grimes No. 4
1-22-48
to
1-23-48
CHART No. 3
79382
FOXBORO, MASS. U.S.A.
Casing
Tubing Closed
Casing Open
Tubing Closed


DAY
NIGHT
THE FOXBORO COMPANY
W. Grimes
No. 4
9 A.M.
1-23-48
to
4:30 P.M.
1-23-48
CHART No. 4
79882
FOXBORO, MASS. U.S.A.
Turbine Governed
Hydraulic Closed


COPYRIGHT 1938 BY THE FOXBORO COMPANY
6 NIGHT → 7
STARBOARD
CHART No. S
79A87
UNIFORM
FOXBORO, MASS., U.S.A.
THE FOXBORO COMPANY
1-22-48
FOXBORO


6 DAY → 7
6 NIGHT ← 7
THE FOXBORO COMPANY
W. Grymes
No. 4
THE on 1 OFF
1-23-48
CHART No. 6
798467
UNIFORM
FOXBORO, MASS., U.S.A.
FOXBORO
COPYRIGHT 1930 BY THE FOXBORO COMPANY

BEFORE THE

OIL CONSERVATION COMMISSION

Santa Fe, New Mexico

"Notice of Publication
State of New Mexico
Oil Conservation Commission

"The Oil Conservation Commission, as provided by law, hereby gives notice of the following hearings to be held at Santa Fe, New Mexico, at 10:00 o'clock A.M., April 15, 1947:

CASE NO. 92

"In the matter of the Application of Gulf Oil Corporation for issuance of a special order permitting the production of more than one horizon or pool through a single well bore in the Hobbs Pool, Lea County, N. M.

CASE NO. 93

"In the matter of the Application of Gulf Oil Corporation for the issuance of a special order permitting the production of more than one horizon or pool through a single well bore in the Paddock, Drinkard, Brunson, Jones and Blinbry Pools, Lea County, New Mexico.

CASE NO. 94

"In the matter of the Application of Gulf Oil Corporation for the promulgation of a General Order permitting and controlling production from more than one horizon or pool through a single well bore.

NOTE: These cases were in part heard January 10, 1947, and are continued to April 15th as indicated above.

Given under the seal of said Commission at Santa Fe, New Mexico on March 27th, 1947.

OIL CONSERVATION COMMISSION

By: /s/ R. R. SPURRIER, Secretary

S E A L"

Said meeting convened at the appointed hour, on the 15th day of April, 1947, in the Coronado Room of the La Fonda Hotel, Santa Fe, New Mexico, with the Commission sitting as follows:

Hon. T. J. Mabry, Governor, Chairman
Hon. John E. Miles, State Land Commissioner, Member
Hon. R. R. Spurrier, Secretary, Oil Conservation Commission, Member
Hon. George Graham, Attorney

REGISTER

NAME	COMPANY	ADDRESS
Russell Glowe	Gulf Oil Corporation	Tulsa, Oklahoma
Paxton Howard	Shell Oil Company	Midland, Texas
C. W. Faris	Shell Oil Company	Midland, Texas
Lloyd L. Gray	Gulf Oil Corporation	Tulsa, Oklahoma
W. E. Hubbard	Humble Oil Company	Houston, Texas
H. B. Pressler	Humble Oil Company	Houston, Texas
J. W. House	Humble Oil Company	Midland, Texas
R. S. Dewey	Humble Oil Company	Midland, Texas
Eugene Hunford	Gulf Oil Corporation	Tulsa, Oklahoma
V. S. Welch	Gulf Oil Corporation	Artesia, New Mexico
Neil B. Watson	Attorney	Artesia, New Mexico

NAME	COMPANY	ADDRESS
Emery Carper	Carper Drilling Company	Artesia, New Mexico
Elmer Patman	The Superior Oil Company	Houston, Texas
W. R. Bollinger	Shell Oil Company	Hobbs, New Mexico
John M. Kelly	Independent	Roswell, New Mexico
Harry J. Gibbons	Skelly Oil Company	Tulsa, Oklahoma
J. N. Dunlavey	Skelly Oil Company	Hobbs, New Mexico
G. W. Selinger	Skelly Oil Company	Tulsa, Oklahoma
Chuck Aston	Consultant for Aston & Fair	Artesia, New Mexico
Donald S. Bush	Lawyer	Artesia, New Mexico
Bert Aston	Aston & Fair	Roswell, New Mexico
M. K. Rouskop	Grayburg Oil Company	Artesia, New Mexico
R. F. Miller	Grayburg Oil Company	Artesia, New Mexico
R. J. Heard	Grayburg Oil Company	Artesia, New Mexico
W. B. Macey	N. M. Oil Conservation Commission	Artesia, New Mexico
H. C. Laird	Otis Engineering Corporation	Dallas, Texas
Paul C. Evans	Gulf Oil Corporation	Hobbs, New Mexico
E. J. Gallagher	Gulf Oil Corporation	Hobbs, New Mexico
J. C. Lowe	Amerada Petroleum Company	Ft. Worth, Texas
W. G. Ricketts	Amerada Petroleum Company	Tulsa, Oklahoma
G. H. Gray	Repollo Oil Company	Midland, Texas
W. N. Little	Tidewater Association	Midland, Texas
D. R. McKeithan	Phillips Petroleum Company	Bartesville, Okla.
E. H. Foster	Phillips Petroleum Company	Amarillo, Texas
Burney Braly	Continental Oil Company	Ft. Worth, Texas
C. B. Wentz	Continental Oil Company	Ponca City, Okla.
Edgar Kraus	Atlantic Refining Company	Dallas, Texas
A. B. Tanco	Atlantic Refining Company	Dallas, Texas
S. B. Christy, Jr.	Sun Oil Company	Roswell, New Mexico
D. A. Powell	Drilling & Exploration Company	Hobbs, New Mexico
H. F. Beardmore	Barnsdall Oil Company	Tusla, Oklahoma
F. E. Heath	Sun Oil Company	Dallas, Texas
Martin A. Row	Sun Oil Company	Dallas, Texas
J. E. Regent	Sun Oil Company	Midland, Texas
D. A. Miller	Phillips Petroleum Company	Midland, Texas
H. B. Hurley	Continental Oil Company	Ft. Worth, Texas
M. H. Dubrow	Continental Oil Company	Ft. Worth, Texas
A. L. Decker	Continental Oil Company	Ft. Worth, Texas
Claig H. Perry	Warren Petroleum Corporation	Tulsa, Oklahoma
R. E. McMillan	Ohio Oil Company	Midland, Texas
M. R. Lamb	N. M. Bureau of Mines & Mineral Research	Artesia, New Mexico
Roy T. Durst	Rowan Drilling Company	Midland, Texas
C. B. Williams	Texas Company	Ft. Worth, Texas
A. E. Willig	Texas Company	Ft. Worth, Texas
H. D. Murray	Texas Company	Midland, Texas
R. G. Schuehle	Texas, Pacific Coal & Oil Company	Midland, Texas
D. S. Googins	Standard of Texas	Midland, Texas
J. E. Wooton	Stanolind Oil & Gas Company	Ft. Worth, Texas
M. H. Card	Stanolind Oil & Gas Company	Ft. Worth, Texas
Lewis Finch, Jr.	Stanolind Oil & Gas Company	Ft. Worth, Texas
J. O. Seth	Stanolind Oil & Gas Company	Santa Fe, New Mexico
Ralph L. Gray	Stanolind Oil & Gas Company	Hobbs, New Mexico
Glenn Staley	Lea County Operators	Hobbs, New Mexico
Arch L. Rowan	Rowan Drilling Company	Ft. Worth, Texas
R. W. Tesch	Texas-Pacific Coal & Oil Company	Ft. Worth, Texas
Henry Forbes	Continental Oil Company	Midland, Texas
S. V. McCollum	Continental Oil Company	Midland, Texas
Foster Morrell	U. S. Geological Survey	Roswell, New Mexico

P R O C E E D I N G S

MR. ELMER PATMAN, Superior Oil Company:

With the permission of Judge Lowe, I would like to make this observation and inquiry. As I understand this series of hearings - of three hearings - is a continuation of hearing before this Commission, which began in January of this year and that

necessarily the record made upon that occasion together with this record will be taken together by the Commission in enacting a rule or formulating an opinion on this matter, or these matters. With that in mind and in the belief that the suggested procedure - I am going to make, will be in the interest of all, I am going to ask the Commission for permission to recall Mr. Dewey who testified in the original hearing. I believe he has already been sworn in this procedure. Before I do that, I believe this statement would be in order -

I would like to first make it very clear the Superior Oil Company is only a small person in New Mexico for considerable undeveloped acreage. We hope to have more production in this state, I would like to make it clear we have no wells presently that are susceptible of multiple completions; so, for that reason, I would like the participation we make in this hearing to be considered in connection with the general policy. We do not like to see or believe it to be right for this Commission or any other commission to arbitrarily close the door upon what we consider the right to complete a well in a manner that would affect the untimate recovery. I have no desire, and I hesitate in making this statement, but I have read the transcript of the January hearing and I find in that transcript and through it in a great many instances, in fact most references and most observations were references made to experiences in Texas. I realize and believe I know few wells in factual survey and as I understand this investigation - it is factual investigation you necessarily have to make decisions upon the facts of the individual reservoir and to have a well, so consequently we well know an experience we might have had in Texas with a particular well might not necessarily apply to a situation in this State. However, I believe I am sufficiently realistic to also know that things that go on in one state have a tendency to wash over the state lines. As an example, after your January 10th hearing, the Railroad Commission of Texas, which is our regulatory body, called a similar hearing and had it in March and I might say your January hearing kind of washed over in Austin in March.

I make those objections of making references to other states.

MR. LOWE: (Amerada Petroleum Company)

There are three cases, 92, 93 and 94. It was our intention that 94 be heard first and the other two followed, but in some manner they got in this place on the Docket. Number 94, as we understand it, is proposing a state-wide Order granting the right to make dual completions, it is not that anyone could goout and complete any well you might want to complete in that manner. If the Order is made, if any operator desires to make dual completions he would have to make application to this Commission and the Commission would set a hearing to be had if necessary, and determine whether or not dual completions could be had in that well. The Order requested in Case No. 94 is not giving everyone the right to make dual completions as they choose. The application in Case No. 92 is an application for a specific well and West Grimes #4 is the well that is being considered in this connection. It would simply be permission to dually complete one well, would not necessarily stand on what the Commission might make in West Grimes #4. Case No. 93 is for a number of pools which boils down to one - one application to one specific well. We do not want anything for a man to complete a well dually if he wants to.

MR. R. R. SPURRIER (Secretary, Oil Conservation Commission)

Judge Lowe, in Case No. 92, the advertisement actually reads as ~~near~~ Hobbs pool and not West Grimes #4.

MR. LOWE:

We will ask to amend the application.

MR. HERMAN PRESSLER (Humble Oil Company)

My understanding of the transcript of the testimony taken on the hearing held January 10, the testimony of Mr. Gray, they had withdrawn and requested to be withdrawn their request for general state-wide order permitting dual completions and had confined their request to the application for an order in certain specific fields as a preliminary order to special orders for individual wells. As we understand the Gulf's proposal, the Commission would enter an order to the effect that dual completions may be permitted in a certain field or pool provided such application was made on each well and a special hearing held on that well. That is the way we understood the testimony of Mr. Gray.

MR. LOWE:

I think further on you will find a statement to the contrary.

MR. PRESSLER:

On page 8 of the transcript, Mr. Selinger asked Mr. Gray -

"I understand you now on behalf of your Company, you do not wish to press your application on Case No. 94 - - - - - -?"

(Mr. Gray) "I think our position on that is, we will leave up to the wishes of the Commission, if that fails it will be best we would have no objection, neither would we have any objection if it was decided to not change the general rules but treat these applications as exceptions, that is 92 and 93."

MR. PATMAN:

I would like to make a statement before Mr. Dewey takes the stand.

I would like to call the Commission's particular attention to the testimony of the first hearing. I would like to be put in the clear on the Gulf's position with reference to Case No. 94.

MR. LOWE:

I think it is in the statement of Mr. Spurrier on page 37 - Mr. Gray left it to the wishes of the Commission - it seems the Commission has already settled it because for cases 92, 93 and 94, he states:

"Cases 92, 93 and 94 are continued until the definite date of April 15, 1947 at 10 o'clock A. M., for the purpose of further testimony in these three cases."

MR. PATMAN:

Do I understand Case No. 94 is continued on because of wanting a General Order permitting dual completions generally?

MR. SPURRIER:

Yes.

MR. LOWE:

I would like to make a statement now or later as to Humble's position generally.

Humble's position is there should be only, when it is essential for dual completions. We have dual completion of a well to recover oil which because of the economic conditions would not otherwise be recovered. We think dual completions should be avoided wherever possible, and in most instances they can be avoided. We do not believe a general practice of multiple completion is consistent with the prevention of waste or conservation problem. Unless all reservoirs are controlled, it induces migration of oil or gas from one reservoir to another.

The results are waste which is irrecoverable. As to the migration of oil from one reservoir to another, we believe very few multiple completions can result in this migration, but most completions may be entirely adequate and one or two in the field might result in the loss. Because of the complex factors involved, we believe there should be no general statewide rule, we believe there should be a general rule for a pool to determine whether or not multiple completion should be allowed in that pool, should be looked at the pool as a whole - as a complete pool, then that that general rule for the pool should not allow indiscriminate dual completions in the pool. After the determination by the Commission, dual completions should be made in the pool looked at as a whole, then before a dual completion of any well is permitted a special application should be made for that well, then a hearing should be had and permit issued.

MR. PATMAN:

Is it not true that so far as the Humble Company is concerned they have one pool in New Mexico and another one in Texas on this question?

MR. LOWE:

I don't know of any difference in our policy where the facts in a given field or pool are the same.

MR. PATMAN:

Page 96 of the offical transcript before the Railroad Commission of Texas, which was heard March 5, 1947; from a statement of the Humble Oil and Refining Company - from a statement made by a representative at that hearing - after several hours had passed of hearing testimony, the Humble Company put on their representative -

By Mr. Nelson Jones:

"I believe that the evidence which has been introduced at this hearing may fairly be summarized by saying it establishes that in some fields oil or gas or both oil and gas can be produced without waste from a dually completed well. This evidence was not introduced by the Humble Company, but it does support the position of the Humble Company, which is simply this: 'We believe that the Commission should handle this question on a field-wide rather than a statewide basis. Especially is that so in view of the testimony you have had here today. We believe that before the Commission permits dual completion or multiple completion of a well it should hear evidence which convinces the Commission that the dual completion will not result in waste, or in impairment of correlative rights, and the fluids involved are not of such characteristics as will result in corrosion which might cause a blow-out or underground waste of oil and gas. That, briefly, is our position in the matter."

MR. PATMAN: Mr. Jones further stated as follows:

"Would it make any difference if we said reservoir-wide or field-wide? That is what I meant by my statement."

MR. PRESSLER:

We do not agree with that statement, and see no conflict between the two statements.

EXAMINATION OF MR. R. S. DEWEY

(After being duly sworn, Mr. R. S. Dewey testified as follows)

MR. PATMAN:

Your name is R. S. Dewey?

MR. DEWEY:

That is right.

MR. PATMAN:

You are the same R. S. Dewey that testified before this Commission on January 10, 1947, and with reference to the subject multiple completions of oil and gas wells or both?

MR. DEWEY:

I don't recall the date but I did testify.

MR. PATMAN:

The hearing was held January 10, 1947, and you did testify - you wouldn't deny that?

MR. DEWEY;

Oh, no.

MR. PATMAN:

You are employed by the Humble Oil Company?

MR. DEWEY:

Yes, sir.

MR. PATMAN:

And you are the Division Engineer of the Humble Company at Midland, Texas?

MR. DEWEY:

West Texas, New Mexico area.

MR. PATMAN:

How long have you been in Midland?

MR. DEWEY:

Approximately 11 years.

MR. PATMAN:

Where were you before you were sent to Midland?

MR. DEWEY:

In McCamey.

MR. PATMAN:

That is still in West Texas?

MR. DEWEY:

That is correct.

MR. PATMAN:

How long have you been in West Texas?

MR. DEWEY:

17 or 18 years.

MR. PATMAN:

Does that approximately date the period of your employment with the Humble?

MR. DEWEY:

No, I have been with the Humble a little over 20 years.

MR. PATMAN:

There were no dual completions in the wells except during the last 17 years so far as you know?

MR. DEWEY:

I don't recall any.

MR. PATMAN:

If there were any you would remember?

MR. DEWEY:

None that I had any contact with.

MR. PATMAN:

You have not had any experience on the Gulf Coast in the last 17 years?

MR. DEWEY:

That is correct.

MR. PATMAN:

You testified here in January with reference to some 46 multiple completions the Humble had had experience with in the State of Texas?

MR. DEWEY:

I do not recall that testimony.

MR. PATMAN:

You recall generally talking about it?

MR. DEWEY:

Yes, sir.

MR. PATMAN:

How many of those 46 dual completions were made under your jurisdiction?

MR. LOWE:

It was 36 wells instead of 46 wells.

MR. PATMAN:

Well, of the 36, how many of those 36 dual completions were made under your jurisdiction?

MR. DEWEY:

I think in the testimony I stated there are two. Two made in West Texas and none in New Mexico.

MR. PATMAN:

So far as you know, there have never been any multiple completions in New Mexico?

MR. DEWEY:

By the Humble?

MR. PATMAN:

By anybody?

MR. DEWEY:

I don't know of any.

MR. PATMAN:

Do you know how many dual completions have shown gas-gas, oil-oil or gas-oil?

MR. DEWEY:

I have no idea.

MR. PATMAN:

Would 1,000 be about right?

MR. DEWEY:

I wouldn't commit myself to that number.

MR. PATMAN:

Do you know what percentage in Texas the Humble has made?

MR. DEWEY:

I have no idea.

MR. PATMAN:

I believe the testimony in Austin, the Sun Oil Company has made 90, do you know about that?

MR. DEWEY:

I do not.

MR. PATMAN:

There have been hundreds of dual completions in Texas. The Humble you say has made 36, and based upon this 36 you told this Commission dual completions cause waste and should not be granted.

MR. DEWEY:

That is my idea of it, exactly.

MR. PATMAN:

You base that on experience, hearsay, or what do you base it on?

MR. DEWEY:

I base it on partly what I read and have read in the literature - I think we furnished the Commission an A. P. I. paper, which to my mind indicated that dual completions contributed to waste.

MR. PATMAN:

How?

MR. DEWEY:

Inefficient operations.

MR. PATMAN:

How do you mean, inefficient operations?

MR. DEWEY:

In the practice to recovery of oil.

MR. PATMAN:

Why aren't they practical?

MR. DEWEY:

They result in more losses.

MR. PATMAN:

Give me some of them.

MR. DEWEY:

Once when you have dual completions you have a lot of junk in the hole.

MR. PATMAN:

What is it?

MR. DEWEY:

Lot of gadgets.

MR. PATMAN:

Name them.

MR. DEWEY:

Tubing and other things.

MR. PATMAN:

You have tubing in single completions?

MR. DEWEY:

That is right.

MR. PATMAN:

The same things in single completions?

MR. DEWEY:

Have the cross-over tools in dual completions.

MR. PATMAN:

Not necessarily.

MR. DEWEY:

In certain instances.

MR. PATMAN:

Name instances.

MR. DEWEY:

In some wells.

MR. PATMAN:

Suppose the well is flowing.

MR. DEWEY:

That is the honeymoon stage.

COMMISSIONER MILES:

Please explain what you mean by the honeymoon stage.

MR. DEWEY:

The honeymoon stage is when everything looks very rosy and the well is flowing quite a bit of oil, and it has not yet been determined just what the outcome will be.

MR. PATMAN:

Give me some more equipment you are going to have in this hole, more in dual completions and not in single completions.

MR. DEWEY:

The packers.

MR. PATMAN:

You have packers in single completions.

MR. DEWEY:

You have several packers - I don't favor packers in single completions, there are circumstances you may have to use a packer.

MR. PATMAN:

Why would setting of packers in dual completions cause difficulty that would make that dual completion impractical?

MR. DEWEY:

The packer may fail, and has often been known to fail.

MR. PATMAN:

Have you ever known a packer to fail in single completions?

MR. DEWEY:

Indeed I have.

MR. PATMAN:

Have you experienced packer failures in single completions?

MR. DEWEY:

Yes, sir.

MR. PATMAN:

You have seen packers in single completions?

MR. DEWEY:

Yes, sir.

MR. PATMAN:

You have seen formation packers?

MR. DEWEY:

Yes, sir.

MR. PATMAN:

You have seen them outside the casing?

Mr. DEWEY:

That is right.

MR. PATMAN:

You have had failures in both instances?

MR. DEWEY:

That is right.

MR. PATMAN:

You wouldn't, in turn, recommend to this Commission that they stop the drilling of all wells in New Mexico where packers are being set, because they fail in single completions?

MR. DEWEY:

I would make no such recommendation, would you?

MR. PATMAN:

I am asking the questions.

MR. PATMAN:

Would you say the packer failures in single completions are greater or less than in dual completions?

MR. DEWEY:

I have no idea - packer failures in single completions are bad enough.

MR. PATMAN:

Generally, isn't it true when you set a packer in dual completions you set it in the casing perforating below and above, running tubing through it?

MR. DEWEY:

Our experience we have had in the two we have set, we did it that way.

MR. PATMAN:

Isn't that a more ideal method of securing an effective packer seal than on the outside casing where the hole might not be even and you are setting it against the hole or pipe ?

MR. DEWEY:

Of course the pipe is a little better than open formation. There are lots of different kinds of packers, different ways of setting them. Lots of circumstances that do not make it ideal.

MR. PATMAN:

My question was - you are more likely to secure effective packer seal set in the casing than you are when you set it against the formation or outside the casing?

MR. DEWEY:

I would say your hopes are higher.

MR. PATMAN:

Are you familiar with the equipment designed to effectuate this purpose?

MR. DEWEY:

I listened to Mr. Gray's explanation.

MR. PATMAN:

That is all you know about it?

MR. DEWEY:

I have had no practical experience with it.

MR. PATMAN:

You say in your testimony you wouldn't recommend them because you have corrosion - do you remember that general statement?

MR. DEWEY:

I think that is a very true statement.

MR. PATMAN:

Tell me why you would have more corrosion in two reservoirs than you would in one - more likely to have corrosion in two reservoirs than

you would have in single completions of the same reservoirs?

MR. DEWEY:

Corrosion is general - it is very hard to predict corrosion. If you operate two reservoirs, either one or both may be corrosive, and if one of them is corrosive and the other not corrosive you have ruined that in your good reservoir with the corrosive one. If you open the one that is non-corrosive, you will probably not get a material amount of trouble, but the other one may be very corrosive and require the replacing of equipment.

MR. PATMAN:

The fact that you set that packer between the two horizons?

MR. DEWEY:

If you experience a condition like that, one corrosive and the other non-corrosive, the corrosive reservoir may corrode all the extra equipment and you might be out there working on that corrosion and all the time you are losing production during that interrim from the other reservoir. The costs in operations are greatly increased.

MR. PATMAN:

Do you know of any situations like that - where you have this bad situation?

MR. DEWEY:

I can cite an example.

MR. PATMAN:

Give me an example of this bad condition where you have gotten your packer out working on it in this corrosion.

MR. DEWEY:

I did not say necessarily packer.

MR. PATMAN:

Give me an example.

MR. DEWEY:

We have had some wells in our fields.

MR. PATMAN:

You got dual completions there?

MR. DEWEY:

No, sir. Corrosion in the Hardin-Glascock field.

MR. PATMAN:

Dual completions there?

MR. DEWEY:

Not on our property.

MR. PATMAN:

Anywhere?

MR. DEWEY:

No so far as I know.
Gold-Smith field is very corrosive, the old Anlon field is very corrosive and a large number of West Texas-New Mexico fields are corrosive.

MR. PATMAN:

In all of those fields which you have named, and in which you state you have the problem of corrosion, are you constantly working on those wells to the extent that you do not ever get to produce them?

MR. DEWEY:

The Smith well is so uneconomical that the cost of corrosion and replacement of equipment far exceeds the amount of money we can get from production.

MR. PATMAN:

How about the Goldsmith?

MR. DEWEY:

It is a monument to corrosion.

MR. PATMAN:

Let us assume that well is two separate horizons and that you had dually completed that well, and the other horizon you are going to find, and which you did not find - you have closed your well in on single completion.

MR. DEWEY:

And the casing is leaking - -

MR. PATMAN:

You have closed your well in.

MR. DEWEY:

Closed it temporarily.

MR. PATMAN:

You could run a string inside.

MR. DEWEY:

You wouldn't have room.

MR. PATMAN:

You have set too small casing.

MR. DEWEY:

What size do you advocate when you run a 4 inch casing you are just out of hole.

MR. PATMAN:

Would the fact that you dually completed a well cause more corrosion than if you had completed those two reservoirs singly?

MR. DEWEY:

Mr. Patman, I do not cause corrosion.

MR. PATMAN:

Multiple completions don't cause it either do they?

MR. DEWEY:

I have little hearsay evidence on that - it is something I do not understand, perhaps you will. I have been told in the Goldsmith field where packers have been set that they find the setting of the packer inside the casing, for some unknown reason has stimulated the corrosion so that the tubing is very badly eaten out.

MR. PATMAN:

That is a single completion well - Would a dually completed be worse?

MR. DEWEY:

I think so.

MR. PATMAN:

Isn't it the chemical characteristics of the liquids from that formation and then the packer?

MR. DEWEY:

If you have an uneconomical situation.

MR. PATMAN:

Answer my question.

MR. PRESSLER:

Mr. Patman is talking about what causes corrosion, it will be the same from the chemicals in oil of dually or singly completed tests - as to what causes corrosion and if corrosion what will be the effect in single and dual completions.

It is the effect of corrosion in dual completions, and I think that is the question that is concerning the Commission.

MR. DEWEY:

I cannot explain so, but the people that told me about it are convinced that the setting of that packer, for some unknown reason, accelerates corrosion. They don't know the cause, they aren't able to tell it to me.

MR. PATMAN:

That is a singly completed well?

MR. DEWEY:

Yes, sir.

MR. PATMAN:

Isn't it true the Gulf is producing in the Goldsmith?

MR. DEWEY:

Yes, sir.

MR. PATMAN:

They have had considerably more experience in Goldsmith than you have?

MR. DEWEY:

You think because they have had more wells, they have had more experience?

MR. PATMAN:

They have had more opportunity haven't they?

MR. DEWEY:

We are concerned in what causes corrosion - by the economic effect of corrosion, if you have two zones producing, dually completed wells, and one or two zones with terrific corrosion and it is continually working, it is uneconomical.

MR. PATMAN:

Who is the technical expert, you or your lawyer?

MR. DEWEY:

I imagine I have had a little more experience than he has. I imagine I have - - -

COMMISSIONER MILES:

Would the Gulf be willing to consider this on an individual well basis?

MR. GRAY:

The Gulf would be willing.

MR. PRESSLER:

The Humble agrees if there were any dual completions made in the field they be considered on individual well basis.

MR. PATMAN:

That would presuppose then, a permissive order - in other words, there would be no state-wide prohibitive order and in turn would be a state-wide permissive order?

COMMISSIONER MILES:

We would get down to the individual well basis and argue on that standpoint.

MR. PATMAN:

You couldn't do that if you had a prohibitive rule to start with instead of a permissive rule. If the permissive rule was in effect, provided the particular facts of the particular application warranted the particular

application. With that understanding I have no objections.

MR. PRESSLER:

I would like to call Mr. Patman's attention to Rule 41:

> "Rule 41. Conflicts between General and Special Rules and Regulations.
>
> "In case of conflict between a general and a special rule or regulation, the special rule or regulation shall prevail without regard to the effective dates of the respective rules ro regulations, unless the contrary is clearly prescribed by the Commission."

I did not mean to be taking what I said as the Humble thinks there should be any general permissive rule over the State as a separate rule.

MR. PATMAN:

I want to be sure you understand the difference - what he says is generally true with reference to orders to the effect that such rules prevail over general rules unless the general rule specifically provides. Otherwise, I don't want any general rule to expressly provide a special rule cannot be had.

You are going to see you have to have a general permissive rule or you are going to have to have your general rule provide definitely - from what I read you are going to have to have it provide in the event the particular facts of the particular application warrants the granting of it - you are going to have to do it.

MR. LOWE:

My theory is this - In any event you are going to have to have an application for a specific well. The Commission has power when an application is filed to make an order for that specific well, and that is satisfactory to us.

MR. SELINGER:

I think we are all arguing about the same thing. In Texas and Oklahoma, and all other states, as in New Mexico, the general state-wide rules provide that in more than one horizon of production through the same bore - each state recognizes there are exceptions and each application is considered on the present well basis as an exception to that general rule, therefore, no additional orders or modifications are necessary in the present rule - merely have to go into individual applications on a specific well. Nothing the Commission has to do on specific orders - all we have to do is go into the individual kinds of exceptions - the Drinkard and Paddock, etc. This state like other states have similar orders, nothing is done about it.

MR. E. H. FOSTER (Phillips Petroleum Company)

We are not opposed to dual completions generally, but we do think each one should stand on its own merits.

I have a statement to present to the Commission:

"Under ordinary competitive peace-time operations we believe the production of two oil reservoirs by means of a dual-completion is in general unwise and should be definitely discouraged in almost all future instances. There is little doubt but that in a vast majority of cases such practice will lead to smaller ultimate recovery of oil from at least one of the reservoirs involved. In addition we feel that added

operating problems are numerous and dangerous and far out-weigh any savings that might be realized in the initial development costs. It is likewise perfectly obvious to us that producing oil through the annulus is inefficient and will certainly result in shortening the flowing life of wells.

"We further believe that with proper well spacing it is entirely possible to economically develop each producing oil reservoir in a field on an individual well basis, thus mostly eliminating the need for dual-completions. There are some instances where extremely thin sand sections or lean reservoirs cannot be spaced in a manner to permit individual well development of each oil reservoir. Under such circumstances, if segregation of production is considered necessary, dual-completions might rightly be the solution to the problem.

"When development is being carried on in conjunction with a plan of controlled pressure maintenance there are undoubtedly certain other instances where dual oil completions might be amply justified.

"Dual oil-gas and dual gas-gas completions are not so susceptible to the many problems consistently found in the dual completion of oil-oil wells. We, therefore, feel that the range of application is considerably broader and should be looked upon with greater general favor. However, it is suggested that even in this type of dual-completion, each case should stand on its own merits.

"In conclusion, we would like to urge the Commission to adopt a policy of holding hearings and carefully checking each individual well application for all types of dual-completions and that permits be issued only after suitable evidence has been received."

MR. A. B. TANCO (Atlantic Refining Company)

I have a statement I would like to introduce into the record, setting forth our views - the views of the Atlantic Refining Company with respect to dual completions.

"The Atlantic Refining Company does not believe that the Oil Conservation Commission of New Mexico should adopt any state-wide rule permitting the dual completion of wells in the State because conditions vary in the different fields.

"Our experiences elsewhere with respect to dual completions have been varied in that some instances we have met with considerable success while elsewhere the success of these operations is doubtful. It is for this reason that the Atlantic Refining Company does not favor the adoption of any state-wide rule with respect to dual completions.

"The Atlantic Refining Company, does, however, favor a policy with respect to dual completion whereby the dual completion of any well will be permitted by the Commission after the Commission shall have determined, at public hearing held after the issuance of notice to interested parties, that such dual completion is feasible as to such well."

MR. TANCO:

We, of course are not in favor of the adoption of any state-wide rule permitting dual completions, for this reason we do not favor the adoption of a state-wide plan.

MR. LOWE:

The state-wide order would not grant any rights at all. We would have to file an application with this Commission if we had a well to dual complete. This involves the intent to adopt a state-wide order that each well must be made a specific case.

MR. PATMAN:

I want to make sure our position is not misunderstood. It has not been our position anywhere that a well should be permitted to be dually completed without an order after notice and hearing be set by a regulatory body, and we think after doing that, that well should be properly policed. That is our position everywhere we operate, and we think it is right. We think we can do it, and have done it non-wastefully and we did not want to see - there was recommendation made in that record - of this Commission to adopt a policy denying it. We do not want to see that, we do not believe it is right. We know particular facts of particular fields that will not warrant that condition. We believe we have recovered fields non-wastefully and wouldn't have been done otherwise.

MR. LEWIS FINCH, JR. (~~Standard~~ Stanolind Oil Company)

Standard Oil Company is not opposed generally to dual completions, we feel that each individual well or case should be considered on its merit, and that notice should be filed with the Commission and proper permit issued.

COMMISSIONER MILES:

Any matter you want to bring up, we will be glad to listen to it - If not is there any other matter to come before the Commission?

We will proceed with the Hobbs Case.

EXAMINATION OF MR. LLOYD L. GRAY

(After being duly sworn, Mr. Gray testified as follows)

MR. LOWE:

Mr. Gray, you testified in the previous hearing on this case?

MR. GRAY:

That is right.

MR. LOWE:

I wish you would detail the facts and circumstances in regard to West Grimes #4 well, which you think would justify dual completion.

MR. SPURRIER:

This is what you consider to be a continuation of Case No. 92?

MR. LOWE:

Yes, sir.

MR. GRAY:

I testified at the last hearing regarding the characteristics of the two formations - I might just briefly summarize the West Grimes #4 which now produces from the Byers formation which is gas sand with some distillate.

Our proposal is to dual complete that well in the Byers and Bowers. The Bowers formation being oil productive sand apparently with gas cap at the top of the structure. Since the last hearing there has been a well completed directly east of the enterprising unit on which #4 was located which was completed as a gas well in the Bowers sand. For that reason it is more important a dual com-

pletion be attempted at this well, since we would certainly not drill a well at the Bowers sand for completion of a gas well. We proposed to kill the well, perforate opposite the Bowers sand which is located at approximately 3,150 feet in depth; set a packer on tubing at an approximate depth of 3600 feet. We will probably set a side-door choke in the tube at about 3,170 feet and a safety joint a short distance above the packer bringing the well in to produce the Byers formation, or the gas well through the tubing and the Bowers formation through the annulus between the tubing and casing.

This well, I feel, will be an ideal well to test the feasability of dual completion. This is the only well we have in the Hobbs pool which is producing from the Byers sand. Both of the formations have substantially little bottom hole pressure. That is generally true to the south in the deeper horizons, it is an initial supplement project to the dual completion of West Grimes #4 is fully justified. I do not believe it will be possible to detail the exact test would be made on the well, however, any information we obtain through the dual completion of this well, we will certainly submit it to the Commission for their information.

MR. LOWE:

You would be willing for the Commission to have a representative present while making your dual completion, and have knowledge of everything done?

MR. GRAY:

Yes, I believe I would, and the Commission should retain jurisdiction to make adequate tests after the job is done.

MR. LOWE:

In the event, after this is completed and the Commission is of the opinion it is not workable, you could plug off one formation and produce with the other without any trouble?

MR. GRAY:

That is correct. We would submit a typical digram showing the type of completion proposed.

MR. LOWE:

That is all the direct examination.

(The gentleman who made the following statements would not give his name)

Jack Cusack

They can get accurate tests on the various formations and also lay down a rule of necessity with these companies, but I question whether those things can happen, if each company comes within the economic factor. If you are going to take the economic factor you must take it as an overall picture. That, of course, would be without aid to Greece - the national figure. If we have drilled two wells we must picture these laborers, you have got to think of these laborers that go out there and process this deal, and their children and families. It is a big picture which we call in the Land Department the Big Picture. I think those things should be taken into consideration. Every condition has to be for the good of all. If you can put down a rule that each formation will get another barrel I think it is a darn good thing - the next thing is necessity.

(2:30 P. M., Governor Mabry joined the meeting)

(Continuation of above statements)

I am sure that this Commission will take into consideration the things we can do to keep people living and not particularly starve to death. That is a little far fetched, but after all, our problems are usually far fetched.

MR. R. W. TESCH (Texas, Pacific Coal and Oil Company)

I did not get all the facts. Is this to be an oil-oil or oil-gas dual completion?

MR. GRAY: I think a number of the operators did not clearly understand that it will be either oil to gas or gas to gas.

MR. TESCH:

How many wells in the Hobbs production from the Byers sand?

MR. GRAY:

Possibly five.

MR. TESCH:

All produce gas?

MR. GRAY:

To the best of my knowledge, they are.

MR. TESCH:

How many producing from the Bowers sand?

MR. GRAY:

Either producing or drilling or gas wells - 11 wells.

MR. TESCH:

11 wells producing from the Bowers sand?

MR. GRAY:

One drilling and one gas well.

MR. TESCH:

Is it your intention to gaslift the Bowers sand from Byers sand through a side door choke?

MR. GRAY:

No, not through side door choke at the present time. The Bowers sand has presently 1900 pounds of bottom hole pressure which is adequate for it to flow. We do not think for quite a period of time it will be of necessity for artificial lift. As it is used it will be brought to the surface, measured and controlled.

MR. TESCH:

You do not think it will be feasible to control gaslift from Bowers sand from side door choke?

MR. GRAY:

I think it could be, but would have difficulty in showing how much gas is used from Byers.

MR. W. H. LITTLE (Tidewater Association)

Do you know the reservoir pressure of the Byers now?

MR. GRAY:

I believe about 1100 pounds.

MR. LITTLE:

I would like to get myself straight, if the Bowers is a gas well, what sort of pro-ration would there be on that gas?

MR. GRAY:

I really don't know what the pro-ration would be. Probably the same as other dry gas wells in the State.

MR. LITTLE:

Are the other dry gas wells in the state in gas fields or sometimes in the same reservoirs with oil - that is, underlined with oil?

MR. GRAY:

I don't know of any gas wells I could definitely state were producing from the oil reservoirs, although they may be.

MR. LITTLE:

I believe Tidewater's position would be they would definitely not like to see a well producing gas as a gas well with an oil reservoir.

MR. GRAY:

I think I could tell you we have a gas well in the Bowers, no particular need to produce in the Bowers, and I feel there is no particular need to produce it as a gas well. I think the only problem would be the protection of the rights.

MR. FINCH: (Standard Oil Company)

Mr. Gray, when was this well drilled, West Grimes #4?

MR. GRAY:

I believe in 1930.

MR. FINCH:

Was it ever produced from the St. Andres?

MR. GRAY:

For a short period, approximately two years.

MR. FINCH:

Then was it plugged off?

MR. GRAY:

It was plugged back to 3,884 feet.

MR. FINCH:

When did you re-cap the well as a gas well in the Byers field?

MR. GRAY:

I believe in 1940.

MR. FINCH:

Do you have any factor in there now?

MR. GRAY:

No.

MR. FINCH:

You have tubing in the well?

MR. GRAY:

That is right.

MR. FINCH:

Do you know what condition the casing is in?

MR. GRAY:

We have made no tests of the condition inside the casing, except made pressure tests when we recapped the well.

MR. FINCH:

Have you had any trouble in the Hobbs pool with casing corrosion?

MR. GRAY:

Had one well - replaced the casing, and one well outside corrosion from liquids in the boiler. Replaced top joint of intermediate casing and three joints of oil string casing.

MR. FINCH:

Do you think the casing in this well is in satisfactory shape for dual completion?

MR. GRAY:

I think it is in satisfactory shape for dual completion as for a single completion. You realize it has pressure at the present time.

MR. PAXTON HOWARD (Shell Oil Company)

You have not run a ~~dex~~ Gamma Ray-log survey on that well?

MR. GRAY:

Not on that particular well, we have run surveys, and as I recall, they showed no serious corrosion.

MR. HOWARD:

There is a corrosion problem in the Hobbs field?

MR. GRAY:

Yes, sir.

MR. HOWARD:

Do you have any information as to how much pressure under your completion program?

MR. GRAY:

I doubt whether the actual surface pressure would be any higher under dual completions than under present conditions. If the well is completed as an oil well that collection of oil would be such that the bottom hole pressure in the Bowers would be 1900 pounds and still not have to be much over 1100 pounds at the surface.

MR. HOWARD:

The corrosion would interfere with the effectiveness of dual completion program?

MR. GRAY:

Not in this particular well - in the dual completion.

MR. HOWARD:

The result could be more disastrous than in single completions, would it not?

MR. GRAY:

I don't believe it would make a great deal of difference.

MR. HOWARD:

Do you have any plans for further tests for sets if it is in condition to carry through?

MR. GRAY:

I think there should be pressure tests.

MR. HOWARD:

At what pressure?

MR. GRAY:

I would suggest slightly in excess of 200 pounds.

MR. FOSTER MORRELL (U. S. Geological Survey)

The matter discussed by the Representative for Tidewater Oil Company - The matter of a gas well producing from an oil reservoir - we have such wells, two of them, that were definitely established to be producing dry gas from oil reservoirs. Those wells were shut in, because we feel the gas produced from the oil reservoir should be conserved for the benefit of oil production. They were allowed to operate to produce gas (if they were), the gas cap was not feasible to take that. I think you mentioned if it was a dry gas well possibly it would be shut in so far as the Bowers well is concerned.

MR. GRAY:

I think cases of that sort are not peculiar to dual completions.

MR. PRESSLER:

If you were denied the right to dual complete this well, would you drill twin wells?

MR. GRAY:

In this particular well I think there is some doubt, for the reason that recently there has been a gas well completed east of this well. We certainly wouldn't be drilling a well there for a gas well.

MR. PRESSLER:

The reason you would not drill single wells is for the danger of obtaining a gas well in the Bowers field?

MR. GRAY:

In this particular instance I do not think that would be true. If the Bowers produces oil it would be much more valuable than a gas well. All we now have is gas well, the gas is being handled and being sold.

MR. PRESSLER:

You wouldn't drill another well to the Bowers sand?

MR. GRAY:

No, sir.

MR. HOWARD:

Mr. Grey, I understood this well was to be handled more or less as an experiment well?

MR. GRAY:

For the purpose of information we will be glad to turn all information obtained there over to the Commission. I think we will be quite willing to have the information published if necessary.

MR. GEORGE SELINGER (Skelly Oil Company)

Do you have any figures showing the economics of the dual completions in this particular well as compared to twin wells?

MR. GRAY:

I did at the last hearing.

MR. SELINGER:

You gave it on the other fields, but you did not give it on the Hobbs.

MR. GRAY:

So far as the drilling cost is concerned, I believe a well drilled to the Bowers would cost in the neighborhood of $20,000 - dual completion depends on how much it will be, would probably range from 6,000 to 10,000 dollars. I think you recognize also at the present time we have much greater shortage of material than we have had even during the war period.

MR. SELINGER:

Calling your attention to the Bowers horizon, I believe you said there were 15 or 18 wells to the Bowers sand?

MR. GRAY:

I believe I said 11. Ten complete, one drilling and one gas well.

MR. SELINGER:

What are the initial productiveness, general average on the range?

MR. GRAY:

From three barrels up to a very substantial capacity.

MR. SELINGER:

What is the maximum?

MR. GRAY:

418 barrels per day - the Continental No. 4 State A, that is probably a 24 hour test.

MR. SELINGER:

Do you have any figures as to the ultimate recovery from that sand?

MR. GRAY:

No, I don't. It isn't a thick sand, the recoveries aren't going to be so awfully high.

MR. SELINGER:

In drilling a twin well at a cost of $20,000, and dual completion at a cost of $6,000 to $10,000, you have approximately $10,000 to $14,000 difference?

MR. GRAY:

That is correct.

MR. SELINGER:

Do you think the operator would recover as economical a return on drilling that well?

MR. GRAY:

The question isn't whether the Bowers would pay for another well, it is whether the Byers would pay for another well. If we re-capped this well in the Bowers, it is very doubtful if we could afford to drill a well to the Byers.

MR. SELINGER:

The well is now producing from the Byers gas sand?

MR. GRAY:

That is right.

MR. SELINGER:

You want to complete the Byers and what other zone?

MR. GRAY:

Bowers.

MR. SELINGER:

The economics of drilling a well to the Bowers oil sand - you understand that?

MR. GRAY:

Yes, sir.

MR. SELINGER:

I was asking you the difference in the cost in drilling a well to the Bowers and the cost of dually completing the present Byers formation and Bowers oil formation - the extent of $6,000 to $10,000 , would you recover the difference of between $10,000 to $14,000 from the ultimate recovery of that well?

MR. GRAY:

I think so.

MR. HOWARD:

I believe you stated there was about a 600 foot interval between the Byers and the Bowers?

MR. GRAY:

Between 500 and 600.

MR. HOWARD:

What you state as your plan to do behind the pipe in order to prevent commingling between the two zones?

MR. GRAY:

This well was cemented with 400 sacks, which should be adequate to well more than cover the Bowers sand. It will be tested to see whether it is making a chanel behind the pipe, and if it is it will be scraped and re-perforated.

MR. TESCH:

Under present regulations you could plug back this present well from Byers to Bowers sand without much trouble?

MR. GRAY:

I believe that is right.

MR. TESCH:

You wouldn't be required to have a special permit.

MR. GRAY:

Wouldn't require a hearing.

MR. TESCH:

If you did that you would have to plug off the Byers sand - would you drill another well to the Byers sand?

MR. GRAY:

No.

MR. TESCH:

If you are not permitted to dual complete this well and have to plug off Byers sand, would that be wasted?

MR. GRAY:

I think it would.

MR. SELINGER:

If the Gulf drilled a twin well to the Bowers oil sand, to their present Byers gas well, would these wells - both wells - recover more oil and gas than a dual completion well to those formations?

MR. GRAY:

In that particular instance I don't believe there will be any difference.

MR. SELINGER:

You mean if you received a flowing oil well in the Bowers sand that if the well had to be placed on the pump you could produce as much oil from that dually completed well as you would if that was a single well completion?

MR. GRAY:

We are not proposing to put the well on the pump. I believe we can take it to the economic limit or gas or lift.

MR. SELINGER:

It will not necessitate going to the pumping stage to reach the ultimate recovery?

MR. GRAY:

I doubt it. We have had greater - and actually taken wells off the pump and put them on gas lift with increased production. We feel there is a good chance of operating wells with gas - artificial lift.

MR. SELINGER:

Is your answer the same with reference to the Byers gas sand?

MR. GRAY:

I am not sure I understand your question.

MR. SELINGER:

If you drilled twin wells to the Bowers oil sand, and you produced your present gas well from it, the Bowers gas sand, would you produce as much gas from that Byers gas well on a single completion as you would from a dual completion?

MR. GRAY:

It probably would produce as much on a single completion.

MR. SELINGER:

Would a single permit the well to produce more than on dual completion?

MR. GRAY:

In this particular circumstance, I don't think it would.

MR. SELINGER:

You are going to flow the gas through the annulus?

MR. GRAY:

That is correct.

MR. SELINGER:

Do you think the pressure of the formation is such that you will produce as much oil through the annulus as you would if your oil were being produced through the tubing?

MR. GRAY:

Some of those questions I think you would have to have a crystal ball to get the right answer.

MR. SELINGER:

You have gone into some explanation as to what might happen - If you don't know, just say you don't know.

MR. GRAY:

If it gets down to a question of whether or not the Bowers ceases to flow through the annulus, we can put a cross over and produce the oil through the tubing and the gas through the annulus.

MR. SELINGER:

When you put in a cross-over how many packers do you set?

MR. GRAY:

Two - two packers on the tubing.

MR. SELINGER:

You got the cross-over in the well producing your gas through the annulus, you think that well will produce as much gas through the annulus as it would as a single completion?

MR. GRAY:

If there was a question about that we would go through a small string of tubing and produce them through tubing.

MR. SELINGER:

A cross-over packer with two separate packers and macaroni string in your well?

MR. GRAY:

On your assumption those wells won't flow.

MR. SELINGER:

In order for that well to produce the greatest ultimate oil or gas, won't those factors have to be working in unison, in perfect order with each other?

MR. GRAY:

No, I think we should take care of those problems when they occur. At the present time we cannot forecast but can solve the problem if it becomes necessary.

MR. SELINGER:

Supposing you flow the gas through the annulus, will it flow as much gas through the annulus as through the tubing?

MR. GRAY:

If no trouble - yes.

COMMISSIONER MILES:

What do you refer to of no trouble?

MR. GRAY:

Some tendency for the condensate to build up in the annulus and gradually the pressure is reduced to where the well won't flow. In that event you remove the side-door choke and it produces for some time. If that becomes too troublesome you can install the macaroni string.

COMMISSIONER MILES:

You said in this particular instance- you said the well would produce as much through the dual completion as the single completion. Is this well - particularly this well, different from any other well in that field?

MR. GRAY:

I don't think it is greatly different, I believe generally we can get as much from dual completion as we can from twin or single completions.

COMMISSIONER MILES:

This well isn't different?

MR. GRAY:

This well is completed in a zone above the Hobbs-Dolman, which is the principal producing zone at Hobbs. For that reason it is not

MR. PRESSLER:

As I understand it, you said the cost to dually complete this well and drilling another well to the Bowers sand would be approximately $6,000 to $10,000.00?

MR. GRAY:

That is correct.

MR. PRESSLER:

If you find that instead of producing the gas through the tubing - the gas from the Byers and the oil from the Bowers through the annulus, then change over to this other method of producing discussed, what additional expense will that work-over job be?

MR. GRAY:

That will be relatively small, it will not occur until the pressures are low.

MR. PRESSLER:

What would be your estimate of that cost?

MR. GRAY:

In the neighborhood of one or two thousand dollars.

MR. PRESSLER:

Has your well any indications of parrafin?

MR. GRAY:

I have nothad any experience with the Bowers sand oil in Hobbs.

MR. PRESSLER:

Do you know whether any corrosive action in the Byers or not?

MR. GRAY:

So far as I know there is no corrosion in that.

MR. PRESSLER:

Or in the Bowers?

MR. GRAY:

We have had small indications, we have had some blow outs at the time of drilling.

MR. PRESSLER:

Have you investigated whether or not there is any corrosion?

MR. GRAY:

We have not pulled the tubing, but the surface equipment has not showed any indication of corrosion.

MR. FOSTER MORRELL:

Do you have any figures on the recovery of gas from the Byers?

MR. GRAY:

I don't believe I have them with me.

MR. MORRELL:

Do you have any idea of the lasting of Byers gas?

MR. GRAY:

I believe that should last for a long period of time.

COMMISSIONER MILES:

This question may have been answered - but it isn't clear in my mind - - This is an individual case your Company is trying, would it affect any other well in the area around it?

MR. GRAY:

I don't believe it would affect any other well whatever. The only danger in these dual completions is in the event of packer failure. As long as they are kept separately there is no harm done.

COMMISSIONER MILES:

But that could happen?

MR. GRAY:

It could just the same as failure of cement behind the pipe, and corrosion of pipe in single completions.

COMMISSIONER MILES:

It wouldn't be likely.

MR. GRAY:

I don't think it is a hazardous proposition.

COMMISSIONER MILES:

I have no further statements, if no one else has any that is all.

MR. SPURRIER:

Before adjourning the meeting I should like to announce we will follow the practice we followed in the last hearing and set a definite date for the next hearing. The last time, after some discussion, we set it for Tuesday, April 15, 1947. I think that July 15, is on a Tuesday also, and if that pleases the majority of the members it is the date we would like to set the next hearing for. In addition to that I will call for your petitions to be in by June 15, which will give us time for the ten days' advertising, and time for communications between the Commission and the Petitioner.

Does anyone have any objection to July 15, 1947, for the next hearing date?

(NO OBJECTIONS)

COMMISSIONER MILES:

I would like to express my appreciation for the cooperation you gentlemen have given to this Commission, and I appreciate the fact that you get together and work out a lot of these problems.

All cases heard today will be taken under advisement, and we will give decisions as soon as possible.

MR. SPURRIER:

Judge Lowe, for Case No. 95, what do you understand is the status of the case?

JUDGE LOWE:

It appears to me the solution of the controversy has been it is not a state-wide order. Each well will be taken up individually and not

necessarily a state-wide order. Our state-wide order - it just contemplated what we are going to do and would have to file separate application on each well. I do not feel the necessity of a state-wide order. I will withdraw Case No. 94.

It was never our intention to have a state-wide order; it would just give permission to the operators to apply to the Commission for an order on a specific well.

MR. SPURRIER:

That is all.

(MEETING ADJOURNED)

BEFORE THE

OIL CONSERVATION COMMISSION

Santa Fe, New Mexico

"Notice of Publication
State of New Mexico
Oil Conservation Commission

"The Oil Conservation Commission, as provided by law, hereby gives notice of the following hearings to be held at Santa Fe, New Mexico, at 10:00 o'clock A.M., January 10, 1947:

"CASE NO. 92

In the matter of the application of Gulf Oil Corporation for the issuance of a Special Order permitting the production of more than one horizon or pool through a single well bore in the Hobbs Pool, Lea County, New Mexico.

"CASE NO. 93

In the matter of the application of Gulf Oil Corporation, for the issuance of a Special Order permitting the production of more than one horizon or pool through a single well bore in the Paddock, Drinkard, Brunson, Jones, and Blinbry pools, Lea County, New Mexico.

"CASE NO. 94

In the matter of the application of Gulf Oil Corporation for the promulgation of a General Order permitting and controlling production for more than one horizon or pool through a single well bore.

"Given under the seal of said Commission at Santa Fe, New Mexico, on December 20, 1946.

OIL CONSERVATION COMMISSION

By: /s/ R. R. Spurrier, Secretary

S E A L"

Said meeting convened at the appointed hour, on the 10th day of January, 1947, in the Coronado room of the La Fonda Hotel, Santa Fe, New Mexico, with the Commission sitting as follows:

Hon. T. J. Mabry, Governor, Chairman
Hon. John E. Miles, State Land Commissioner, Member
Hon. R. R. Spurrier, Secretary, Oil Conservation Commission, Member
Hon. Carl Livingston, Chief Clerk & Legal Adviser, Oil Conservation Commission

R E G I S T E R

NAME	COMPANY	ADDRESS
Glenn Staley	Lea County Operators	Hobbs, New Mexico
W. R. Bollinger	Shell Oil Co., Inc.	Hobbs, New Mexico
H. B. Murray	The Texas Company	Midland, Texas
A. E. Willig	The Texas Company	Ft. Worth, Texas
P. H. Bohart	Gulf Oil Corporation	Tulsa, Oklahoma
Paul C. Evans	Gulf Oil Corporation	Hobbs, New Mexico
Eugene Husford	Gulf Refining Company	Mt. Pleasant, Michigan
H. C. Otis	Otis Pressure Control	Dallas, Texas
H. C. Laird	Otis Engineering Corporation	Dallas, Texas

REGISTER (Cont'd)

NAME	COMPANY	ADDRESS
G. H. Gray	Repollo Oil Company	Midland, Texas
Lloyd Holsapple	Repollo Oil Company	Ft. Worth, Texas
W. N. Little	Tide Water Association Oil Co.	Midland, Texas
Robert L. Bates	N. M. Bureau of Mines & Mineral Resources	Socorro, New Mexico
William B. Macey	Oil Conservation Commission	Artesia, New Mexico
E. J. Gallagher	Gulf Oil Corporation	Hobbs, New Mexico
John M. Kelly	Independent	Roswell, New Mexico
Foster Morrell	U. S. Geological Survey	Roswell, New Mexico
Vernon B. Bottoms	Superior Oil Company	Midland, Texas
R. S. Christie	Amerado Petroleum Corporation	Ft. Worth, Texas
H. L. Johnston	Continental Oil Company	Midland, Texas
S. V. McCollum	Continental Oil Company	Midland, Texas
N. R. Lamb	State Bureau of Mines & Mineral Resources	Artesia, New Mexico
D. R. McKeithan	Phillips Petroleum Company	Bartlesville, Oklahoma
Lloyd L. Gray	Gulf Oil Corporation	Tulsa, Oklahoma
S. A. Sanderson	Gulf Oil Corporation	Tulsa, Oklahoma
J. D. Atwood	Gulf Oil Corporation	Roswell, New Mexico
Charles C. Rodd	Gulf Oil Corporation	Tulsa, Oklahoma
Ralph L. Gray	Stanolind Oil Company	Hobbs, New Mexico
J. E. Wooton	Stanolind Oil & Gas Company	Ft. Worth, Texas
R. Floyd Farris	Stanolind Oil & Gas Company	Tulsa, Oklahoma
Roy O. Yarbrough	Oil Conservation Commission	Hobbs, New Mexico
J. W. House	Humble Oil Company	Midland, Texas
W. E. Hubbard	Humble Oil Company	Houston, Texas
R. S. Dewey	Humble Oil Company	Midland, Texas
George Berlin	Skelly Oil Company	Tulsa, Oklahoma
George W. Selinger	Skelly Oil Company	Tulsa, Oklahoma
J. N. Dunlavey	Skelly Oil Company	Hobbs, New Mexico
E. O. Anderson	New Mexico Bureau of Mines	Hobbs, New Mexico
Lewis Finch Jr.	Stanolind Oil & Gas Company	Ft. Worth, Texas
J. O. Seth (Attorney) -	Stanolind Oil & Gas Company	Santa Fe, New Mexico

DIRECT EXAMINATION

COLONEL ATWOOD, Attorney, for Gulf Oil Corporation:

I represent the Gulf Oil Corporation in this matter, and would like to call Mr. Gray.

(After being duly sworn, Mr. Lloyd Gray testified as follows)

MR. ATWOOD: State your name, please, and residence.

MR. GRAY: Lloyd Gray, Tulsa, Oklahoma.

Q. You the same Mr. Gray that testified in the preceding case?

A. Yes, that is correct.

Q. I would like to make a statement - these four petitions, one calls for a general order allowing dual completions of wells in any pool designated by the Commission after a hearing - Another calls for special orders on about 4 or 5 pools already named in Lea County, which would result in making exceptions to the present Orders. As I understand it, the present rules prohibit dual completions or the commingling of production from two or more pays in the same well. This special Order would call for exceptions to that rule. The third one calls for taking care of a special case in the Hobbs pool, and we would like, if satisfactory to the Commission, to go ahead and take these up in the order of the General Order in connection with the Drinkard Pool, and on with the others, all in one hearing to avoid repeating, but would like the Orders written separately. The purpose in filing two petitions, one for a general order and one for a special order was to give the Commission jurisdiction to make any kind of order it saw fit. If it wanted to go by the way of a general order, or by any pool, it could do that or adhere to the policy of the present order, and distinguish certain pools, and from time to time other pools - they could do that. The Commission can give any kind of order they want.

MR. GRAY:

I might add I don't believe we would object to the entire elimination of the one that has to do with a general order. It could be handled as an exception. Also, in the case of the Hobbs pool, the only thing we had in mind there was dual completion of West Grimes #4. We won't insist on it being a pool wide order.

COMMISSIONER MILES:

The factual data you have - has that been prepared by you or under your direction?

MR. GRAY:

It has been prepared by me or under my direction.

COMMISSIONER MILES:

As I understand it, you sponsor all this factual data, you can vouch for the reasonable accuracy of it?

A. That is correct.

COMMISSIONER MILES:

Will you proceed then to explain the proposal you are making?

A. I feel the matter of dual completion is definitely a conservation proposition, that is the multiple completion of several pools or formations in production through a single well. All the states in which we operate - the states have at one time or another had provisions for multiple completions. In the case of Kansas, it had such a provision but during the past year they rescinded it. In that particular case there was a very good reason for eliminating dual completion. As a matter of fact, we opposed the rule at the beginning on the premises we did not have mechanical means of separating two formations when at least one of them had to be pumped from inception. In this type of completion it was necessary to raise and lower tubing through a packer in order to pump each zone alternately. This practice caused an excessive amount of leakage, or the failure of the packer seal between tubing and packer. I think we highly agree in those instances they should not have dual completion.

We have prepared a fairly lengthy report on the various aspects of multiple completions - I do not believe we should burden the Commission with the reading of all of it. I will be glad to leave the report as evidence and exhibit in the case.

"In the Drinkard area there are two pays, the Blinbry and Tubb, which on the basis of present information appear to be gas-distillate zones. Although data are inadequate for making accurate estimates of recovery, it appears that recovery will probably not exceed 24,000 Mcf gas and 500 bbl of distillate per acre. On this basis, net revenue, after taxes and royalty would amount to $1,060 per acre or $42,000 for a 40-acre well. Assuming $75.00 per month operating expense and a twenty-year life, total operating expense would be $18,000 leaving only $24,000 to pay drilling and equipment expense. Since drilling and equipping wells in these formations will cost approximately $65,000 for Blinbry and $70,000 for Tubb wells, it is obvious that these pays could not be exploited on 40 acre, or even 80-acre spacing. However, the exploitation of these formations would be profitable in a dually completed well, and in cases where the other pays are doubtful the possibility of making a dual completion might well be the deciding factor in determining whether or not to drill a well.

"It also appears that the Paddock, Drinkard and Ellenberger pays will be marginal over certain portions of the area, and the use of dual completions in such cases may have a definite bearing uopn the completeness of development and the overall efficiency of recovery. A case in point is Gulf's L. I. Baker, Section 5-22S-37E, currently being drilled to the Ellenberger pay. This well

appears to be near the edge of the Ellenberger pay and will probably have a thin pay section and produce water early in its life. Overall recovery is expected to be approximately 100,000 bbl, and due to early water production, operating expense will undoubtedly be above average, possibly amounting to 20¢ per barrel. Estimated life of the wells is 8½ years of which 3 years will be required to pay out the drilling cost and net profit will amount only to $17,000. Considering the risk involved, cost of tank batteries, etc., this is a rather poor investment. However, if the Drinkard pay, which in this area appears to be fairly productive, can be exploited through the same well, the Ellenberger oil can be recovered for total additional expense of $62,000 and total profit of $67,000. In the case of the Baker well the Ellenberger pay will be exploited regardless of dual completions but it is doubtful if very many wells of this type would be drilled and certainly wells which might recover only 50,000 or 75,000 barrels could not be drilled".

MR. GRAY:

The tabulation gives the reservoir information, pressures, gas solution and flowing tests, etc.

Economics of dual completion, I think is very important, particularly when wells are drilled to distances of greater than 5,000 feet. Economics average cost-estimated cost of dual completion and savings to be effected --- at the present time our average cost of drilling a well to the Paddock pay has been $72,000, and the present estimated cost due to reduced contract prices largely, is $56,413.00. Likewise for the Drinkard pool, the average cost per well is $97,000, compared with the estimated cost at the present time of $75,000. The Brunson Pool wells, Ellenberger production, average cost is $113,000, the estimated present is $87,200. In addition to the change in contract price there is a number of other things coming into the reduced cost at the present time during the early portion of development, we, naturally, took more tests; and in addition certain wells gave quite a bit of trouble in the processes of completion. Our estimated present cost is probably going to be low on the average. The estimated savings by various pool completions are as follows:

Assuming a Drinkard-Ellenberger completion, the same completion estimated on present cost, considering they are twin wells, a total cost of $170,625, the dual completion cost estimated $160,531, or under present conditions it is estimated there would be a saving of $64,094.00. The same kind of comparison for Hope and Ellenburger shows a saving under present bill of approximately $44,822, Ellenburger and Drinkard completion saving of $45,184. I think probably it is a fair rule that a dual completion will cost about 60% of what two individual completions would cost. That estimate is entirelly with the economics of drilling and various completions.

The economics as applied to marginal pays, I think is even more important when the production horizon gives substantial recovery.

MULTIPLE COMPLETION PRACTICE

"Most multiple zone completions involve only two producing horizons, although a comparatively small number of wells have been completed with three producing horizons being produced separately. In a majority of instances all the horizons flow although they are numerous cases where one zone flows and one zone is lifted artificially, and a few cases where two zones are pumped simultaneously. One or two instances have been reported where two horizons were produced simultaneously by gas lift".

This portion has to do with the multiple completion practice. This portion we have had experience for the use of packers in New Mexico for a period beginning about 1935, started in the Hobbs pool, used packers to separate the gas zone and lower oil zone. Also to separate waters from the upper portion and lower portion. We have had almost no trouble with packers. Only one well, and I think, we could

if we estimated, throughout the Lea County area, probably have 50 or 60 wells in which we have formation packers and have not experienced any great difficulty. Packers have certain formations - also for some flow packers were set up in the casing, and there again was no difficulty. In Kansas we have a number of salt water disposal wells; because the water and the corrosion in that area we are not tubing the coat on the inside with the same thing and setting the packers on the bottom so that the water will not compact the casing - and again I do not recall a packer failure - the packer is similar to dual completion.

"The practice of pumping two zones alternately reached considerable proportions in Kansas but was recently discontinued. In this type of completion it was necessary to raise and lower tubing through a packer in order to pump each zone alternately. This practice caused an excessive amount of leakage, or failure of the packer seal between tubing and packer.

"Texas has the greatest number of multiple completions of any mid-west state.

"Most dual completions utilize the annulus between tubing and casing for producing the upper horizon and utilize the tubing for producing the lower zone. A standard packer, run on tubing and set between the two zones, and a side door choke, to facilitate completion and permit access to either formation, is all the special equipment required. This procedure lends itself readily to artificially lifting the lower zone. The principal drawback is the relative inefficiency and difficulty of sustaining flow through the annulus. As an aid in overcoming this difficulty, a double side door choke has been devised which permits both zones to be flowed alternately through the tubing. Vertical movement of four inches is required to change the ports in the tool. This movement is accomplished by a wire line attachment for raising and lowering the choke.

"A device known as the Lewis valve has been used to unload condensate or fluid from the annulus. In this arrangement a packer and the Lewis valve are run on tubing, usually 4 inches. A macaroni string of tubing is run inside the production string and attached to the Lewis valve. Time and pressure actuated surface equipment automatically raises and lowers the macaroni string periodically, permitting the annulus to unload through the macaroni string when the valve is in the raised position. The lower zone produces through the production string at all times and can unload through the macaroni string when the valve is lowered.

"The usual procedure of producing the upper zone through the annulus and the lower zone through the tubing may be reversed, if desirable, by using two packers, one of which is a "cross-over" type. In one type of installation both packers are run on tubing and set simultaneously. In another type of installation, the bottom packer is non-removable and is run on drill pipe or tubing prior to running the upper or "cross-over" type. In one type of installation both packers are run on tubing and set simultaneously. The lower packer is set between the producing zones and the cross-over packer is set above the top zone. A section of flush joint tubing extends through the lower packer".

The purpose of this portion is to show mechanical features of dual completion have been developed and it is not really in an experimental stage. In addition to this portion of the report I would like to enter a reprint which was shown in the Petroleum Engineer in August 1946.

"From the mechanical standpoint, dual completion of a well is largely an outgrowth of the practice of controlling ratios by blocking off a part of the gas-bearing portion situated above oil-bearing portion of a producing formation. Correctly placing the packer to admit the desired amount of gas into the tubing was often very difficult. The packer had to be reset several times in many instances before the desired results were obtained.

"This difficulty led to the development of equipment that made it possible to admit the gas into the tubing at the desired rate from the annulus above a packer that was set near the gas-oil contact or opposite a break between

the oil-gas section of the pay. This type of completion was practiced in the Jefferson field in the latter part of 1935 or early in 1936, followed by its application in Rodessa and Hobbs. This type of completion received some publicity in September, 1936.

"With equipment available for the type of completion just described, it was a simple matter to set a packer between two separate formations and utilize the gas from an upper zone to produce oil from a lower zone. At the same time gas could be produced at the surface from the casing. Some of the earliest dual completions were of this type, that is, upper gas and lower oil".

I might give you a few figures shown in this paper, prepared by Mr. Laird - shows the number of dually completed wells in California approximately 300. For Texas it goes into detail of just what type of dual completion, whether it is oil-oil or oil-gas, or gas-gas. The number has increased since 1940, the grand total is 920 - at the time of this paper. So far as the production rate is concerned, general rules and regulations now in effect in New Mexico are "Before any oil or gas well is completed as a producer, all oil, gas and water strata above the producing horizon shall be sealed or separated, in order to prevent their contents from passing into other strata".

In our application, I believe our proposal was rather general, it suggested that after approval had been given for any particular area that it would then be necessary to submit the detailed information on the construction of the well, then to be approved by the Commission without public hearing.

At a meeting last night (January 9, 1947) some of the other operators said they would like to know more what is going on, and I think it would be entirely satisfactory if we would amend the application to the Commission for dual completion, to submit to the Commission the usual number of copies, also copies to all offsetting operators; and the operator requesting the multiple completion would sign an affidavit that he had given to offsetting operators the information on the well, and a given period of 10 to 15 days for such operators to protest the application, but in event no protest was received that the Commission then, if they believed the application satisfactory, go ahead and approve it without public hearing - but if there be a protest have a public hearing on the case.

We have some information on co-mingling, I don't know if it would be pertinent at this time because we don't anticipate co-mingling at this time. A little later when wells become marginal it may become desirable to permit co-mingling. With regard to suggested plan of reports, we have prepared this proposed form and I might read this - it will be interesting I think to other operators just what procedure is proposed.

"Dual or multiple completion of a well initially would necessitate only a slight change in these reports. Form 101, Notice of Intention to Drill, would be submitted as usual. At the same time, Form 102, Miscellaneous Notices, would be submitted. Under 'Additional Information' on Form 101, it would be specified that the well is to be a dual or multiple zone completion. Form 102 would include a description of the work to be performed, such as zones to be exposed, procedure to be followed in completion, proposed packer setting depth, etc.

"Reconditioning of a multiple zone producer would be submitted as usual on Form 103.

"In lieu of the regular Well Record, Form 105, a special completion report would be submitted showing information on production from the various zones, gas-oil ratios, depth perforated, etc. A proposed well record form for dual or multiple zone wells is attached and could be designated as 105-A."

I believe that is all.

MR. LIVINGSTON:

What is meant by side door lock?

MR. GRAY:

It is a device run inside the tubing - the tubing has a special setting device running on it, has an opening out of the side of the tube. A side door choke is sealed, goes down over that side opening so that it can be sealed off. You can bore a hole between the two packings, also, having another tool, if you want to take bottom-hole pressure. You have got the packer between the upper and lower zone, you can take bottom-hole pressure for the lower zone, but cannot get bottom hole pressure on the outside. By going in and closing off the bottom portion of the tube and pulling the tool opening from the side you get bottom hole pressure on an average. Sometimes the well will load up and cease to flow on the annulus, again you can use the side door lock and seal off the bottom, and start it through the tube.

MR. SPURRIER:

Anyone here who would wish to ask Mr. Gray any further questions?

MR. WILLIG:

The proposal was a slight change from the written petition that you have Mr. Gray, in other words, the hearing procedure in connection with the proposed dual completion?

MR. GRAY:

The application for dual completion in any particular well would be submitted to the Commission as usual, also would go to the offsetting operators, and they would have 10 to 15 days to protest. If they did not want it to be permitted they could protest, and could have a public hearing - if they did not protest the Commission could approve without a public hearing.

MR WILLIG:

You had in mind following that procedure with the original dual completions in each field or subsequent?

MR. GRAY:

On subsequent, I think the original proposal should be a public hearing and get things traced out, but subsequently the individual wells would be handled this way.

MR. WILLIG:

These petitions that have been filed today, are they considered as applications on original dual completions?

MR. GRAY:

The one that has to do with the general Drinkard-Brunson area I think willbe of that nature and subsequently we would submit application as proposed on each individual well.

MR. WILLIG:

There are some other petitions I understand - are they also covered in the original applications?

MR. GRAY:

They might be in the start - we proposed they restrict for Gulf - West Grimes #4, in the so-called gas or packers sand. Our peoposal on how

to complete the West Grimes #4 is combined.

MR. ATWOOD:

All combined instead of going ahead with the case in Hobbs?

MR. GRAY:

West Grimes #4.

COMMISSIONER MILES:

Anybody else any questions?

MR. SELLINER:

I think it would be better for Mr. Gray to go ahead with his testimony on that particular well, then we can question him.

MR. GRAY:

This well was drilled early in the life of the Hobbs pool, I believe in early 1941. Two wells on that particular 40 acre pro-ration, one West Grimes #4 and one West Grimes #7. Because of high gas-oil ratio in #4 the well was shut in a number of years ago and the production from that unit - from #7. About 4 years ago we plugged the Hobbs Drinkard Pay. Found gas at approximately 3700 feet. I believe the potential on the well was slightly in excess of 23 million cu. ft. Since that time we have marketed the gas to the Lea County Gas Company, some for domestic and camp purposes and some for the gas system. Recently 5 wells have been completed in the Brunson zone, approximately 3200 feet deep. The location of West Grimes #4 is NE NE NW S32 18S 38E. We proposed to dual complete the well by plugging off the Byers sand and test the Powers sand later, drilling with the plug set packer between the two pays. The Powers gas and oil between the tube and casing, gas between the tubing.

COMMISSIONER MILES:

Anybody else want to ask any questions or bring up any points?

MR. SELLINGER:

Mr. Gray, I understand you now, on behalf of your Company, you do wish to press your application on Case No. 94, for a general order permitting dual completion for the State of New Mexico?

MR. GRAY:

I think our position on that is, we will leave up to the wishes of the Commission, if that fails it will be best we would have no objection, neither would we have any objection if it was decided to not change the general rules but treat these applications as exceptions, that is 92 and 93.

MR. SELLINGER:

Then I take it you are not pressing the Commission for the revocation of the provision for dual or multiple completions in this State?

MR. GRAY:

No.

MR. SELLINGER:

With respect to the procedure for permitting dual completions in a particular pool, as I understand, you are recommending to the Commission that first the application be for a pool wide basis, all whether or not dual or multiple completion should be permitted in that particular pool?

MR. GRAY:

Pool, field, or area. May be several pools.

MR. SELLINGER:

I take it, for each particular pool the application should be first as to whether or not multiple completion should be permitted involving that particular pool?

MR. GRAY:

Yes, sir.

MR. SELLINGER:

If the Commission acts favorably and does permit multiple completion involving that particular pool, it is your recommendation that subsequent applications need not be heard by the Commission itself, but be approved by the Director?

MR. GRAY:

Director, in the usual manner in which they approve applications.

MR. SELLINGER:

In addition, you would place the burden on the operator - requesting the multiple completions, the task of advising the adjacent lease holders?

MR. GRAY:

That is right. I think you should also advise the Commission who is advised.

MR. SELLINGER:

Such notice would be confined to the immediate adjacent 40 acre tracts, the entire lease or just how would you work it out?

MR. GRAY:

In Kansas the requirement is that you send notice to all operators who have a well located within one-half mile of the well under consideration.

MR. SELLINGER:

Lets confine it back to New Mexico; would it only apply to the owners of the 40 acre tracts adjacent to the particular 40 acres involved, or the leaseholders immediately adjacent?

MR. GRAY:

Personally, I don't think it would make any difference. I wouldn't object either way - I don't feel if we want to do a well in one end of the field, we should notify the operator on the other end.

MR. SELLINGER:

Do you not think any operator having production in a particular pool would be interested in knowing whether or not a different source of supply is opened in that particular place by multiple completion - don't you think other operators would be interested and as much involved as the immediate owners?

MR. GRAY:

I think we are all interested, I believe the people immediately offset certainly are going to be more interested than those more remote, so that if those operators are notified it should be sufficient.

MR. SELLINGER:

Mr. Gray, referring to the particular application which is involved - Case No. 92 - with respect to the Hobbs pool, you are asking the Commission to permit similar multiple completion to the various pays in the Hobbs pool, or confining this hearing merely to the Byers gas field and Bowers oil field?

MR. GRAY:

It is neither, has to do only with Gulf West Grimes #4, as a dual composition in the Byers and Bowers in that well only.

MR. SELLINGER:

Then that is a departure to your suggestion previousl - the first application should open the entire pool for multiple completions?

MR. GRAY:

We are willing to do that if the other operators want to - we do not want to push the thing unless other operators want to go along on it.

MR. SELLINGER:

Then, in view of that answer, you are not following your own suggestion - the first application - in a particular pool whether it involves one well or several wells, should open the Commission's action to multiple completions for a well in that pool -

MR. GRAY:

I think you should be permitted to ask for a hearing in any individual case. You may want to go ahead and have it pool wide - I don't think you should be restricted from having a hearing.

MR. SELLINGER:

If another operator in the Hobbs pool desires to do a completion to the Bowers oil sand and the Byers gas sand, under your present suggestion to the Commission, in establishing a procedure, would he be required to file an application with the Commission or can he file his application with the Director, giving notice to the direct offset?

MR. GRAY:

I think that depends entirely on their action here today - we have offered to restrict this to that well only. Any subsequent action would require probably a hearing.

COMMISSIONER MILES:

What do you refer to when you say "director"?

MR. SELLINGER:

I am taking Mr. Gray's suggestion it would be unnecessary on subsequent applications for the operator to file an application to the Commission and have a regular hearing - under Mr. Gray's suggestion, after the first application was filed subsequent applications need not be ordered by a hearing.

MR. ATWOOD:

In the first place, Mr. Gray has not made any suggestions to that effect. The Gulf filed application to know if certain pools have multiple completion, to be followed if that application is granted - the Hobbs application makes no suggestion whatever for throwing open Hobbs - We would appeal direct to the Commission to take that individual well case.

COMMISSIONER MILES:

The point I did not get - if the Commission should grant this and they did not have to come back to the Commission - - - the Director -

MR. GRAY:

It was my own error - sometime back I believe Mr. Kelley was shown as Director of the Commission - handled routine matters, had to do with approval of wells to be drilled. I think the action was under the Commission - I wish you would strike everything that had to do with the Commission.

MR. ATWOOD:

Once the pool has been thrown open by the Commission, therafter an individual well case, unless protested, the individual case can be passed upon without a hearing. Where the pool has not been thrown open - before any one well can be completed it will have to go before the Commission.

MR. SELLINGER:

If the Commission should grant Gulf Oil Corporation permission to multiple completions and West Grimes #4, from the Byers gas sand and the Bowers oil sand - and should another operator desire to do the same thing, under your recommendation will that operator have to file a formal application and have a formal hearing before the Commission?

MR. GRAY:

That is my understanding.

MR. SELLINGER:

I notice in some of the exhibits you introduced, or which you marked, I don't know particularly which one - - -

MR. GRAY:

They are not exhibits.

MR. SELLINGER:

Thap part of your statement with respect to the West Grimes #4, will, in which you state you desire to dual complete - that will fall as to producing gas from your Byers - to approximately what depth?

MR. GRAY:

Approximately 3700 feet.

MR. SELLINGER:

Bowers approximately what depth?

MR. GRAY:

3200 feet.

MR. SELLINGER:

In a case like that, in what part of your mechanical equipment would you produce the oil and what part the gas?

MR. GRAY:

The gas through the tube and oil through the annulus - between the tubing and casing.

MR. SELLINGER:

In order to get an average on the same basis, you mean the gas would be produced inside the tubing and the oil would be produced in that piece between the tube and casing?

MR. GRAY:

That is correct.

MR. SELLINGER:

Of course the space through the annulus is greater to what degree than the space inside the tube and casing?

MR. GRAY:

That is correct.

MR. SELLINGER:

Of course the space through the annulus is greater to what degree than the space inside the tube?

MR. GRAY:

It will be somewhat greater on the annulus than tubing, but we propose - when we submit our equipment we will show 3" tube and the space between the casing and tube will be less.

MR. SELLINGER:

You are probably familiar with the general rules of the Oil Conservation Commission of the State of New Mexico, are you not?

MR. GRAY:

Generally, yes.

MR. SELLINGER:

You are familiar with the rule which requires all flowing wells to be tubed in the State?

MR. GRAY:

I believe that is right.

MR. SELLINGER:

How would you produce this particular well and still comply with the particular provision?

MR. GRAY:

I think this would have to be an exception to that rule - - -

MR. SELLINGER:

If the Commission granted an exception for your particular well, they would have to grant a particular exception to requirement of flowing wells to be tubed, so far as this particular well is concerned.

MR. GRAY:

I think that is correct.

MR. SELLINGER:

In some part of this statement you made some reference about the inefficiencies - about flowing oil through the annulus space - do you recall that?

MR. GRAY:

Yes.

MR. SELLINGER:

Then I take it the flowing of the oil through the annulus space with particular regards to the West Grimes #4, by your own statement you should be less efficient than if the oil was flowing through the tube?

MR. GRAY:

Possibly it could - wasn't quite indicated - the thing that sometimes happens when the bottom hole pressure decreases, there is some tendency it will load up and cease flowing. In a great many instances we can get just as good ratio through the casing as through the tube. The operator has to revise it either by opening the side door lock or other methods - it still isn't exactly inefficient.

MR. SELLINGER:

What is the purpose of producing wells through the tube instead of the casing?

MR. GRAY:

Quite a number - perhaps sometimes you may get the well to flow longer through the tubing than through the casing.

MR. SELLINGER:

Is that generally true?

MR. GRAY:

Not always true, quite frequently find less flow through the casing and more through the tube.

MR. SELLINGER:

Do you find that very ordinary - to be able to flow through the casing and not through the tubing?

MR. GRAY:

Not uncommon but I imagine on the average they will flow longer through the tubing.

MR. SELLINGER:

You have any other reason why it is preferable to flow oil through the tubing than through the casing?

MR. GRAY:

There are cases you can get better gas-oil ratio.

MR. SELLINGER:

In flowing oil through your casing is there a head of gas forming in regard to working or bringing the well back to flowing - A head of gas you must get rid of?

MR. GRAY: I don't think so.

MR. SELLINGER:

Let us turn to your testimony with respect to Case No. 93, on the Paddock-Drinkard, and other pools which you testified about - turning to those, particularly to the Paddock - what formation is that geologically?

MR. GRAY:

I don't know if I can tell you.

MR. SELLINGER:

What is the common description for that pool?

MR. GRAY:

I do not recall.

MR. SELLINGER:

Glorietta?

MR. GRAY:

I believe that is right,

MR. SELLINGER:

How many wells are producing from the Paddock at the present time?

MR. GRAY:

I will be glad to submit this map in evidence, the wells producing from the Paddock are shown here in light green color.

MR. SELLINGER:

How many are there Mr. Gray?

MR. GRAY:

Looks like there are probably in excess of 50 to 56 wells.

MR. SELLINGER:

In the Paddock area?

MR. GRAY:

Yes, sir.

MR. SELLINGER:

Are all those wells flowing wells?

MR. GRAY:

I think all - I am not sure whether they are all flowing wells or not, The Paddock pay does not have a great deal of gas, they have at least one that has to be kicked off they say by a gas lift.

MR. SELLINGER:

When you say they do not have very much gas, you mean the flowing life will be considerably short?

MR. GRAY:

It may be - on the other hand it may be very long. Right now we have a low gas-oil ratio. If this proves to be a dry gas-oil ratio it will increase. We may have less trouble in six months to a year than now.

MR. SELLINGER:

Do you know what the dominating energy of this field is now?

MR. GRAY:

I believe it is going to be gas dry reservoir.

MR. SELLINGER:

Would that normally result, as time goes on, in higher ratios and in more gas?

MR. GRAY: That is correct.

MR. SELLINGER:

At the present time, however, the ratios are low and from what you know now there is a shortage of gas?

MR. GRAY:

Some of those wells are the nicest flowing wells we have.

MR. SELLINGER:

Are you familiar with the pressures of that area?

MR. GRAY:

Fairly well.

MR. SELLINGER:

Could you tell the Commission whether or not the pressure is sub-normal, normal or ab-normal for that depth?

MR. GRAY:

Initial bottom hole pressure of 2120 the depth about 5100 feet - so I would say the pressures there are about normal.

MR. SELLINGER:

You gave us the initial pressure, do you have any information as to what the present pressures are?

MR. GRAY:

I don't believe I have it here.

MR. SELLINGER:

Do you know what they are?

MR. GRAY:

No, I don't, I can get it for you.

MR. SELLINGER:

Will you supply the record with what the present pressures are for this field?

MR. GRAY:

-------- Yes??

MR. SELLINGER:

Mr. Gray, what I am interested in securing is the record of the present average pressure of those 55 wells if you have them.

MR. GRAY:

We do not have them.

MR. SELLINGER:

If you do not - do you have the present pressures of the Gulf wells?

MR. GRAY:

I think we have pressures on all Gulf wells, although I am not certain.

MR. SELLINGER:

That tabulation you have in front of you - in which you give the initial pressures - that covers what - only the Gulf wells?

MR. GRAY:

That is our wells in that area.

MR. SELLINGER:

Is that an average of the Gulf wells in that area?

MR. GRAY:

The static pressure of the Gulf wells in February - February 20, 1945, was 1765 pounds, in May 1946, 1525 pounds.

MR. SELLINGER:

1525 pounds - the latest you have?

MR. GRAY:

November, 1946, 1344 pounds.

MR. SELLINGER:

How much of a decline is that from the initial pressure?

MR. GRAY: Between 700 or 800 pounds.

MR. SELLINGER:

The difference between 2120 and 1344?

MR. GRAY:

Correct.

MR. SELLINGER:

Mr. Gray, you have had considerable experience in the oil business have you not?

MR. GRAY:

Some.

MR. SELLINGER:

What is your opinion as to whether or not that is a pretty good decline for a year's production?

MR. GRAY:

It is a very rapid decline, and the decline tests indicate we have a gas dry reservoir - on the other hand it has been my experience a drop experienced in the early life of the field is much greater than during the later life.

MR. SELLINGER:

In other words, you do not anticipate the same rate of decline for the following year or following periods of time?

MR. GRAY:

I do not.

MR. SELLINGER:

Will you explain to the Commission the value of having high pressures in producing oils?

MR. GRAY:

Less trouble - they flow easier.

MR. SELLINGER:

Is pressure indicative of the flowing life of the field?

MR. GRAY:

Not entirely.

MR. SELLINGER:

Is it an indication of whether or not a field will flow over a longer period of time if you have higher pressures?

MR. GRAY:

If you have higher pressures it will have a greater tendency to flow. It does not make a great difference what pressure if the water gets in excess of 20 or 25 feet you will have trouble.

MR. SELLINGER:

What is the water situation with respect to the Paddock field?

MR. GRAY:

So far not serious.

MR. SELLINGER:

What is the highest percentage of any well you know of - if you do not have that, what is it on the Gulf wells?

MR. GRAY:

I don't know.

MR. SELLINGER:

With respect to your Drinkard pool - how many wells in that field?

MR. GRAY:

Looks like 45.

MR. SELLINGER:

45 wells - how many owned by the Gulf?

MR. GRAY:

Approximately 25, maybe 30.

MR. SELLINGER:

Would you say the pressures in that field are sub-normal, normal, or ab-normal?

MR. GRAY:

I think they are about normal.

MR. SELLINGER:

Was the Gulf the descriptive well of that field?

MR. GRAY:

That is right.

MR. SELLINGER:

What is the initial pressure of that field?

MR. GRAY:

The pay in that field ranges from 6500 down to 6900 feet, it depends on the depth of completion of the well - the pressures show ranges of 2860 to 2812 pounds.

MR. SELLINGER:

Initial pressures?

MR. GRAY:

That is right.

MR. SELLINGER:

What is the latest pressures you have - having in mind the different depths, giving me the minimum and maximum.

MR. GRAY:

1903 to 2213 pounds.

MR. SELLINGER:

How old is that field?

MR. GRAY:

I am not positive about it, but I imagine in the neighborhood of 2 years old.

MR. SELLINGER:

Would you say the pressure has declined in that time - that the decline is considerable or normal?

MR. GRAY:

Substantial decline.

MR. SELLINGER:

Do you anticipate that the wells will continue to decline in their pressure for the present and future as they have in the past?

MR. GRAY:

At the same rate per thousand barrels of oil produced.

MR. SELLINGER:

What kind of deposit is this field?

MR. GRAY:

I believe this is also gas drive.

MR. SELLINGER:

What is the condition of the water?

MR. GRAY:

Some water produced, but not maj or quantities.

MR. SELLINGER:

You anticipate a water increase as time goes on, in this field?

MR. GRAY:

Yes, but not too much quantity of water.

MR. SELLINGER:

With respect to the pressures, would you say the pressures in that field are sub-normal, normal or ab-normal?

MR. GRAY:

Probably fairly well normal. The initial pressure was 3150 pounds, the depth right at 8,000 feet. That is fairly close to normal.

MR. SELLINGER:

What is the last pressure you have on this particular pool?

MR. GRAY:

2990 pounds, November, 1946.

MR. SELLINGER:

How old is that pool?

MR. GRAY:

Between one and one and a half years old.

MR. SELLINGER:

And is that similarly a gas drive field?

MR. GRAY:

No, I believe it will be a water drive in that reservoir.

MR. SELLINGER:

Are any of the wells making water now?

MR. GRAY:

Yes, sir.

MR. SELLINGER:

How many wells in the field?

MR. GRAY:

I count 16.

MR. SELLINGER:

How many owned by the Gulf?

MR. GRAY:

One and part of another.

MR. SELLINGER:

Your request here, Mr. Gray, is for permission to dual complete any two of those mentioned in your application, or for permission to complete as many as are in the zones as your equipment can permit?

MR. GRAY:

We anticipate only dual completion at the present time, we don't want to restrict it just to to dual completion - at the present time we do not have equipment, but certainly expect exploration of more than two horizons. There has been substantial improvement in equipment, and subsequently, we may be able to do it - would not like to see it prohibited for only that.

MR. SELLINGER:

Your request for dual completion - you wish orders to permit multiple completion?

MR. GRAY:

That is correct.

MR. SELLINGER:

Are your wells in these pools able to have multiple completions - that is in excess of two?

MR. GRAY:

Multiple completion?

MR. SELLINGER:

The equipment of your wells, can they at the present time have multiple completions in them, is it possible to make multiple completions on your wells with the present equipment?

MR. GRAY:

We would have to put additional equipment to dual complete - the condition of the wells are such that you could dual complete them.

MR. SELLINGER:

In excess of dual completion, would some of your wells have to have an additional string of casing run?

MR. GRAY:

Might be - might require it, I don't know. Might require an additional string of tubing.

MR. SELLINGER:

Each additional string would necessitate additional packer or two packers?

MR. GRAY:

Each additional one, normally, would require one packer.

MR. SELLINGER:

And would be only three packers on triple completion?

MR. GRAY:

I think so. Although, if we want to put a cross-over packer, it might require four.

MR. SELLINGER:

If you put a cross-over it would necessitate two packers for that cross-over, is that right?

MR. GRAY:

That is correct.

MR. SELLINGER:

Will you explain to the Commission what you mean by cross-over?

MR. GRAY:

A cross-over packer has a provision you can change the flowing string from the tubing to the casing or the reverse. You can take from the annulus and go into the tube. In the case of West Grimes #4 by the installation of a cross-over packer we could produce the gas through the tubing. If we find we are running into high gas-oil ratios, we would anticipate that type of packing.

MR. SELLINGER:

By installing that cross-over it would necessitate your running two packers in that particular well?

MR. GRAY:

That is correct.

MR. SELLINGER:

With regards to the practibility of packer in order to prevent what they call a leak packer, you would have to take of pressure differential between the two zones, would you not?

MR. GRAY:

Yes, sir.

MR. SELLINGER:

Will you explain to the Commission the reason for maintaining pressure between the two zones?

MR. GRAY:

I don't understand the question.

MR. SELLINGER:

Why is it necessary to maintain pressure between the two zones as equally as possible?

MR. GRAY:

I don't think that is necessary.

MR. SELLINGER:

If too much pressure is applied to the packer from one zone, would it have a tendency of blowing out or not holding?

MR. GRAY:

You wouldn't have a good packer.

MR. SELLINGER:

If there is too much pressure on the lower zone, what would the tendency be for the packer?

MR. GRAY:

Depends on what kind of packer you have - the regular wall packer, there would be a tendency to lift it.

MR. SELLINGER:

Do those slips work to prevent the packer from being pushed up?

MR. GRAY:

Only have two sets of slips.

COMMISSIONER MILES:

There are packers that would prevent anything like that?

MR. GRAY:

That is correct.

COMMISSIONER MILES:

Anybody else?

MR. SELLINGER:

I I might say, I understood with regards to the co-mingling, you are not preparing an application for the Commission at this time?

MR. GRAY:

No, not even in the original application. It was anticipated they would not approve it at this time, but might recognize it at which time it would be desirable - in that case it would take a hearing.

MR. SELLINGER:

Would you recommend the Commission to disregard that?

MR. ATWOOD:

There is nothing in your petition asking for co-mingling.

MR. GRAY:

We just mentioned it might require co-mingling.

MR. ATWOOD:

You stated in your petition co-mingling is not requested at this time. Something you said about the notice given in the case of individual well applications, after a pool had been opened up for dual completion the people interested are to be notified and it submitted to the Commission for hearing if necessary.

MR. GRAY:

Yes, that is just a suggestion. I suggested 10 or 15 days to get the notice circulated and give plenty of time.

MR. ATWOOD:

It is up to the Commission who to notify.

MR. GRAY:

That is correct.

(EXAMINATION OF MR. R. S. DEWEY)

(After being duly sworn, Mr. Dewey testified as follows)

MR. W. E. HUBBARD (Examiner)

Mr. Dewey, will you state your full name, affiliation, and experience?

MR. DEWEY:

My name is Robert S. Dewey, I am employed by the Humble Oil Company and have been employed by them the past 20 years, most of the time in the West Texas and New Mexico area. I am the Division Petroleum Engineer, located at Midland, Texas.

MR. HUBBARD:

You mind stating, Mr. Dewey, what you know of the operations of the Humble Oil Company in dual completions, and the new experience in West Texas, which would have any bearing on the propriety of dual completions.

MR. DEWEY:

A survey made recently of the Humble Company's experience with multiple zone completions indicates out of 36 multiple zone completions made, up until the late Spring of 1946, the Humble Company had 14 failures, and has had to work over 18 of these wells as a direct result of having completed them as dual zone completions. In addition to this, for the past 16 months, ending April 1, 1946, the Humble Company had 78 packer failures; and single zone completions in its operations - of 58, these failures where the cause was known, 27 leaked on test, 12 could not be unseated, 5 hung up going in the hole, and 4 failed to set. The sets gave way on 4 packers when set while running in the hole, and for the other 5 it was considered the channels behind the casing were responsible for failure to obtain shut off. The detail material of which that is a summary - we would be glad to prepare. The show of individual wells at a depth at which the completions were made - the depth at which the packers were set, and the cause of failure as we interpreted it. If the Commission would desire that type of information in detail we would be glad to submit it to them for this hearing.

MR. SPURRIER:

Do you have that information in a form you may submit it right now as an exhibit?

MR. DEWEY:

No - it isn't ready. We have it in a way, but not in a way we would like to handle it.

MR. SPURRIER:

We will put in the record you may prepare it in detail and send it in and we will make it a part of this record.

MR. DEWEY:

That record will cover the Humble's experience in West Texas and New Mexico, as well as being included in the whole. We draw a conclusion from our experience of multiple zone completions based upon failures - we have noted that they have not proved satisfactory and that there is still room for improvement in the manner of both making multiple zone completions and the equipment used. We do not feel that either have reached perfection yet.

MR. SPURRIER:

You think, Mr. Dewey, there is a good chance of doing this, once a great number of wells in the pool have been dually completed?

MR. DEWEY:

I do - I think one or two poorly completed may cause serious migration from one zone to another.

MR. SPURRIER:

Will that cause waste?

MR. DEWEY:

It might cause very serious waste, particularly the oil from one horizon got away and got into sand - got into water sand, and the waste might be very extensive. I might illustrate one basis for that conclusion - The operators in the Seminole sand in West Texas decided to employ a consultant to analyze the reservoir characteristics in the field to determine for the current condition of the reservoir and make recommendations, looking toward the future production and possible secondary recovery program or gas maintenance program. In the Seminole reservoir there are two horizons, the upper is the Yates and it is in the central part of the field, it carries ab-normally high gas, the oil productive horizon is in the San Andres formation, a considerable depth below the Yates horizon. The original gas cap in the San Andres formation - this gas cap was under laid by oil in the drilling of the reservoir, the operators found it rather difficult to drill their wells without setting an intermediate set of casing to exclude the Yates sand gas. In fact, the rules and regulations were written by the Texas Railway Commission requiring the central part of the shale each operator would case off the Yates gas sand. The consultant, after analyzing for some 6 or 8 months came to the conclusion that there must be migration downward on the Yates gas sand into the gas cap overlying the oil production and that this migration of free gas from the upper to the lower horizon was of such serious extent they might be unable to complete their analysis - so the Seminole reservoir test confirmed the fact that there was such a migration. At the present time the operators in the Seminole field are concerned over this migration and we are trying to find which well or wells are contributing the gas to the lower horizon. This illustration, to my mind, even where operators use due diligence and have submitted cases, made tests prescribed by the regulatory board, even then perhaps one or two, perhaps more wells can change very greatly the reservoir characteristics from one reservoir flow into another reservoir under multiple zone conditions. A similar thing might happen, in fact an opportunity for it to happen would be greater I think than under the example I have cited. We do know in the Seminole reservoir the corrosion is bad, casing corrosion, and we do know we have casing corrosion in such pools as Hobbs in New Mexico, and other pools in the Hobbs pools. For instance one operator, the Shell Company, had been carrying on a rather extensive program in setting inside strings of casing in a great many of their wells. This Company felt that it was pertinent to protect their investment and future recovery in the Hobbs pool, setting

strings of casing - and a good deal of expense to themselves. I am sure they are not the only operators in New Mexico that have similar conditions.

I think casing corrosion is one of the very serious things that should be considered in writing any general order or any specific order relative to permitting dual completions. As yet, we know very little about preventing casing corrosion. One method that has been tried and is being tried is by lubricating foamites and other compounds down the annulus between the casing and tubing to act as an equalizer to prevent the corrosion from attacking the casing. Under dual completions method where the annulus space is used as a flow string we do not see how an operator can use preventitive measures so far as anything to prevent casing corrosion. We also know that in single completions we have a great deal of trouble with parrafin, wells have a tendency to parrafin up. We don't know just how the multiple zone completions and operator is going to handle the parrafin problem, how he is going to successfully pull the tube and scrape the parrafin that may accumulate in the annulus. We have heard nothing from the relative solution of that problem. I think it is one that should be given consideration in the multiple zone completions in the New Mexico area.

MR. SPURRIER:

Did the Humble Company operate in the field now under construction?

MR. DEWEY:

That is correct - in the Hobbs pool the Humble operates several leases. Our principal is our federal Leonard lease which offsets the Gulf West Grimes lease, in which Mr. Gray has proposed making dual completions. This is a federal lease which, under the current federal regulations, will not permit us to make a dual completion to protedt withdrawals from the Bowers sand. Not that we have planned or care to make dual completions; it has been our intention that as the Bowers sand develops we would drill a well to the Bowers sand and to complete it there, and we have had no idea of trying to make dual completion between the present sand and ours and the Bowers sand. In fact, we oppose Mr. Gray's application in that we feel such application sets a precedent in the Hobbs field which we think would be detrimental in any way not only to ourselves, but to the other operators interested in the pool.

COMMISSIONER MILES:

Do you feel that would apply to the other fields?

MR. DEWEY:

We do - we feel the regulations now in force will serve best.

COMMISSIONER MILES:

You feel it will be economical?

MR. DEWEY:

We feel economy over a long range will be better served under single completions as a whole than it will under dual completions. Dual completions indicate a nice initial saving - on down the line the difficulties that can and do arise under it in working wells over and loss of oil, and other things will more than neutralize the initial savings. We think in individual cases perhaps dual completions will effect a nice saving for some particular operator.

COMMISSIONER MILES:

In all particular cases from conservation of the oil?

MR. DEWEY:

If some operators are particularly lucky in the installation and type of reservoir - he might not have parrafin or corrosion trouble, may not have these two things to contend with. Some other operator may be led into following the example.

Just one other thing relative to the Gulf application for dual completion in Hobbs pool, I wish to point out to the Commission if anything was offered in the test relative to what intentions the Gulf had relative to the taking of bottom hole pressure - and other things that might be of interest following the productivity of Bowers sand. It has been the Humble Company's experience that where dually completed wells are permitted it is very difficult to get the same type and quality of production data and pressure data that we feel we need in making our reservoir studies. If we do not have that type of information we are unable to analyze our reservoirs and determine whether consideration should be given to secondary recovery pressure maintenance and other means of increasing the ultimate recovery that might be obtained on just direct flow to abandonment.

I have here a paper that was prepared for presentation before the A.P.I., and Pacific Coast Division of Production, American Petroleum Institute, Los Angeles, California. This is a preprint I have obtained from the API titled "Dual Performance of Multi-Zone Wells in the Wilmington Field, California," by Carlton Beal of the Richfield Oil Corporation, and Read Winterburn, Union Pacific Railroad Company.

I would like to introduce this as an exhibit in the case.

Relative to the Drinkard-Paddock area - for another purpose we prepared a typical cross section of this area which might be of interest in showing and following this discussion of the various zones. We are particularly interested in the Paddock area, due to our development on our New Mexico State lease - Up to December 30, 1946, we had 11 wells completed on that lease, we took some productivity on the State, S9, S10, and S11, and the productivity factor on New Mexico State was taken November 6, 1946, after just 6 hours test - indicated fluid productivity factor of 29 or 35, this fluid productivity became a substantial decline, if the test is extended long enough the productivity factors are rather low, which does not indicate that it is too good producing property. S9 had .83, .43, S10 had .36 to .18, S11 had .77 to .30 - These increasing productivity factors were accomplished by increasing the gas-oil ratio and also by increasing water percentages. We are perturbed on this lease; we have at least 3 horizons in the Paddock Pay, and in these 3 horizons we haven't as yet been able to identify an individual well - just which ones are making water and which ones are not. While the water percentage is not very large as yet, it is increasing and looks to us that this would constitute a very serious problem on that lease before long. We do feel these wells, if they had been dually completed it would have been almost impossible for us to gather the type of information we will need to identify the water - where the water is coming from, and to do the necessary shut off when it becomes too large, without sacrificing production from the lower Drinkard horizon during the time we are working over the well and the expense would be greater than it will be under the condition where each well is produced from one horizon at the time. We do view with alarm the declining pressure Mr. Gray testified to. In the Drinkard field we may have some indications of the gas cap, which may need to be corrected. We feel so far as our property is concerned we would aid to have the Drinkard and Paddock wells dually completed. There is more water being produced from our Drinkard area than there is from the Paddock wells. The gas-oil ratio, the last time we consulted, it was 1732 pounds - a rather high ratio for the length of time the wells have been under production. In

In completing Greenwood in the Grunson field, we found there were two zones of production in the Ellenburger line which were substantially separated from each other by a barren streak - shortly after completion of the well the water percentage increased, at an alarming rate, so that we felt it was necessary to go in and abandon the lower part of the Ellenburger formation.

If you will note from the cross-section submitted to you, that this covers quite an area and it might be possible to get almost any number of wells completed between different zones - it might be possible if the area continues to develop as it has in the past you could go down one well beyond one horizon and follow where it is duly completed and follow down progressively through 6 different steps across the field until you had everything tied from the Paddock Pay clear to the Ellenburger Pay, some gas drives and some water drives, some would necessarily have to be pumped. It would become an exceedingly complicated pattern, and present a problem to any regulatory body to devise any adequate means of policy and maintenance of equities between the operators. We feel that dual completions were justified as a war emergency, but that the war emergency is largely in the past. We might look forward to sufficient steel to give us the necessary casing to make single casing in our wells and not too much undue delay.

In conclusion, I wish to emphasize it is our intention to continue with the single well completions, and we hope we will not be forced to meet offsets that are dually completed.

MR. SELLINGER:

Mr. Dewey, the 58 instances you referred to earlier covered flowing wells did they not?

MR. DEWEY:

That is my understanding.

MR. SELLINGER:

Where you have a dual completion in which one or both are pumping, it would be less satisfactory than a flowing dual completion would it not?

MR. DEWEY:

I think greatly so. That would depend upon whether the upper formations were pumped or the relative amount of trouble you would have with the two.

MR. SELLINGER:

Where one or both are pumped, the problem would be greatly exaggeraged would they not - from a practical point of view?

MR. DEWEY:

That is right, the packing element would be increased. The packers treated as being such simple mechanisms, but besides the principal packer you have to put in a well, there are other packing elements in there, so that you may have from 5 to 8 different elements that have to hold. It isn't just one single packer. Where you are trying to pump through a pack there is a certain amount of wear and the difficulties are greatly increased.

MR. SELLINGER:

That is all.

MR. ATWOOD:

Mr. Dewey, wouldn't it be up to the individual operator in each individual case whether or not the advantages out weighed the disadvantages in making dual completions?

MR. DEWEY:

I think we are in a common reservoir and we all have common interests into those reservoirs, and any damage that is done by one operator may lead to damage to the other operators in there - I do not see why one operator should have the right to go in there and jeopardize the equity the other operators have in the pool to gain maybe temporary economy.

MR. ATWOOD:

Damage can only result through improper completion couldn't it?

MR. DEWEY:

The operator may make a completion with all best intentions and he may feel it is a proper completion, and nobody may detect the damage for a considerable length of time - it is similar to that case I tried to explain to you about the Seminole field. You might not be conscious there is any damage done. The same thing could happen with multiple zone completions, everybody be entirely innocent of the damage.

MR. ATWOOD:

You claim the Seminole pool damage was due to multiple completions?

MR. DEWEY:

No, sir, that was due to something else.

MR. ATWOOD:

And if a failure in completion occurs, or if later a failure occurs, can it not be detected by proper inspection?

MR. DEWEY:

With the operators in the Seminole field, they were as diligent as operators generally are.

MR. ATWOOD:

I am speaking about multiple inspection in Lea County, New Mexico.

MR. DEWEY:

That is a question I could not answer flat yes or flat no - We have none in New Mexico that I know of.

MR. ATWOOD:

If it is permitted - you have said damage could come about through failure - - -

MR. DEWEY:

It could.

MR. ATWOOD:

Cannot that failure be detected?

MR. DEWEY:

I would have to answer that no, because of the fact that it might be detected after the damage is done. It isn't a question I could say yes or no to. It might be detected - there is a very good chance the damage would be done before it was detected.

MR. ATWOOD:

That could also happen in single zone completions.

MR. DEWEY:

Exactly, and does happen, but the damage is not as great, is not as hazardous an operation as packer setting. I think wells that have to be maintained - I don't think the two can be compared.

MR. ATWOOD:

How many cases do you know of where damage from multiple zones or dual completions have happened?

MR. DEWEY:

Frankly, I don't know of any, I am not experienced in multiple zone completions, because we have made but two and both of those were the very simple type or we were producing gas through the annulus and oil through the tubing, and all it required was the simple packer. Did not require a lot of supplemental gadgets such as multiple zone completions may run into.

MR. ATWOOD:

Isn't it possible by use of proper material, skill, and handling - to successfully complete dual zone operations in Lea County?

MR. DEWEY:

I think it is possible, but one or two bad ones may neutralize all good ones.

MR. ATWOOD:

You have just said there were bad ones in single zone operations - completions.

MR. DEWEY:

Yes, we have so many troubles we don't want to complicate them with a lot more.

MR. ATWOOD:

You understand this order is permissive only, and not mandatory?

MR. DEWEY:

Yes, I understand that, but if a permissive order like that is granted it sooner or later becomes almost mandatory by its greater enlargement.

MR. ATWOOD:

Wouldn't that be because of the success of it?

MR. DEWEY:

Not necessarily - no, sir.

MR. ATWOOD:

If it is a failure it would not be mandatory.

MR. ATWOOD (cont'd)

You object, I believe, to the completion of the single well in Hobbs as dual completion well, do you think it will damage the Humble lease to do that?

MR. DEWEY:

If they complete a dual well there, I anticipate the federal authorities will expect us to complete a dual well.

MR. ATWOOD:

Anytime your acreage is offset by production from another zone, you try to offset it don't you?

MR. DEWEY:

Yes, we try to do that.

MR. ATWOOD:

In this case, you would be willing to do it, if Mr. Morrell would let you, wouldn't you?

MR. DEWEY:

I think so.

MR. ATWOOD:

Your objection is ? ?

MR. DEWEY:

The unfairness of it.

MR. ATWOOD:

You own federal leases and they own private leases. You want your federal leases equalized by burdens on the other fields?

MR. DEWEY:

No, we manage to carry our load.

MR. ATWOOD:

You are afraid they are going to do it - - -

MR. DEWEY:

We would like to get characteristics of that well, and be able to get production history and things difficult to get with dual completions.

MR. ATWOOD:

I believe you say down in Texas you have not had very good luck in dual completions ? ?

MR. DEWEY:

We have had two in our area, one of them - - I would say they were both successful so far as the mechanics in dual completion was concerned. One of them was unsuccessful due to the fact that we did not develop the gas reserve we thought we had. The other one was successful, it was done as a war emergency.

MR. ATWOOD:

Other companies have had fair success, have they not?

MR. DEWEY:

I do not like to give a lot of hearsay, but - - -

MR. ATWOOD:

You have heard the testimony of Mr. Gray - the Gulf's experience?

MR. DEWEY:

He was testifying about Kansas and Oklahoma.

MR. ATWOOD:

You think your failure down in Texas was on account of being in Texas?

MR. DEWEY:

The conditions might be different, may be we are just poor operators in Oklahoma.

MR. ATWOOD:

That is all, thank you

MR. S. A. SANDERSON:

On these 58 dually completed wells where you had the 8 failures, do you know in a general way, where they were located.

MR. DEWEY:

Two of them were located in West Texas area, and the others in the operating territory of the Humble. I can give you a general idea, I think, where they were located. We are going to supply this to the Commission.

MR. SANDERSON:

Do you know anything about the conditions with respect to temperature in those cases?

MR. DEWEY:

The temperatures are much higher than they are in the West Texas-New Mexico area. The tabulation will give the depth of those and we can supply the temperatures if you would be interested.

MR. SANDERSON:

In a general way the temperatures down there exceed 200 degrees?

MR. DEWEY:

I could not testify to that, not well enough acquainted with that country to say they exceed 200 degrees.

COMMISSIONER MILES:

Anybody else want to testify, or ask a question, or make a statement.

JUDGE SETH:

We are instructed by Stanolind Oil Company to make no general opposition to the Gulf petition provided, however, an order is so framed everybody

JUDGE SETH (cont'd)

interested will have a chance to be heard on each particular well. We mean every producer from the pools affected so that each well may be considered on its merits. We do, however, object to the consideration of this Grimes well at Hobbs, because we have had no chance to prepare anything on the Grimes well. We object to any consideration at this time of that one particular well.

COMMISSIONER MILES:

Mr. Gray will you take the stand?

I know you stated a number of things in which you thought were in favor of dual-multiple completions - what would you say was the most important contributing factor in favor of the completions?

MR. GRAY:

I think one of the major factors in it is the probable increase in ultimate recovery. We have quite a number - two zones that will definitely not support a well, could not possibly drill single completions in.

COMMISSIONER MILES:

I lost part of that statement.

MR. GRAY:

The Tubbs and the Blinbry pays are largely gas, the estimated gas recover of gas will be insufficient to pay for the investment of drilling, let alone the operating cost. As a matter of fact we could not even go on 80 acre spacing and have those wells pay out. In other zones - the Ellenberger, the Drinkard and the Paddock, and certain portions of the pools - there are going to be wells that couldn't possibly pay off.

In permitting dual completions I think other wells would pay off that otherwise couldn't.

In our packer experience - I recall two packer failures in the Hobbs pool - one of them on a well that produced water, and the other failure, as I recall, on our East Grimes #2, resulted from an acid, tried to acidize the well, and again we knew immediately there was a failure. I do not believe we are going to have a great deal of difficulty in detecting it anytime a packer will fail.

COMMISSIONER MILES:

In the recovery of this oil you speak of through this method is due to the fact that you would not drill perhaps, if it had to be single completion?

MR. GRAY:

That is right.

COMMISSIONER MILES:

Then the expense of drilling enters into the recovery of the oil by drilling one well through two completions to save enough expense to be able to operate them?

MR. GRAY:

Yes.

COMMISSIONER MILES:

Couldn't recover anymore oil than you would if they were single completions?

MR. GRAY:

I don't believe you would recover anymore oil than in single completions, but you couldn't sustain single completions. In so far as obtaining bottom-hole pressure and reservoir information, we would get equipment for that. Also, in case of our West Grimes #4, if we have any trouble we anticipate the cross-over packer.

We have a well in the Byers sand, there is not enough there to justify drilling. We could leave that well the way it is - I believe if we had to make a choice - plug the Byers and develop packers and have gas for other operations. Certainly should be no difficulty in detecting any leaks.

COMMISSIONER MILES:

You are, at the present time, particularly interested in Hobbs?

MR. GRAY:

Yes, sir. So far as corrosion is concerned we will have that in either single or dual completions - of ocurse you cannot get the treating compounds down to the bottom hole. A single string of tubing there is definitely a possibility for each string of casing bring treating compounds down to the bottom of the hole. As I understand, the field work in Hobbs was largely to take care of corrosion - in other words, they have had some cases of corrosion.

MR. ATWOOD:

Mr. Gray, with reference to this abstract of report read by the previous witness, concerning a certain field in California in which multiple completions have been had, in which was brought up repairs have been required from time to time, is that experienced anywhere in any oil well.

MR. GRAY:

Naturally, going to be repairs even on single completions. I think it would be up to the operator to make the choice. There are some instances where even though there would be higher operating costs, you would definitely save money in the long run by dual completion. Your savings would be substantial.

MR. ATWOOD:

I believe you stated the first multiple completions have been completed in California?

MR. GRAY:

It is my understanding there are no rules in California that require the segregation. Such dual completions as they may be must have been voluntary by the operator.

MR. ATWOOD:

Pro-ration is not very highly rated in California anyway is it?

MR. GRAY:

I really don't know.

MR. FOSTER MORRELL:

You speak of the Blinbry and Tubbs formation for possible dual completions - the Tubbs you refer to, is that formation produced in your Gulf Paddock #4?

MR. GRAY:

I believe it is 4 - either 3 or 4.

MR. MORRELL:

SE corner of Section 1?

MR. GRAY:

I think that is right.

MR. MORRELL:

But that one - you produce that from a separate reservoir from the Drinkard ? ?

MR. GRAY:

I think so - it is anticipated we will keep them separate. We speak of dual completion formation from common source of supply. I think the Commission will agree we cannot be too highly technical on the source of supply.

MR. MORRELL:

They established by the Oil Conservation Commission.

MR. GRAY:

That is right - so far as we know there has never been any ruling on the Tubbs.

COMMISSIONER MILES:

Anyone else who would like to be heard?

MR. A. E. WILLIG (The Texas Company)

I take it all the witnesses have expressed themselves in this matter?

COMMISSIONER MILES:

I presume so.

MR. WILLIG:

I would like to make a statement for the Texas Company. The Texas Company, as well as the other operators in Lea County, appreciate the fact that economics can be considered by the Oil Conservation Commission of New Mexico in matters of this kind. This matter of dual completions is apparently primarily an economic one. The Texas Company doesn't consider economics altogether, although they permitted quite a number of dual completions as a war emergency measure, they have lately reluctantly granted additional dual completion permits. It does appear obvious to the Commission here that this matter of dual completions is fought with quite a number of complex problems. I was particularly impressed with the Humboe Company's testimony. The Texas Company has not made any dual completions in West Texas and consequently has no evidence to offer. We believe that is probably inevitable in certain fields they fail from the standpoint of economics and conservation. I don't believe the Commission has too much in the record on the conservation angle. I believe it would be hard to substantiate that as much recovery would be obtained from two zones dually completed as singly completed, we say they are inevitable in certain cases. We don't want to take general exception of the Gulf application, we do not see any need for a general order in this respect since they themselves have suggested each case be a separate exception. We do want to protest the granting of an application in the Drinkard field.

MR. SPURRIER:

Do you know whether the Texas Commission requires a hearing on each and every well in addition to - or in other words a separate hearing?

MR. WILLIG:

Yes, sir, they do. Each well is a separate hearing and the Texas Commission has granted numerous permits - they are defenseless against additional permits, where one has been granted they have to allow another operator the same right.

I think it is very important that the Oil Conservation Commission consider the rules in effect in regard to dual permits on federal lands.

MR. ATWOOD:

May I make this statement in response to the Texas Company concerning federal leases offsetting leases by the operators - our position is that the offset rules apply whether federal, state or individual leases, and an operator on a federal lease drills on a certain horizon, the operator on the offsetting lease must drill to it and produce it. If that operator on the federal drills another well and brings it in at lower production than this operator on the state or individual lease, he must also protect for drainage from that horizon. The fact that the operator on the federal lease drilled separate wells will certainly not create a burden on state wells. We can't help it because the federal government will not get up to date with its regulations.

MR. MORRELL:

Again we have gotten into this subject of dual completions, and the concensus of opinion, after discussion of the matter with a number of major operators of Lea County, and the history of production which is of course the criteria. We have to go as to what might happen with respect to dual completion, and does not lead to a satisfactory conclusion that dual completion would be practical from the standpoint of eliminating waste or obtaining the greatest recovery. Theoritically, dual completions can be made satisfactorily; practically, they present so many problems - as has been presented in testimony to you today, of the mechanics of keeping the packers, cross over and other material necessary, in proper condition and the difficulty of ascertaining whether they are maintained in satisfactory condition. It has been testified before you today that the damage would normally have already occurred before it would be detected. We have an interesting history in Lea County on gas-oil ratios, they have to be satisfactorily controlled in Lea County; in a single well where you could get at it and work it over. It has been presented to you and you have so granted that most of the sand areas have no limited ratio. If you cannot control gas-oil ratios in the open, it is not logical you can do so behind pipe or behind tube.

We have made a survey of most operators of federal lands as to what is their desire, and most, the vast majority, of those operators are not in favor of dual completions, which include all petitions mentioned by the Gulf, except the Ellenburger. Below that, we have an open mind for consideration and presentation of facts. The low porosity and permeability - so many irregularities makes it very difficult to handle the production through open bore hole, much less through completion below the permeam, we may expect lower uniform conditions or higher pressures of water control, which might be susceptible, and I am speaking in all probability in distances of 910 to 12,000 feet completions where your economics over rule your probable laws of ultimate recovery through dual completions. There have been no facts presented, there have been no statements made or opinions expressed that more oil could be recovered by dual completion

that would only be marginal cases which could still be handled by deepening existing wells that are produced at higher levels. If you grant one exception, regardless of how economical or marginal it might seem to that one operator, you open the door for all of them. For that reason we have taken the position you will find the general operation is not in favor of dual completions. Regardless of the offset condition, we would still take the position it is not proper or feasible to permit dual completions on federal lands. The only proof we would have there would be in future developments.

MR. ATWOOD:

I think you could do it - based on the records available from today on - that is why I spoke of the permit of all these wells. You cannot say based upon that dual completion would not be successful, it might be if it was tried.

MR. MORRELL:

You have the opinion it would be, we have the opinion it would not be.

MR. ATWOOD:

If you fellows ride hard on that like you do on other things you will darn near control it.

MR. SELLINGER:

I would like to make a statement for Skelly Oil Company, apparently the discussion of the general order for permission of multiple completions throughout the State is eliminated from the hearing today - with reference to Case No. 92, on the multiple or dual completions in the Hobbs pool, in the Hobbs field - as an operator in that field we object to the issuance of any dual permits in the field at this time.

MR. ATWOOD:

How will Skelly be injured by the dual completion of this one particular well?

MR. SELLINGER:

I refer you to the states in which we have operations, and I have yet to find a single field where it is only one multiple completion - when one starts it spreads.

MR. ATWOOD:

Because it is a good thing.

MR. SELLINGER:

Two states have permitted it as a wartime measure, and have regretted it - at this time one has taken official action, the other, which is my personal opinion, the regulatory body there is very reluctant to issue any permits on fields that have not had permits before.

In Case No. 93, we have production in the Brunson, and we object to dual completion of that.

MR. R. S. CHRISTIE (Amerado Petroleum Company)

The Amerado Petroleum Company feels that perhaps physical waste would result rather than conservation, if dual completion were allowed. We believe in an area like the Paddock-Drinkard and Brunson where the test shows several conditions.

MR. CHRISTIE (cont'd)

We have gas cap, water in some of the formations, low pressures that if you have high ratios that are water in the wells and they are dual completed, the tendency will be to put off remedial work. It is hard enough to go into some well and do remedial work and expect to get good results and two tied together it is more difficult. I think most of our exceptions have been brought out this afternoon. We want to say we are not in favor of dual oil completions with respect to Hobbs. Two of the wells recently drilled at San Andres have been recently completed had two packers - were sand wells, and they are now drilling the second.

MR. VERNON BOTTOMS (Superior Oil Company)

We have no interest whatsoever in Case No. 92 and No. 93, we do not have any wells in those fields, and do not have any feeling about them. We feel it is specific cases in which dual completion should be granted, and those should be based on individual pool hearings and individual well hearings, to determine whether it should be granted or not.

MR. GEORGE GRAY (Repollo Oil Company)

Repollo Oil Company does not favor dual completions generally, but feel if the dual completion is permitted there should be a hearing in order to consider dual completion - we think individual wells should be considered and a hearing called to consider that well.

MR. S. C. McCOLLUM (Continental Oil Company)

The Continental Oil Company would like to make a general statement - that is we object to the principle of dual completions.

MR. W.R. BOLLINGER (Shell Oil Company)

The Shell Oil Company would like to make a statement that Shell does not object to the principle of dual completions, but feels that it is favorable in some cases, feels each well should have its own particular well hearing. Further, due to apparently involved reservoir conditions in the Drinkard area, we object to dual completion in that area.

MR. SPURRIER:

We would like to continue this hearing in cases 92, 93, and 94 until a suitable date in April -

Cases 92, 93 and 94 are continued until the definite date of April 15, 1947 at 10 o'clock A. M., for the purpose of further testimony in these three cases.

In the meantime anybody can make any petitions they want to make, because the Commission will act upon it without prejudice as we try to do all cases. In addition, to those three cases we will have a hearing for the purpose of promulgating an order which will give us a proper gas-oil ratio for the State of New Mexico, not for counties but a State wide order.

We will also consider testimony to show, during this hearing, how any interested operator may be able to use common tank batteries vs. the method of using separate tank batteries and separate tanks for pools. We feel that if any operator can show us how he can effectively separate the production of one well from another by producing those two wells into the same tank, we are willing to issue an order which will allow that. However, we do not interpret our present law to allow that.

COMMISSIONER MILES:

The testimony in this hearing today has been very interesting to me, while I have not formed any opinion as to what should be done. Some of those representing companies had not had time - were not familiar with what was presented, to prepare a statement or testimony. I would appreciate it if they would consider this, as all the information we can receive will be helpful in making a decision on the cases.

MR. SPURRIER:

In view of the fact that we are breaking a precedent in setting a case ahead, I would like for it to also be in the record we will consider on April 15, any case which reaches our office before March 15, 1947, which gives 30 days for objections.

NEW MEXICO
OIL CONSERVATION COMMISSION

Santa Fe, New Mexico

Box 1545
Hobbs, New Mexico
March 29, 1947

Mr. Carl B. Livingston
Box 871
Santa Fe, New Mexico

Dear Carl,

Enclosed is clipping from the Hobbs Daily News Sun of Legal Notices as of March 27, 1947.

I was down at the News Sun this morning and they said they were mailing you a printers affidavit.

Very truly yours,

Roy

Oil & Gas Inspector

ROY:cg

GULF OIL CORPORATION

Case 9

LAW DEPARTMENT

TULSA 2, OKLAHOMA

December 20, 1946

RUSSELL G. LOWE
ASSOCIATE DIVISIONAL ATTORNEY

ADDRESS ALL CORRESPONDENCE TO
P. O. BOX 661, LAW DEPARTMENT

Mr. Carl Livingston
%Conservation Commission
State Capitol
Santa Fe, New Mexico.

Dear Carl:

Pursuant to telephone conversation, this will be your authority to insert in the caption and the application wherever necessary after the word "horizon" and before the word "through", the words "or pool".

This is in connection with Hobbs No. 92, Paddock No. 93 and General Order No. 94.

If the numbers I have given are not correct, this letter is in regard to the three applications of Gulf Oil Corporation for authority to produce through one or more horizons or pools.

Thanking you, and with kindest of personal regards, I am,

Yours very truly,

Russell G. Lowe

RGL.W
CC-Production Dept.

'L CONSERVATION COMMISSIOI
SANTA FE, NEW MEXICO

COPY

December 20, 1946

The Artesia Advocate
Artesia, New Mexico

Gentlemen:

Re: Cases Nos. 90, 91 and 94 - Notice of Publication.

Please publish the enclosed notice once, immediately. Please proof-read the notice carefully and send a copy of the paper carrying such notice.

UPON COMPLETION OF THE PUBLICATION, PLEASE SEND PUBLISHER'S AFFIDAVIT.

For payment please submit statement in duplicate, accompanied by voucher executed in duplicate. The necessary blanks are enclosed.

Very truly yours,

Chief Clerk and Legal Adviser

CBL:mem
Encl

NOTICE OF PUBLICATION
STATE OF NEW MEXICO
OIL CONSERVATION COMMISSION

The Oil Conservation Commission, as provided by law, hereby gives notice of the following hearings to be held at Santa Fe, New Mexico, at 10:00 A. M., January 10, 1947:

Case 90

In the matter of the application of Stanolind Oil and Gas Company for modification of the rules and regulations of the Commission with respect to the periods prescribed for waiting on cement in connection with the cementing of casing.

Case 91

In the matter of the application of Gulf Oil Corporation for the promulgation of an Order revising Rule 15, General Order No. 4 "Oil Tanks and Fire Walls".

Case 94

In the matter of the application of the Gulf Oil Corporation for the promulgation of a General Order permitting and controlling production from more than one horizon or pool through a single well bore.

Given under the seal of said Commission at Santa Fe, New Mexico on December 20, 1946.

OIL CONSERVATION COMMISSION

By: (Signed) R. R. SPURRIER, Secretary

SEAL

BEFORE THE OIL CONSERVATION COMMISSION
OF THE STATE OF NEW MEXICO

IN THE MATTER OF THE APPLICATION OF :
GULF OIL CORPORATION for the issuance :
of a Special Order permitting the produc- :
tion of more than one horizon through a :
single well bore in the Hobbs Pool, Lea :
County, New Mexico. :

A P P L I C A T I O N

COMES NOW THE GULF OIL CORPORATION, hereinafter called the applicant, and shows to the Honorable Oil Conservation Commission of the State of New Mexico that:

1. Gulf Oil Corporation is incorporated in the State of Pennsylvania and is duly authorized to do business in the State of New Mexico.

2. Gulf Oil Corporation is actively engaged in the exploration, development and production of oil and gas in the State of New Mexico, and that Gulf Oil Corporation is one of the larger producers of crude oil in that state.

3. Gulf Oil Corporation at present owns and operates five producing leases, consisting of 1120 surface acres, within or adjacent to the Hobbs Pool. Said properties include 23 wells, 22 of which produce oil and gas from the San Andres lime and one well produces gas, used for lease purposes, from the Byers sand.

4. There is no provision in existing general rules or orders governing the production from more than one horizon through a single well bore except Order No. 4, Rule No. 6, which is quoted as follows: "Before any oil or gas well is completed as a producers, all oil, gas and water strata above the producing horizon shall be sealed or separated, in order to prevent their contents from passing into other strata".

5. Developments in drilling and completion practice over the past several years have proven the feasibility of producing, without comingling, more than one horizon through a single well bore. With increased drilling depths and greater drilling costs, such multiple completion practice provides, in many areas, a means for more economical drilling and completing, and in some cases will undoubtedly permit the exploitation of horizons which could not or probably would

not otherwise be produced or explored, thereby increasing economic recovery.

6. The occurrence of producing strata above the major producing horizon has been proven by recent completions in the Hobbs Pool. The occurrence of deeper pays is also a definite possibility. In the opinion of the applicant the production of more than one horizon through a single well bore will greatly facilitate the economic exploitation and recovery of the various known and probable pay zones, and would be a conservation measure and in the public interest. It is further considered that such completion practice should be controlled in order to protect correlative rights. The following measures are suggested as being reasonable and adequate:

(a) There shall be no comingling of oil from different horizons, within a single well bore, except as specifically authorized by the Commission. Where such comingling is authorized, the maximum allowable shall be the same as that of non-marginal individual wells producing from the highest horizon. Except where comingling is specifically authorized, wells shall be maintained and operated at all times in such manner as to prevent subsurface comingling of fluids from the separate horizons and that the Director be authorized to require such tests as he may deem necessary to assure segregation.

(b) Applications for completion in more than one horizon shall show the name and location of the producing horizons, casing plan, location of packer or packers, location of perforations, proposed method of production and any other pertinent data. Not more than one horizon shall be produced from uncased hole.

(c) Completion record (Form C-105) shall show all details of the completion including name and depth of each producing horizon, casing records, depth of perforations, type of packer or packers and depth set, method of producing each horizon, initial production from each horizon and all other pertinent data.

(d) Each producing horizon of a well producing from more than one horizon shall be subject, in so far as applicable, to all general rules and regulations applying to individual wells producing from only one horizon.

Wherefore your applicant prays that this Honorable Commission promulgate a special order applicable to the Hobbs Pool that will permit the production of more than one horizon through a single well bore.

Respectfully submitted,

GULF OIL CORPORATION

By _____
S. G. Sanderson
Manager of Production

Dec. 16, 1946

NO

CASE 92: Gulf Oil Corporation - Petition for special order permitting production of more than one horizon or pool thru single wellbore