DISCUSSION PANEL

ON

Automatic Custody Transfer

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PANEL MEMBERS

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MR. STANSBURY

The use of automatic custody transfer equipment is growing rapidly after several years of intensive trial and development.

A recent survey made by the API Committee on Lease Automatic Custody Transfer reports that a total of 99 installations will be in operation by July, 1958. The installations involve 18 producing companies, 29 pipeline companies, and locations in 12 states and 2 provinces of Canada.

Total throughput for the 99 stations covered in the survey amounts to 170,000 barrels per day and about half of this total will be handled by unattended facilities. The production measured by ACT installations will amount to about 2 1/2 percent of the production in the United States and Canada by July, 1958.

So far, with few exceptions ACT equipment has been provided by the producer. In only a few cases have the pipeline companies purchased any major equipment such as meters or samplers. For the most part in these cases it has been done to permit the pipeline to gain experience with the new equipment.

What is the producer's justification for ACT? What are we learning about current costs and savings of ACT systems? What is the pipeline's outlook for savings on ACT systems? Should the pipeline companies take a greater share of the initiative and leadership in the use of ACT equipment? These questions and many, many more involving best selections of equipment, engineering methods of system design, etc., face us today.

The purpose of this panel discussion today is to explore these many questions that face our industry on ACT. Two members of our panel represent pipeline companies and two members represent producing companies. I would now like to introduce to you our panel members.

MR. NEAL G. WILSON

Mr. Wilson is an engineer for Shell Pipeline Corporation, Houston, Texas. He graduated from the University of Missouri in 1950 with a B.S. degree in chemical engineering. After working for the Paint Division of Pittsburgh Plate Glass Company for one year, he joined Shell Pipeline's Research Division. Subsequent work assignments have included engineering and economics groups, and he is presently employed in Shell's head office Operating Services Department where his principal duties are involved with oil measurement. Mr. Wilson is a member of API Code 2500 Automatic Tank Gauge Subcommittee and is chairman of API Code 2500 Automatic Sampling Subcommittee.

MR. RUDY A. HAMILL

Mr. Hamill is Chief Gauger for the Service Pipeline Company, Tulsa, Oklahoma. He graduated from the Southeastern State Teachers College in 1931 with a B.S. degree in methematics. After pipeline gauging experience in the Seminole oil field during the time that he was going to college, he joined the Stanolind Pipeline Company, which is now the Service Pipeline Company, in 1933. He has served with Service Pipeline in various capacities: District Gauger, Division Gauger, Assistant Chief Gauger, and is now Chief Gauger. Mr. Hamill since 1953 has been actively working with committees for standardizing gauging and tank calibration practices in both ASTM and API Division of Technical Services.

MR. FRANK W. BEACH

Mr. Beach is an engineer for the Cities Service Oil Company, Bartlesville, Oklahoma. He graduated from the University of Minnesota in 1941 with a degree in petroleum engineering. He went to work for the Cities Service Oil Company after graduation. He has served with Cities Service in various capacities including Field Engineer, District Engineer, Assistant Production Superintendent, Assistant Secondary Recovery Engineer, Waterflood Equipment Engineer, and is now Special Projects Engineer. Mr. Beach is a member of the

American Institute of Electrical Engineers.

MR. SAMUEL H. POPE

Mr. Pope is an engineer for the Gulf Oil Corporation, Tulsa, Oklahoma. He graduated from the University of California in 1927 with a B.S. degree in petroleum engineering. He went to work for the Gulf Oil Corporation in June, 1927 after graduation. He served with Gulf in various capacities including Roustabout, District Engineer, Assistant Division Treating Engineer, Division Treating Engineer, Mechanical Engineer in charge of Tank Battery Design, Assistant Division Mechanical Engineer, Zone Mechanical and Construction Engineer, and is now Division Mechanical Engineer. Mr. Pope is a member of the Lease Automatic Custody Transfer Committee of the API. Mr. Pope points out that Gulf Oil Corporation's double-weir two-tank constant-volume LACT system in Kansas was the first in the United States to deliver oil to a connected pipeline on an automatic and unattended basis.

I understand that all good panel discussions have to have certain ground rules. Therefore, discussion will start with each member of the panel being allotted 10 minutes to state his views. The next 40 minutes will be devoted to the panel members questioning each other, with a 5 minute limit on each question and answer. The rest of the time will be devoted to questions from the floor.

MR. STANSBURY:

The first member of our panel who will speak to you today, Mr. Sam H. Pope.

MR. POPE:

Thank you, Mr. Moderator, and gentlemen. I will try to give a little history of LACT.

Lease Automatic Custody Transfer or (LACT) is by definition "the automatic determination of quantity and quality of crude in conjunction with the automatic running of that oil into the connected pipeline on an unattended basis and in accordance with any predetermined schedules required." The amazing progress of the LACT method is evidence of the potential benefits from its use.

Early experimental work was done in Texas some ten years ago. It was soon apparent that such an important change in the method of oil handling must be accomplished on an industry-wide basis. Consequently, in 1953, an API committee was formed of producers and transporters to coordinate the efforts of the various companies. The committee has proved of great value as a means of exchanging data.

The first unattended custody transfer of oil at the lease level was made in late 1955. By the end of 1956, there were eight installations in actual operation in the United States and Canada. The middle of 1957 saw some 30 installations under construction or in operation and a recent survey indicated some 99 installations should be in operation by July of this year.

For some time, automatic operation has been accepted for leases, tank batteries, pipelines and refineries. With the acceptance of automatic custody transfer of oil from producer to transporter at the lease level, the door is wide open for complete automation.

LACT accomplishes automatically the same functions that have been performed manually by gaugers and pumpers for years. Automatic sampling and automatic temperature recording have been approved by the API for some time. The two items that had to be resolved were an acceptable method of accurately measuring the oil and also some means for determining that the oil delivered to the pipeline company was merchantable.

Volume measurement can be accomplished by tanks or positive displacement meters. The tank method was initiated in the Mid-Continent and Texas, due in part to state rules and also because companies were reluctant to use positive displacement meters for the measurement of crude at the lease level. In Canada and in California, PD meters were used initially due to their general acceptance in those areas. Measurement by tank can, of course, comprise a number of different methods, such as the double weir in a conventional tank, single upper weir in a reduced area, floats in reduced areas, and the measurement of liquid between valves. PD meter installations are universally alike and depend upon the design of the meter chosen.

Development of the capacitance type instrument solved the problem of assurance that the oil was merchantable.

The experimental stage of LACT is nearly over and the majority of the companies will now accept its use, where economically justified.

Costs for complete LACT systems are from $5,000 to $12,000, depending on the type of installation chosen and the volume of oil handled. LACT in reality replaces the second, third, and fourth day storage capacity normally required in the conventional battery. It does not alter the need for a treating system or for sufficient storage capacity to handle production during a reasonable period.

If LACT installation costs seem somewhat high, it must be remembered that a complete installation also provides for the automatic treating of bad oil immediately upon detection by the capacitance instrument. LACT also permits complete automization of producing properties, if desirable.

In general, from the producer's standpoint, a saving in capital investment is realized if lease production is 400 bpd or more. Of course, as production exceeds this figure, savings become progressively greater. Other benefits to producer are: reduction in BS&W accumulations, a potential decrease in evaporation losses, and a better utilization of man power. Benefits to pipeline companies are: reduction in number of trips required by the gauger, fewer run tickets, and always the possibility of improved system operation.

Both producer and transporter are equally responsible for the accurancy of custody transfer, whether manual or automatic. Therefore, LACT installations can only be installed upon mutual agreement and in accordance with existing regulations.

The bright future of LACT is evidenced by its rapid and widespread acceptance. As installation costs are lowered and the method extended to the majority of leases, both old and new, savings to industry will be appreciable.

MR. STANSBURY:

Thank you, Mr. Pope. I would now like to call on Mr. Neil Wilson.

MR. WILSON:

Thank you, Mr. Stansbury, and gentlemen. I would

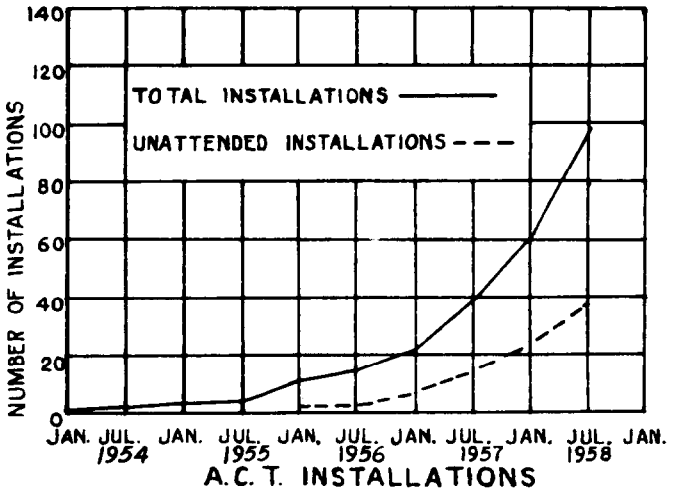


Fig. 1

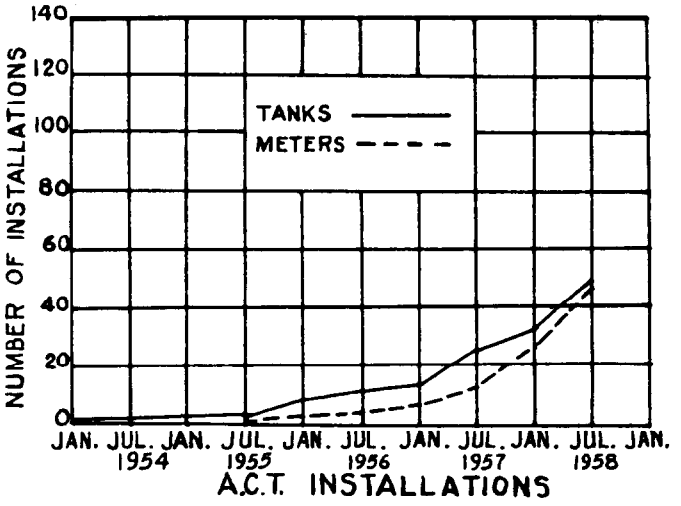


Fig. 2

like to talk very briefly about three separate aspects of automatic custody transfer. First, about the growth of lease automatic custody transfer, which Mr. Pope has mentioned; second, equipment features and some of the operating features that are common to a positive displacement meter installation; and, third, a suggested relationship between the pipeline and the producer, in the purchase and the operation of these facilities. I have a few slides here showing how automatic custody transfer has grown. This data was compiled by the committee of which Mr. Pope is a member, the API Lease Automatic Custody Transfer Group, and is based on an industry wide survey that this committee made. You will note (Fig. 1) that two years ago there were approximately fifteen automatic custody transfer installations in operation, whereas today there are ninety-nine. Thirty-eight or thirty-nine of those are completely unattended. Fig. 2 shows the comparison between the number of tank and meter installations in operation as determined by this survey. You will note there are about the same number of each at the present time, but that the meter installations are gaining. There are more meter installations being installed at the present time than tank installations. Fig. 3 shows the production that is presently being measured. It is increasing at approximately the same rate as the number of installations. Meters are measuring about 100,000 barrels, and tanks about 55,000 barrels. While the number of installations are the same the meters are generally handling a little more oil. Fig. 4 shows the size of the leases this equipment is on. Most of the leases produce between 300 and 2,000 barrels per day, although there are a few on very small leases. There are some leases with as much as 20,000 barrels per day production. Fig. 5 shows some relative cost information worked up by the API Committee. The important thing here is that a meter installation will break even with a conventional battery at a little over 200 barrels per day, and a tank system will break even at about 500 barrels per day. Of course, as production goes up, the savings are quite appreciable when compared with a standard battery with four days storage.

Now a little bit about some of the operating features of a meter type system. This schematic layout (Fig. 6) is reasonably typical of a lot of installations that are going in at the present time. I will run very briefly through some of the operating features for you. All systems have float capacity to provide for about one day's operation. The float capacity should be large enough to provide for emergency shutdown of the facilities. From the float tank, the oil goes through a cut monitor. This device detects and diverts any oil that contains water in an excess of a pre-set amount, and it works on the dielectric constant principle. Next is a mechanical sampler which takes a composite, representative sample of the oil being shipped. The oil then passes through a gas eliminator. One fail safe feature here which we like very much is a float arrangement whereby the unit will shut down if the oil contains more gas than the eliminator can handle. Next are the meters. In this case there are dual meters. They are dual in this particular instance because we wanted the throughput flexibility that dual meters provide, which is a 10 to 1 throughput ratio. Incidentally, the meter counter has a detector which shuts the system down in the event that there is flow when the meter counter stops turning. The oil then goes through a back pressure valve which is set at some pressure in excess of the vapor pressure of the crude. This is to assure that the pipe line doesn't buy

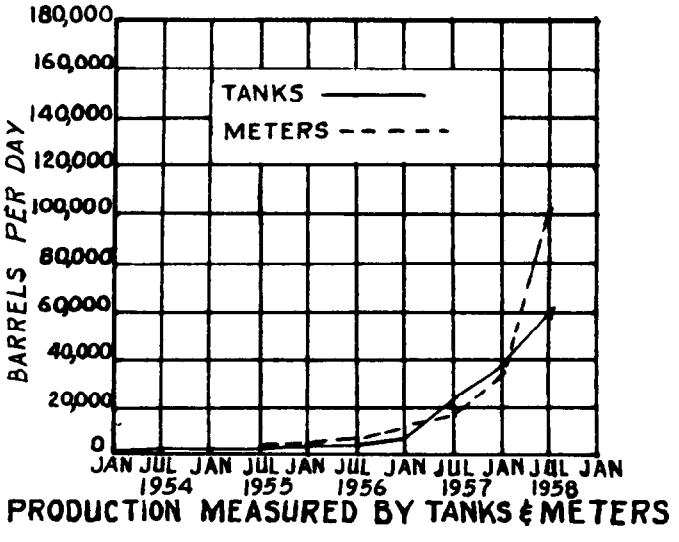
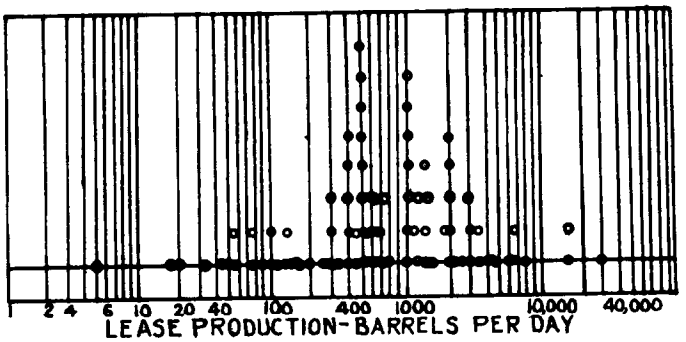


Fig. 3



SIZE DISTRIBUTION OF A.C.T. INSTALLATIONS

Fig. 4

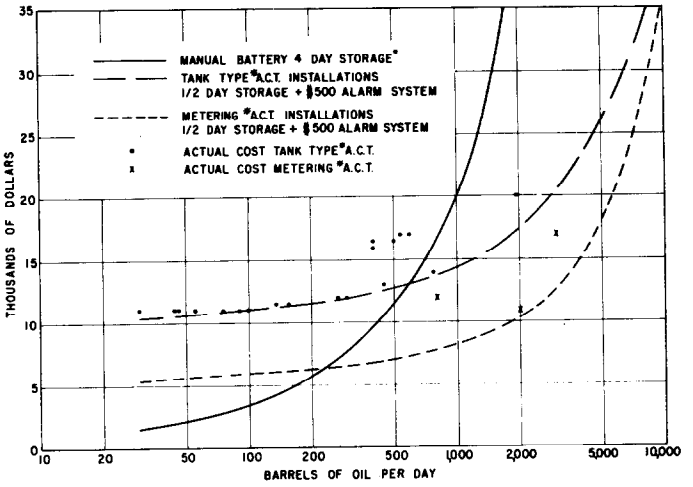


Fig. 5 ESTIMATED COSTS OF ACT INSTALLATIONS

gas at $3.00 a barrel.

Now the last item is the relationship between the pipeline and the producer. We have issued an automatic custody transfer policy which is in effect with the producers with which we deal. The first requirement of any system is that it comply with all state and federal laws and regulations, and the design and construction must be in accord with not only our engineering standards, but with API codes. It must be capable of sustaining an accuracy of 1/10 of 1%. We must, of course, get quality measurements and this is done with the automatic sampler. Further, we feel that the producers should buy and install all this equipment, since the major savings accrue to them by savings in lease tankage. The pipeline will calibrate the meters and will maintain the meters and associated equipment where personnel is available to do so. The calibration will be done at no charge, but the maintenance to be done at actual cost of labor and material. Thank you.

MR. STANSBURY:

Thank you, Mr. Wilson. I would now like to call on Mr. Frank Beach.

MR. BEACH:

The use of automatic devices in oil field production

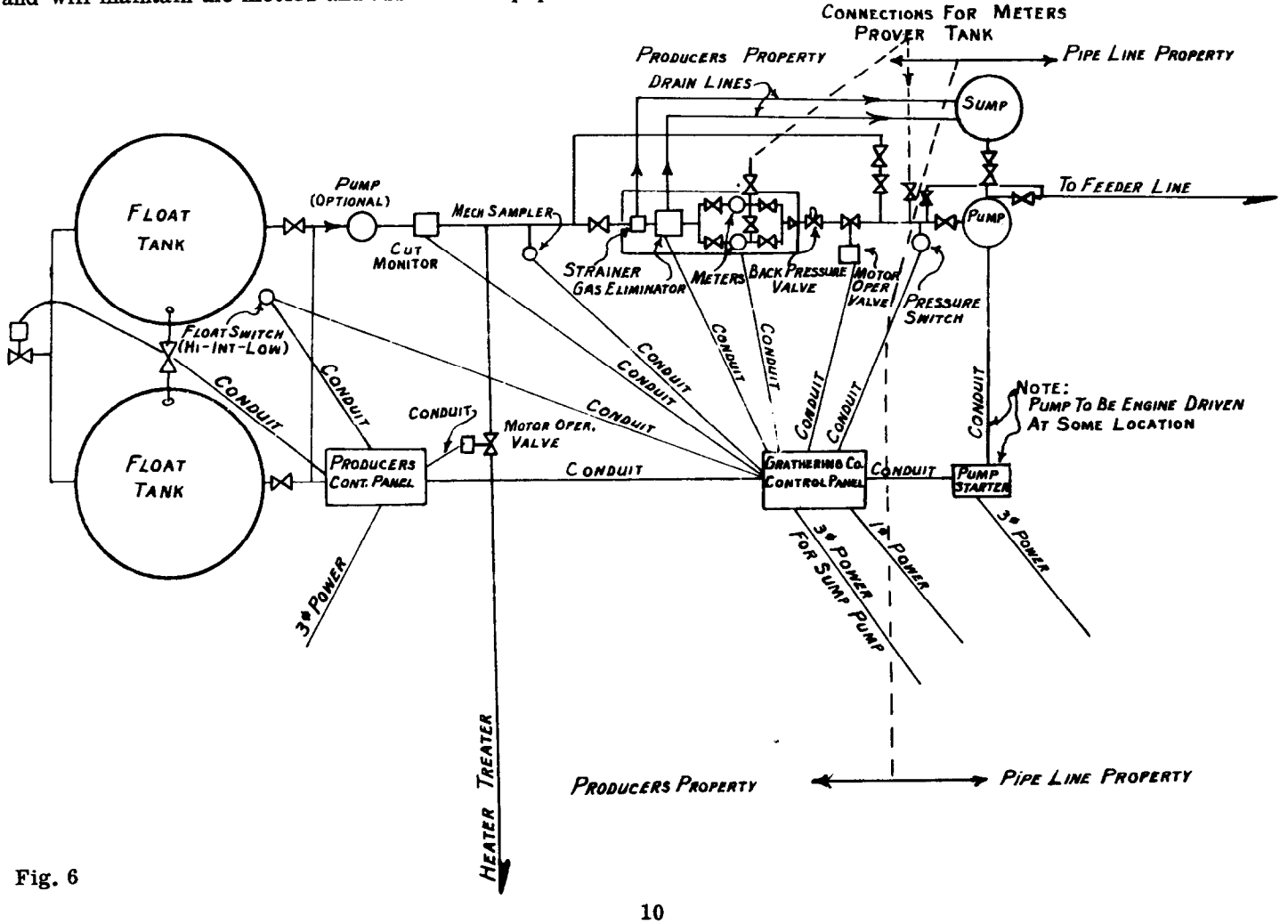


Fig. 6

has shown a phenomenal increase during the last two years. Most of the automatic devices now being used have been available for a long time. It is only recently that the potential of these devices have been realized by using them in the combinations that can result in more or less automatic field operation. Automatic tank batteries are only one illustration of recent oil field automation where the components of automation have been available for some time. Producers have considered lease automation for some time. Everything looked encouraging until it came to the point of transferring oil from the producer to the pipeline. At this point, both the producer and pipeline balked due to a reluctance to trust available methods of measuring oil automatically. These difficulties have been largely removed by the increased spirit of cooperation that now seems to exist between pipeline and producer. The attitude today seems to be to try and work something out even though momentary difficulties might occur. Probably much of this feeling comes from increasing confidence in positive displacement meters by pipelines. Meters are now being used to transfer millions of barrels of oil from one pipeline to another and from the pipeline to the refinery. Automatic transfer of oil from producer to pipeline has shown great promise in the last two years and the growth will probably go on at an increasing rate in the near future.

Getting down to a more detailed look at ACT, it is evident that a cheap and easy method must be devised to install or convert a regular battery to ACT. One method of making ACT easier to install is by skid mounting all of the important devices so that a battery can be formed by assembly of the necessary skids. Pumps, tanks, meters, level controls, monitors, well headers and controls can be shop fabricated and tested before delivery to the lease. At the lease, the individual skids can be plugged in like so many coffee pots or toasters. Such an approach eliminates the heavy cost of field fabrication where labor costs are high, materials are not readily available, and specialized manpower is difficult to obtain.

Automatic custody transfer of oil from producer to the pipeline appears to be generally successful. Both the producer and the pipeline benefit from its use. The pipeline probably benefits most from direct labor savings; the producer more from other aspects of automation than through ACT itself. The BS&W monitor prevents transferring bad oil to the pipeline. In order to have truly automatic operation, the bad oil must be automatically treated out and made acceptable to the pipeline. This in itself has been an advantage to the producer in that tank bottoms are never allowed to accumulate. Then, of course, the producer benefits in the savings in gravity and vapor losses. In our Pampa installation, we estimate that on a monthly production of 15,000 barrels we saved 60 barrels per month due to smaller BS&W content run to pipeline, 300 barrels per month due to elimination of tank bottoms and 175 barrels per month due to gravity and vapor conservation. Estimated net earnings were $1400 per month. Labor savings on the Pampa installation were estimated at 40 hours per month.

The pipeline stands to gain the most in labor savings from ACT. Our Pampa installation originally had 14 tanks which required the pipeline gager to write 60 tickets per month. With ACT this has been reduced to 1 ticket per month. In addition, oil was run more or less continually to the pipeline which should be an eventual advantage in the design of future pipeline gathering systems.

It would seem that pipelines stand to gain the most as far as labor is concerned and it would seem only fair that the pipelines bear at least part of the cost of ACT. An equitable arrangement might be that the producer would furnish the tanks, the oil treating system and the monitor. The pipelines would furnish the meters and samplers. Since ACT is a measurement problem, it would seem that the pipeline would be more qualified to handle such equipment than the ordinary oil field employee.

There is not much doubt that metering oil by positive displacement meters or by the dump tank system is more accurate than hand gaging. We have checked our meters many times against the 500 barrel sump tank in our Pampa battery. The oil meters were temperature corrected. In gaging the tank with only two temperature measurements the tank gages and meters would not agree at all. It was only after we took continuous tank temperature readings while we were running the oil that tank gages and meters would agree.

Positive displacement meters have a certain amount of wear which results in drift of the meter factor. The meter factor drift in our meters has been about 1% which is larger than we like. Examination of the meters indicated rather severe wear. Since these meters revolve some 2 million times a month, a very small amount of abrasive could easily be the cause of the meter wear. We suspected that silt suspended in the oil was causing the trouble. However, examination of the oil by our Research Laboratory indicated the wear was caused by a combination of erosion caused by salt crystals and corrosion caused by brine water droplets. Since we found this condition, we have been experimenting with harder and more corrosion resistant materials for meter internals. We have not had sufficient time to evaluate results as yet.

The question comes up as to what type of meter to use, the dump tank type or the positive displacement meter type. In my personal estimation, both types are satisfactory.

The positive displacement meter is customarily proved at least once each month. Meter wear or meter drift is normally always positive which favors the pipeline and penalizes the producer. To be equitable, the meter factor used should be the average of the meter factor determined at the beginning and the end of the month. Meter factors are known and can be predicted with some accuracy. Errors in total measurement will be small especially if a check meter is used to guard against total sales meter failure.

Dump tank meters usually require a larger initial investment but less attention and maintenance once they are installed. Calibration of a dump tank meter is a perplexing business. Some of the dump tanks are large and require a great deal of labor to measure the tank volume with calibrated cans. Many of these tanks are calibrated with carefully calibrated positive displacement meters. Such calibrations are usually only made once and it is assumed that the tank volume will remain the same forever.

Dump type tanks generally favor the producer. A tank can never get larger but the volume can get smaller due to deposits on the walls of the vessel. Plastic coatings do much to reduce the possibilities of such deposits but there is no assurance that on

very cold days some paraffin does not deposit and later melt off. Accumulative deposits are also a possibility. To illustrate this point, our plastic coated 10 barrel meter prover tank was inspected recently. There was apparently only a very thin deposit on the plastic lining but washing with hot solvent removed about a half gallon of semi hard materials.

Even with these problems with meters, the wear and drift of the P.D. meter and the possible error in original calibration of the dump tank and surface deposits there is not much doubt in my mind that we are getting better oil measurement than ever before. In addition the pipeline is getting a better grade of oil with less BS&W and less chance for slugs of water or BS getting into their system.

Last fall, as a test, I asked a pipeline gager and a pumper to gage a 500 barrel tank with me. None of us agreed on the oil volume within an 1/8" until the third attempt. Accuracy of hand gaging can only be estimated. Meter errors are generally known and compensated for.

Metering oil with positive displacement meters is still in the first stages of development. Meters themselves must be made of materials which will stand the severe service of lease application. In most cases, crude oil as produced on the lease will contain varying amounts of salt, BS, silt, brine and other corrosive or abrasive substances. These problems can be helped or eliminated by greater clearances between wearing parts, hard surfacing and the like. Temperature compensators have generally been satisfactory and we have not been able to trace any meter drift to compensators.

Meter proving by the use of the calibrated meter prover tank is a time consuming task which must be done with great care for precise calibration of meters. A more convenient way to easily and automatically check and calibrate meters must be devised. A master meter might be used, but I would prefer a more foolproof method such as the piston type prover now being tested by our Pipeline Department. In using the meter prover tanks of the conventional type, we have found it necessary to insulate the shell and if possible provide a sun shade. It was found that shell temperatures varied widely due to the heating action of the sun on the tank.

BS&W monitors have caused little if any trouble. We had some trouble on initial installation and checking but once we got the apparatus calibrated and in use, there was no further trouble. The monitor is checked occasionally by grinding out a sample and checking the reject point.

The original centrifugal pump on the Pampa meter skid was equipped with a mechanical seal. This seal wore out quickly and was eventually replaced with regular packing. The cause of failure of the mechanical seal was probably due to salt crystals.

All other electrical and mechanical equipment gives very little trouble and causes a minor amount of maintenance.

So far, our experience with ACT indicates that the process can be used with success and profit. At the present time, we are in the process of installing two units similar to our Pampa installation in our Oil Hill District.

MR. STANSBURY:

Thank you, Mr. Beach. I would now like to call on Mr. Hamill.

MR. HAMILL:

Thank you, Mr. Stansbury and gentlemen of this panel and folks out there.

Now, anticipating that these gentlemen, engineers that they are will go over the technical aspects of this thing and cover it pretty thoroughly, I decided that it would maybe be better for me if I talked a little bit about the human side of it.

There are several groups of people who deserve congratulations for the successful work they have done to promote this new Art in our industry.

First of all, I think credit is due the API committee on Crude Oil Measurement for its informational bulletin 2509-A. This bulletin was published in 1956, when many of us did not even realize that such things were being considered. These men started from scratch with the idea in mind that if pipe line companies can operate million-dollar pump stations from a remote point and if producers can automatically produce, test, and record information on hundreds of wells, surely the transfer of oil between the producer and pipe line can be made automatically. The committee was composed of men with the necessary technical and engineering ability and also men of experience and know-how in measuring, sampling, and testing of crude oil. It took many hours of debate, discussion, and meeting of minds before the first promising ideas were developed. These men had some good basic principles that they laid down as guide posts and they have steadfastly refused to deviate from these principles. In general, they are such things as these:

1. Any approved system must equal, or surpass, the accuracy of careful hand gauging.
2. It must contain safety interlocks and fail-safe equipment, designed in such a way to prevent mis-measurement.
3. It must be simple in design so that it can be understood, operated, and maintained by regular field personnel.
4. It should manifest some visual evidence that it is functioning properly.

They realized that the tax collector, the regulatory bodies, and the royalty owners must all be protected. They, too, must be confident that the unit will accurately measure the oil transferred. These men also must be congratulated on the excellent missionary work they have done. They are almost wholly responsible for the widespread and favorable publicity this movement is receiving.

Next, we must give credit to Management of the various producing and pipeline companies who recognize the great economic possibilities of these new methods of measuring oil and have, therefore, generated within their companies a congenial attitude towards them. However, they also recognize problems that concern their personnel and have allowed this movement to progress only to the extent that it does not cause any widespread disruption or demoralization of their personnel. Management has chosen liberal policies or up grading, and transfer and termination, to soften the effects of this new automation.

Oil field service companies also contribute a helping hand. Their design engineers and production men have ingeniously arranged the various components of auto-

matic measurement to systems that are increasingly simplified and efficient.

We should also appreciate the cautious, yet practical, attitude of the police and regulatory bodies of the various state governments in their acceptance of these systems. I know of no case where any system of merit has been condemned by a regulatory body.

My dad was a pipe line gauger and so was I, therefore, I cannot greet these new methods with complete happiness. For almost as many years as our industry has existed, the producer's pumper and the pipeline's gauger have formed the traditional hub between these two great divisions of our industry. You cannot in justice deprive them of their deserved vote of thanks. The results of their work plainly says, "A job well-done". Management entrusted to their competent hands, with very little immediate supervision, the daily task of transferring millions of dollars worth of products. They have not failed and they should not be belittled. We are now on the verge of a transition period that will likely transfer them into our warehouse of oblivious where we, as a progressive industry, have already stored the manila-rope driller and tool dresser, his wooden derrick, screw pipe, and the line walker.

I did not avoid mentioning technical or economic evaluation of the merits of various systems of lease automatic custody transfer because I have no ideas concerning them, nor is it that I don't wish to express my thoughts on these matters. I would rather that these thoughts and ideas be developed by the cross-questioning of us panel members and from your questions from the floor. There are many complex and unresolved problems in connection with automatic custody transfer. I hope that your questions will lead into those areas that concern you the most. Please do not leave with an unasked question. You may not receive a satisfactory answer, but it will lead many people to study your problem and eventually the answer may be resolved. I personally hope to gain from you invaluable information on how you view these problems.

MR. STANSBURY:

Now for the next short period of time, I would like to pretty much turn it over to the panel members themselves for a brief exchange of questions and answers. During this you might get some ideas yourself on questions you might like to ask about. Since Mr. Hamill seems loaded for bear, I wonder if he would like to ask the first question.

MR. HAMILL:

I would like to ask a question of the producers here. They have stated in their talks, that the pipelines seem to have the greatest financial benefit from this thing. We haven't found it yet. I would like for you to tell us where to look for that financial benefit.

MR. POPE:

I don't think that we made the statement necessarily that the pipelines have the greatest financial benefit. Actually the producers save capital investment and eventually through the complete automation of their properties they will be able to save more. As far as LACT is concerned, without automatic lease operation, very little labor can be saved by the producer. Now, as far as the pipelines are concerned, you have asked a specific question. If your gauger goes to a property, he can make 6 or 7 runs a day. If he makes one run off each of 7 leases a day and visits them every day he can handle 7 leases per day, week or month. If that same man goes to a LACT battery once a month, it takes him no longer to do an LACT job because he only has to grind the oil from the sampler and take off a chart. He could conceivably run 210 leases. That is very theoretical, but conceivably from a labor standpoint, the pipeline has a better chance than the producer for savings because LACT in itself is not going to save the producer a great deal in labor. However, in conjunction with an automated lease, labor savings will be made.

MR. BEACH:

Mr. Hamill, there is one more thing to consider here in installing LACT units, we will consolidate many leases into one just for the purpose of getting automatic custody transfer. In these cases, we often eliminate your individual lease gathering systems and assume this cost ourselves in order to get all of our leases to a central point and pass the oil to the pipeline. That not only saves the labor of maintaining these lines, but also the cost of probably replacing them in time. I have heard mentioned costs somewhere in the neighborhood of $40.00 to process a run ticket from the field clear through the accounting department and to the payment stage. This reduction in paper work alone makes it desireable from the pipeline's standpoint.

MR. HAMILL:

Well, now I know we are going to get some savings on this thing, and that's why we are for it. Transportation gathering cost analysis of our company in places where we gather about 80% of the oil that we gather into our system show that it is gathered in with a gauger cost of less than a cent a barrel. If we could gather that 80% of our oil all automatically, and cut out all the gauging costs we could come down or reduce our cost a cent. We don't save but a very little bit on investment. We still have our pipeline out there. We still have to pay taxes on it. We still have to maintain it. We still have to have our machinery out there and we will probably have more machinery. To get LACT moving and moving on schedule is not like putting on a gravity tank where you don't care just when it goes out, just so it goes out between now and the time tomorrow when the gauger comes by. You can't tie these LACT batteries up that much, so we will probably have to put in more pumping units so we can get the oil moving away from the lease. This is a fast moving thing. It just doesn't sit there and soak out overnight. We would have everybody does up if we did. Now, Joe, in places where we are gathering most of our oil and those are the places where the production warrants installation of lease automatic custody transfer, our labor costs for gauging oil is small. Now it goes up to almost 7¢ a barrel in some places in stripper fields where we have a tank from a lease once every two or three months. The well on the lease makes maybe a quarter or a half barrel, and the tanks are thirty-five barrel size, well, you're not going to get any lease automatic custody transfer in there, and that's where it would save us some money. Now you save vapors that you pass on us to lose. Now all of the vapors that you save, we've

got to try to keep, and it's harder for us to keep, and it's harder for us to keep. We think in our company that we should probably do the sampling and we've been buying the samplers and putting them on these automatic custody transfer deals. The back of the sample, anything that connects to the tank or becomes part of the tank or the metering unit, we don't think that we've got a responsibility of doing that.

MR. STANSBURY:

Next question.

MR. WILSON:

I would like to ask a question of Mr. Beach. Would you hazard a guess as to which type of system is going to predominate in the future - the tank or the meter system?

MR. BEACH:

It is my estimation that the positive displacement meter systems will prevail mainly because the pipelines are used to using them. I think they trust the accuracy of meters a little more than they do the dump type system. It is a continuous system instead of an intermittent system, and if it does come to the point where the pipelines do own the meters it will be something they are familiar with and can work with. For that reason, I think that the P.D. meter will be the prevailing methods for measuring oil. Another, and probably a good reason, is that if there are errors in measurement, they are generally in favor of the pipeline. I mean the calibration generally rises which means that the pipeline is getting more oil than shows on the dial of the meter. For those reasons I think that the positive displacement meter will prevail in the end. That is just a guess on my part.

MR. WILSON:

I agree with you because of the money involved.

MR. BEACH:

Yes, they are somewhat lower initial cost. I don't have anything against the tank type meter personally.

MR. WILSON:

The pipeline does only where wax incrustation is a problem because we have been taking losses for years due to incrustation. You can not combat that problem with tanks if there is a wax problem in the field.

MR. POPE:

Pipelines favor meters because they think they're of greater benefit to them. Essentially that's correct, isn't it?

MR. WILSON:

I have no feeling one way or the other except in waxy crude service, but in a tank, which requires a top gauging and a bottom gauging, we cannot correct for errors due to incrustation.

MR. POPE:

I would like to ask Mr. Hamill a question. When LACT was first under consideration there was some concern by the pipeline companies over possible loss of control in handling the oil. Does experience show this to be a problem?

MR. HAMILL:

No, it hasn't. On installations that we're connected to so far we control our own pump, and we have put there a time cycle device, a programer, that can start our pump any fifteen minutes or shut it down any fifteen minute period twenty-four hours a day for seven days. We can program the entire week. Therefore, we have maintained with that programmer, control over when the oil is received into our system. The pipelines have to do that. That's one of the requirements of any type of oil movement. We have to know when the oil will come into our system. We have to pro-rate our line space among the various producers. It is our control, and we have made arrangements to control it where control is needed.

MR. POPE:

Now, if there were many, many systems, do you think that would become a problem?

MR. HAMILL:

No. That would not become a problem. I think if there were many, many systems we would have a problem of needing 150 gaugers on the last day of the month and none for the balance of the month. We are connected to maybe a thousand leases, in the Levelland, Lovington and Denver City Districts, and if they were all automatic and the gauger went there the last day of the month to close them out, then he's going to have a lot of batteries that last day. If we had six hundred of them and say the gauger could get 10, we would need 60 gaugers.

MR. POPE:

What's the difference between that and the conventional battery? Does he make the conventional battery at the end of every month?

MR. HAMILL:

No, but he does run their oil up to, well, maybe he starts closing out the tickets for the last battery on the 25th of the month.

MR. POPE:

With LACT you are automatically closed out when you have run your allowable on the 24th or 23rd.

MR. HAMILL:

Can you do that in Texas?

MR. POPE:

I don't know. LACT shuts the lease down and you go

around and read the recorders.

MR. HAMILL:

It shuts them down, but you would be running oil in advance of your allowable.

MR. POPE:

Well, you are apparently doing that now - - -

MR. HAMILL:

But, you have tankage to hold it now and you won't have with LACT. Only just one day.

MR. POPE:

Possibly the law will be revised some day.

MR. HAMILL:

Well, now you've got to do some politicking.

MR. POPE:

Mr. Beach, the cost of proving meters in LACT has been assumed to be one of the disadvantages of positive displacement meters. I would like to ask the following question: Oil has been sold from stock tanks for years, why not prove a meter from a conventional stock tank, and eliminate the cost of special proving tanks and then secondly, how much does it actually cost to prove a meter, how often should you prove it, and is it an ASTM regulation that you apply the meter factor over the preceding period?

MR. BEACH:

We would like to use stock tanks to check our meters, but we think that it is useless to use an innacurate measurement to check an accurate device. In other words, a stock stank can be any shape, it can be round, square or egg shaped. We do not have the same meticulus measurement of fluids per unit of volume in a stock tank that we do in our calibrated meter prover. It would be all right if the stock tank was new, was round, was well calibrated, and we could prove that the stock tank held so much fluid between certain marks in that tank. We have considered the thing and have not come up with an answer of how to do it anymore cheaply than we can by prover tank. At this time certainly a prover tank is an unwieldy way of doing things and I think eventually there will be better ways of doing it. Our pipeline company is experimenting now with what they call the Portable Cylinder Prover. Mr. Hamill may have heard of it. It's a cylinder about 12 feet long and about 12 inches in diameter, and you just run the meter into this cylinder with a kind of a plunger in it and it automatically calibrates your meter. This sort of thing might replace our common prover. As far as the cost of proving meters is concerned, I don't know. It takes us two hours per month to prove our meters. We have an engineer and the gauger there at the time. We make three runs on the meter and take the two nearest readings. They must come out within certain limits or we run it over. The normal time is two hours for two men -- the gauger and the engineer. At the present time we don't use the pumper for this service. We're still experimenting with these meters and we like to keep an engineer on this kind of work until we are settled in the way in which we wish to do it. As to how many provings to make, we make one proving in the middle of the month; the pipeline makes their gaugings at the beginning and at the end of the month, and we take the proving in the middle of the month which gives us an average factor for the month. That is our situation at the present time.

MR. HAMILL:

I want to ask Mr. Beach if he is satisfied with that 1% drift in the meter?

MR. BEACH:

No, sir. We are not satisfied with it. I think we have found that our meters were being eaten up with some salt, and we have gone to harder materials and meters with greater clearance in them. We don't know which device will work the best as yet. It seems like meters with greater clearance will hold on to their calibration the longest right now. What the eventual results will be I don't know, but our last test was about .05 of 1% variation through a month's period. I think in all earnestness that we cannot expect to hold our meters to very minute variations in lease measurement, for this reason - the oil is very dirty, it contains salt crystals, and it contains silt. Wear will be experienced by meters unless clearances are sufficient to pass the particle sizes that we are handling. In any case it is just as accurate or more accurate than tank gauging. Even though we have this variation in factor by averaging the factor over the month's period, it brings the thing back into line.

MR. HAMILL:

We checked the dump type tank system for about 10 months. The first 5 months we checked it, 72,000 barrels through it, and we came up with a loss against careful hand gauging of .13 of 1%. Before we started into the program our research lab analyzed the crude. It was 43 gravity and pretty near 9 Reid vapor pressure, and at the time of year when we were doing this gauging, the temperature was running from 60 to 80 degrees. We figured that we would have .15 of 1% of vapor loss, in coming out of the dump tank into the conventional tanks. Now over that five months period we had .13 of 1% loss. Now this is a long ways from 1% drift in a meter or looking at a half of 1% as being acceptable.

PANEL MEMBER:

You were proving this .13 of 1% against gauging in common tanks. I don't know whether you can prove anything by gauging in common tanks or not. As to whether that is the accurate way of checking any meter, I think you can meter things more accurately than you can gauge them. I don't know if you agree with that or not.

MR. HAMILL:

I think probably you can, but not with 1% drift in

them.

MR. BEACH:

That doesn't sound like normal positive displacement meter operation. We don't claim that it is. We are being frank about our troubles and we have troubles. Now the only way you people learn anything about meters is by the trouble of others. There is no need for us to try to hide it and tell you that our meters are right on the nose, because they are not. But we are doing something to find out what it is and trying to correct it. And what we do may help prevent some of you people from doing the same thing and having the same troubles. This thing can be licked. I think we are on our way to doing it. Now, we are not perfect. We have to find out just like everybody else.

MR. WILSON:

I would like to ask you one more thing, Mr. Beach, in regard to meter proving, and that is have you tried master meters, and if so, what were the results?

MR. BEACH:

No, we have not tried master meters. And the reason that we haven't is that we had a prover tank handy, permanently installed on the lease at Pampa, and we didn't have an extra meter to make into the category of the check meter, so we have not tried that system yet, but it is not out of the question that we may do it in the future.

MR. STANSBURY:

The panel will now entertain questions from the floor.

QUESTION FROM FLOOR:

I would like to address a question to Mr. Pope. Is the temperature compensation of the meter system required or optional?

MR. POPE:

Mr. Hamill can probably add something to this, but as far as temperature compensation it makes it easy. A temperature compensator P.D. meter prints out barrels corrected for temperature which is highly desireable. On a tank system that's also desireable because even though you run a constant gross volume in a dump tank you have to take the temperature at the time of the top gauge or when you establish your upper level and turn the tank on. If it's not temperature compensated you have many small "dumps" to correct. You add up all your temperatures and divide by the number of tanks and multiply by that factor. So I can say that it's desireable, but not necessary to have temperature compensation. However you achieve your temperature correction is all right. Whether it's with a thermometer or by temperature compensation. Temperature compensation is desireable to reduce the amount of work.

MR. HAMILL:

I agree with that. It is almost essential on P.D. meter installations, otherwise you would have to record temperature on the meter throughput all the time in order to determine how much oil should be corrected for what temperature. I think that it is a desireable thing. I don't think that it's essential or a requirement. It will be recommended practice, I am sure.

MR. STENTZ (Stentz Equipment Co.):

You stabalize crude at one pound for eight hours then you put it into a pump at 15 pounds and you put it into the line at 1250 pounds and deliver it to the refinery under pressure. Where do the evaporation losses occur?

MR. HAMILL:

Why when we put the oil in a tank.

MR. STENTZ:

But, you deliver the oil to the refinery under pressure.

MR. HAMILL:

Sir, I don't know what refinery you are talking about, where we deliver under pressure.

MR. STENTZ:

Well, I just wondered.

MR. HAMILL:

No, we don't deliver under pressure. The only pressure is the head of oil in the tank. Most of the tanks at the refinery are floating roof tanks, but we still go into some cone roof tanks at the refineries. We leave more of the vapor in the lease tank. If it's a dump tank system, we leave more of the vapor in the lease tanks as the vapor pressure goes up. If it's metered then the first tank that we go into along our system we stand a chance of losing more vapors than if the oil had weathered quite a while on the lease, like they now do. We don't have any tanks on our system that will stand a pound of pressure on the roof. Now I don't believe they make them.

JIM CONINE (Great Western Drilling):

I would like to ask a question of the panel in general, concerning the size of prover tanks. On a P.D. it is possible to interpolate to a thousandth of a barrel. If you have one barrel of oil through and establish a factor, that factor would not be as accurate or as reliable say as if you put 10,000 barrels through. I was wondering if there had been any optimum prover tank size discussed or what is the general feeling. How many barrels should go through a meter into a prover tank in order to come up with a factor that is reliable.

MR. WILSON:

I'll try to answer that for you. The API code says that there shall be sufficient capacity in the meter prover to prove for a minute and a half at the maximum rated capacity of the meter. Now, that's, I think, really

getting down to the minimum. It's better to have two minutes. There is one other factor involved in sizing a prover besides just the time and the total volume, and that is that some meter temperature compensators correct for temperature in incremental corrections. In most meters that would be sized for lease operation, that increment is 5 gallons. So the volume of the prover tank should be in 5 gallon increments so that the last 4.99 gallons goes uncorrected.

MR. CONINE:

Well, I agree with you about the size of the prover and all that. What I was getting at was in regard to the API code as a function of time when you relate it to the volume going through the meter. If you have a meter that, say a very small meter, where maybe you run five barrels in two minutes and you had a prover that size and missed your reading on interpolation to about 1/1000, well, you could conceivably be off more than the meter factor drift.

MR. WILSON:

That is certainly correct. There should be a minimum size. Maybe some of the other panel members have a thought on that.

MR. POPE:

Is it a Shell policy to furnish a 300 or 400 gallon tank for a prover?

MR. WILSON:

The policy we have is to furnish a 500 gallon portable tank and where that is not sufficient to prove the meter, the producer must make his own provisions for proving.

MR. CONINE:

Just one other question. This proving is pretty interesting to me, and I think it's a critical part. In regard to proving, what is the panel's outlook on proving on some known viscosity crude and establishing a factor between that and various crudes in the field, and utilizing a centralized prover on one crude and converting it back to various crudes in the field.

MR. WILSON:

I personally do not favor master meters because even though you prove it in the plant and take it out to the field, transportation of that meter may cause the factor to change, certainly flow rate as well as viscosity is important in establishing a meter factor as well as static pressure. It may not be possible to reproduce operating conditions away from the operating location.

MR. STANSBURY:

Next question.

QUESTION FROM FLOOR:

Cost of run tickets was raised.

MR. HAMILL:

Costs as high as $4.00 per run ticket have been mentioned but it does not cost my company a dollar to process a run ticket once it gets to Tulsa.

FLOOR:

You stated earlier that your company costs are a cent a barrel, does that include just the gauger?

MR. HAMILL:

That's the gauger and his time, and his transportation. The vehicle that we furnish him.

FLOOR:

That excludes the cost of running the oil to pipeline and things like that?

MR. HAMILL:

Yes. Or the investment in our pipeline, pumping, taxes, or depreciation on our equipment, that's not in there. I mean just sending the gauger out there to turn on the tank of oil, and 80% of all of the oil that we gather costs us less than a cent a barrel.

FLOOR:

You will agree with me though that there is a marked saving on automatic tank batteries over the conventional method.

MR. HAMILL:

Certainly, sir. I didn't say that we didn't save some money. You save some, too. You don't need to send your pumper there every day to top out a tank. That is just about as much saving as we save on the gauger.

FLOOR:

I think both the producer and the pipeline company should share the cost of the automatic equipment. I don't think that one should stand the whole cost.

MR. HAMILL:

There is one other thing that comes in with the pipelines that you people don't have to put up with - you producers - there is a body up in Washington called the ICC. We have had some of our top men up there working for the government. They work for the government instead of Service Pipeline Company, they're up there so much trying to keep this thing running. We've got to publish what services we do for people and what we charge for those services and we cannot discriminate. Now if we go out to City Service and buy a meter installation and put it out there and Joe Blow comes from across the street and tells us "I've got fifty barrels over here and I want to sell it through a meter and I want you to supply the meter, too." Well, you can get into some places there where a pipeline company has got to be just a little more cautious in publishing their policy than you producers do. Now, I don't know where this thing is going to end up, I can see where the pipeline company may be

forced in some installations and in some cases to put the whole thing in to protect their own shirt. In places where the crude is thicksotropic or the incrustation is a function of temperature and where no amount of cleaning or washing down of the tanks helps you a bit. Every time you run one when it's below 40° you leave a bunch of it in blops hanging on the side of the tank. You don't even get a good level measurement at the bottom in those areas. There might be places where we're losing a lot of money and the producers in good faith have already laid their capital outlay for what they thought were going to be adequate measuring devices for their crude. I don't think we can ask them to go in there to save our 1% to put in meters and junk that they have. In some of those cases, we might put in the meters for our own protection, but not just as an ordinary round the clock deal.

FLOOR:

Question raised as to the cost of run tickets?

PANEL:

I have some costs here that were arrived at by two men in our company from a fairly comprehensive study of what it costs to process a run ticket and they came up with $5.00. That's a pretty fair price, but I can't vouch that it is right.

MR. HAMILL:

That's what it costs the gauger to write out the run ticket. That's the gauger's cost.

FLOOR:

Why should not the pipeline and the producer share the cost of the automatic lease installation?

MR. WILSON:

To answer this question as to why the pipelines and producers should not share the cost of the installation, Mr. Hamill gave some very good answers. But there is one other factor here, and that is that the producer has customarily furnished the measuring device, which is the lease tank, and he is the person who makes the biggest gain because he eliminates two or three days storage. There is very little financial incentive for the pipeline companies to install LACT. If there is one automatic battery out here and twenty manual batteries around it, the pipeline doesn't save anything.

FLOOR:

Do you agree that automation is a coming thing?

MR. WILSON:

Certainly. And at the time that LACT begins to dominate the lease picture then we will all benefit financially.

FLOOR:

We have four pipeline companies serving our second Sacroc unit. And the way the thing looks now, it looks like Magnolia Pipeline might take quite a bit of that oil, in other words take it away from some of the other pipeline companies, Service being one of them. And I was just wondering how it could be worked out where we could maybe split your share of it down the line somewhere and make everybody happy. What's your ideas on that situation?

MR. HAMILL:

I think you left me at the second left turn. You can have dual connections into certain leases where both pipelines could be hooked in and split their pro-rated take at that lease. The purchaser of the crude oil you might arrange for a transfer somewhere where you don't know anything about. The pipeline's keep on running the same amount of oil that they are now running, and part of it will be sold from one purchaser to another from here to Timbuctoo. There are just as many ways as Farmer Jones has of going to town, but that thing can be handled. One thing about it, if you get both pipelines hooked into one battery you ought to ask them to use one tank table. Your pumper will turn in figures based on that maybe Magnolia's tank tables, and later the thing is run by Service tank tables and there will be a little bit of difference. These accountants or pencil jockeys who want everything to balance right on the nose and they won't balance that way. You ought to get the pipelines to agree on one tank table.

FLOOR:

Question concerning same thing.

MR. HAMILL:

We have to work with the unit operator of course. We have it in the Rangely Field right now. One of the pipeline companies got thirty or forty thousand barrels ahead and we had to make an adjustment. The main thing being that we would rather gather the oil because in gathering we make a tariff and we have our investment out there, and if they're gathering the oil - the oil that we should gather - we lose the tariff on that amount of oil. We're not too happy about it. We wouldn't want it to keep on running on and on that way. We're in there to make money. If they do our work, we don't make any money.

NEAL McCASKILL:

There is one thing that's been worrying me about this automatic custody transfer and that's this business about pipeline proration. In Texas if you don't have the oil in the tank on the first day of the month you've lost your allowable. Most of the LACT systems have very little storage capacity. I know that where we have had 4 or 5 days storage during recent years, we have paid for it over and over again by being able to accumulate that oil and hold it until the pipeline could move it. Mr. Pope, do you have any thoughts along that line?

MR. POPE:

Not being from Texas, I have no particular comments, but I believe from the way the commission has co-

operated in the past those things will be ironed out to where they will actually be workable, as you realize the commission has been most cooperative in accepting LACT. I think eventually that if they see the benefit to the producer and the transporter they will do something about it. I know nothing about the laws of Texas.

MR. STANSBURY:

Thank you, gentlemen, for your contribution to this panel discussion. The meeting is adjourned.