ECONOMIC IMPACT RESULTING FROM USE OF CASING PLUNGERS

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INTRODUCTION

Plunger Lift is the most economical method of Oil and Gas production after open flow has ceased. Large returns are possible from relatively small capital expenditures. This is particularly true for marginal gas wells.

This results from low initial equipment costs and low annual maintenance costs. Plunger lift has a significant market and continues to be even more competitive.

While tubing plungers are cost effective, this form of lift will NOT take the well to the end of its producing life. Although plunger equipment provides great return, for the investment, the natural depletion of a well makes the long-term use of plungers implausible. It is at this point; the operator must consider other methods.

ALTERNATIVES

What can be done if the cost of a pumping unit or other mechanical lift method is greater than the value of the well's capabilities to produce on this investment? Many wells simply sit idle and undeveloped. Many produce far below capabilities.

The lift alternatives now have a viable, new option to consider. The use of a casing plunger has proven to make a depleted well profitable and productive. The cost of the equipment and the rig time are minimal. The removal and sale of the tubing from the well will usually pay most of the capital equipment costs. This form of lift has been fully developed into a complete system by Multi Products Company.

The following example will provide a better explanation of this investment on a 5000 foot well. (See Table 1).

CONCEPT OF THE CASING PLUNGER

The casing plunger system developed by Multi Products Company has evolved into a state of the art system that is totally automated (See Figure 2). The casing plunger uses Hydraulics and pneumatics to lift the wells liquids to the surface and into the gathering system. The plunger falls from the surface equipment to the stop set in the casing. This stop is set above the perforations.

The formation pressure pushes the plunger to the surface as the casing plunger pushes the liquids in the casing above the plunger. The cross-sectional area of the 4 ½" plunger can use 100 PSI to lift 1280 lbs. of actual liquid weight. This gives the casing plunger the ability to lift 1 barrel of water with only 35 PSI. This makes its use on depleted reservoirs very desirable.

A polymer "seal-cup" is used that will compress against the inside wall of the casing and trap the gas pressure below the plunger eliminating the "Stall effect" seen in tubing plungers. The loss of flow rate creates a slow down in plunger velocity. The tubing plunger will immediately begin to slide back to the bottom of the tubing. This stall or fallback is eliminated by the casing plunger because there is no loss of pressure below it. The upward flowing pressure is trapped by the seals holding the plunger's position. Additional flow from the formation will move it upward as it continues to the surface.

The pressure per barrel requirement is less than 25% of that for tubing plunger. The maximum line pressure can be higher in a casing plunger operation. Fall back is achieved by the opening of a large by-pass port in the body of the plunger upon its arrival at the surface.

The volume of gas, in 4 ½" is 3 times that contained in a 2 3/8 inch string of tubing. The volume of gas, in 5 ½" is 3 times that contained in a 2 3/8 inch string of tubing. This is the first indication of the volume of gas that a well can sell with this system. The casing plunger can freely fall while gas flows to the gathering system. There is no pressure buildup from having the well's flow shut-in. ***The well will flow 24/7 while the plunger is falling.***

THE CASING PLUNGER SYSTEM

The system is a fully automated system that consists of a plunger, down-hole stop, and controller with motor valve. A lubricator with an automated catch and release actuator is also included. The stop can be either a four-legged collar stop or a casing stop with slips. The motor valve has a large sized trim to maximize the flow from the well after the plunger arrives at the surface. The controller operates the plunger latch and the motor valve.

The casing plunger lubricator is the operation center for the JetStar casing plunger system. An automated catch releases the plunger after the well has been flowed for the specified interval to sell gas from the casing. The arrival sensor is a sealed magnetic device that does not give false signals as can be seen by many inferior clamp-on devices. This sensor must actually see a mass of steel in its field. This eliminates false readings of the plunger arrival.

The lubricator also has a hinge device to allow the operator to open the lubricator and swing it into a horizontal position to service the plunger. This is of a great assistance to removing the plunger for inspection and servicing.

There are dual flow outlets in the Lubricator. This is necessary to create an optimal flow from the well after the liquid load is removed from the casing. The top outlet is open to the sales line all the time and is never closed. This allows the liquid column to accumulate for the plunger to retrieve on the next cycle.

The single largest contributor to failed or rejected casing plunger candidates is casing damage. A procedure for conditioning (Scraping & Swabbing) is completed to casing plunger operation.

This system is not designed for use in wells that successfully operate a tubing plunger. The results from a depleted well with a casing plunger exceed the production of tubing plungers. In most cases, there is an immediate result from this form of lift for a well.

CONTROLS

The controls include two transducers for monitoring pressure of the casing and flow-line or its differential. The optional use of a differential transducer can be attached to allow the limits to be set by inches of water and it will drop the plunger when the differential is at the low limit. The “Fail-Safe” design means that there are only 3 entries required. It is certified for Class 1; Division 1; Groups C & D. Telemetry with Modbus capability is standard. The flow times are constantly adjusted for each cycle.

Software for selecting a candidate well and projecting its operation is available from the manufacturer of this system. The free program is able to determine the wells ability to perform.

Producers will tell you that making that kind of change in cash flow for 50 to 100 wells is what we are all trying to do in this industry. Having mature, depleted wells show significant gas revenues is a prime goal. High priced gas makes a casing plunger system provide an even quicker payback.

CONCLUSIONS

A project of 5 wells can be done for $55,000.00 in equipment costs and an additional $25,000.00 in rig time. This $80,000.00 investment can be paid back in 3 months by 5 wells producing only 30 MCF/Day more at $6.00/MCF.

Table 1

Equipment Costs and rig time.		
Cost of the Casing plunger system[1]		$11,500.00
Cost of the Service rig to pull tubing and prepare casing & swab.[2]		$ 4,000.00
	Total with no sale of assets	$15,500.00
Sales of Assets from Well.		
Sale of the tubing string in good condition @ 2.00 per foot.[3] 5000 ft.	$10,000.00	
Sale of the current tubing plunger system.		$ 1,800.00
	Total from sales of Assets	$ 11,800.00
Cost of change out of the system after sale of assets.	$ 3,700.00	

[1] Maximum costs of complete system with casing head valve. Most systems are lower.
[2] Rig costs can vary with the location, availability and services required.
[3] 2 3/8” tubing in serviceable condition will vary by locality.

Table 2
Monthly Revenue from Production Increase

Gas Increase	**Price of Gas $/MCF**				
$ per MCF	$3	$4.	$5.	$6.	$7.
Production (+)	**Revenue Per Month**				
10 MCFD	900	1200	1500	1800	2100
15 MCFD	1350	1800	2250	2700	3150
20 MCFD	1800	2400	3000	3600	4200
30 MCFD	2700	3600	4500	5400	6300
40 MCFD*	3600	4800	6000	7200	8400
50 MCFD	4500	6000	7500	9000	10,500
60 MCFD	5400	7200	9000	10,800	12,600

Table 3
Yearly Revenue From Increase In Gas Production

The following table shows this production extended over a period of a year. This will provide the point in time of when the production can pay for the equipment and service time. This does not reflect the value of the tubular sales.

The sale of tubing is going to vary by area, need and supply. This tubing sales revenue that will reduce the total expenditure by as much as 75% on some wells.

The current price per MCF will also either reduce or extend the payoff point of this expenditure.

Gas	**Annual Revenue Price of Gas $/MCF**				
$ per MCF	$3	$4	$5	$6	$7
Production (+)					
10	10,800	14,400	18,000	21,600	25,200
15	16,200	21,600	27,000	32,400	37,800
20	21,600	28,800	36,000	43,200	50,400
30	32,400	43,200	54,000	64,800	75,600
40	43,200	57,600	72,000	86,400	100,800
50	54,000	72,000	90,000	108,000	126,000
60	64,800	86,400	108,000	129,600	151,200

Automated Casing Plunger Telemetry or Stand-Alone Operation

Figure 1 - Shows The Casing Plunger Installed and Operating on a Well in West Texas
Note: The Long Drip Required to Get a Liquid Free Gas Supply for the System

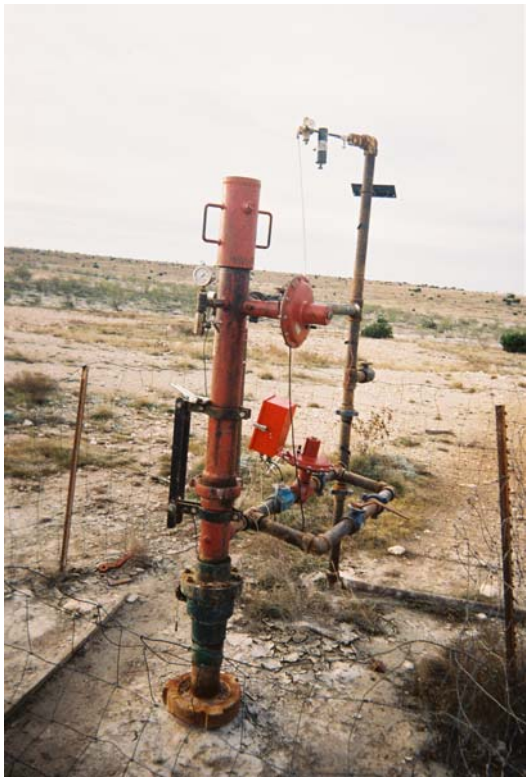

Figure 2 & 3 - Show the Plunger Being Removed from the Well after Three Cycles to Determine Its Seal Status
Note: Lubricator top has been removed for cleaning of a large amount of paraffin the plunger packed into this lubricator in three cycles.

Casing Plunger with Control System

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JETSTAR PLUNGER LIFT SYSTEM