The Load Indicator—Its Use and Operation

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INTRODUCTION

Over 400,000 oil wells are now being produced by sucker rod actuated bottom hole pumps. These wells vary in depth from less than 1,000 feet to over 10,000 feet, and the production rates of these wells vary greatly, as do the depths.

The proper and economical operation of pumping wells is highly desirable, for the basic objective of any oil producing company is to recover the maximum amount of oil at a minimum cost.

In these days of high taxes and low profits, it is mandatory that the efficient producing of pumping wells be maintained. This is growing in importance since a constantly increasing number of wells are being put on the pump. A formula for arriving at the cost of lifting oil will vary with the producer. However, of primary consideration is the cost of operations per day and included in this cost must be pulling and pump repair costs.

More and more producers are recognizing that greater attention should be paid to pumping wells, but all complain of the lack of trained personnel or lack of time.

Much discussion has been going on about the possible development of a simple instrument for checking the bottom hole pump before it is withdrawn from the well, but little action has been taken. Since operation and maintenance of equipment on pumping wells has always been considered the function of the field man, the instrument should be one that will lend itself to use by the field man. Therefore, it must be low in cost and easily understood so it can be properly utilized.

A new instrument has been developed which has been designated as a polished rod Load Indicator. The name is appropriate since it does indicate the changing loads on the polished rod as the well pumps.

It is the purpose of this paper to explain the methods of determining the action of the bottom hole sucker rod pump by using the Load Indicator. The Indicator consists of a hydraulic cylinder filled with a glycol base fluid and a free floating piston. To the cylinder is attached a pressure gauge which is calibrated so as to record pounds load rather than pounds per square inch. When installed and used properly, the indicator reflects the action of the pump and this permits the operator to observe this action at the surface.

BASIC FUNCTIONS OF LOAD INDICATOR

The Load Indicator is made in two different sizes. This is done for two reasons:

1. Many unit pumpers have a narrow carrier bar, and the smaller model, 5 inches in diameter, is adaptable to this situation and to smaller loads;
2. The larger model is 6-1/4 inches in diameter and is designed for larger units which most generally have the larger load.

The Indicator is installed directly on top of the unit carrier bar and beneath the polished rod clamp, allowing the cylinder to support the entire polished rod load which is read by adding two zeros to the number indicated on the dial.

When the well is pumping, the indicator hand will reflect the difference between the maximum upstroke and the minimum downstroke load which is the change of the fluid load from rods to tubing caused by the opening and closing of the traveling and standing valves. Therefore, by observing the indicator hand, one can determine whether or not the valves are actually opening and closing.

The Proper Use

The proper use of the Load Indicator will show the condition of the bottom hole pump. To determine if the valves are operating properly, one must check them to see that there is no leakage. To check the traveling valve, apply the brake gently and bring the unit to rest midway on the upstroke. In this position the traveling valve is closed and the fluid weight is on the rods. The indicator hand should now be in the high range.

If the traveling valve and plunger are in good condition there will be no loss in load. If the hand remains constant for 45 seconds, it is safe to assume that they are in good condition. However, if either traveling valve or plunger are worn and leaking, the load will decrease which causes the indicator hand to decline from the high to the low range. The speed at which this drop occurs is indicative of the amount of wear and leakage.

To check the standing valve, apply the brake gently and bring the unit to rest on the downstroke. Since this is the most difficult of the two valves to check, be certain that the weight shift from the high range to the low range has occurred before the unit comes to a complete stop. In this position, the fluid weight is on the tubing. If the standing valve is in good condition, the indicator will show no change in load. However, if the standing valve is leaking, an increase is load will be noticed.

Fluid pound can be visually observed by noticing the indicator hand. When a pump is performing correctly the traveling valve contacts the fluid immediately on the downstroke. The traveling valve opens and a weight loss will be noticed. If, however, the barrel is only partially filling, the traveling valve will not open on the downstroke until it meets the fluid. During part of the downstroke the indicator hand will remain in the high range until the standing valve contacts the fluid and at this instant a sudden unloading of the indicator hand will be noticed.

Another visual check made possible by the use of a Load Indicator is for a gas locked pump. In a completely gas locked pump, both the traveling and standing valve are locked shut and the load on the polished rod is nearly constant. Since there is no transfer of weight from rods to tubing, the indicator hand will remain in the high range on both the upstroke and the downstroke.

This brief explanation of the Load Indicator does not exhaust its possibilities in the determination of pumping conditions. These are the basic functions and if the operator understands its use and operation he can actually reduce downtime, maintain production and thereby help measurably to reduce excessive lifting cost.

Subsurface Maintenance

A major part of the direct lifting expense is subsurface maintenance. Pumps are pulled because of a drop in production, resulting from any number of reasons, only to find that the pump is in good working order. The operator decides that since the pump has been pulled that the

slightly worn valves, barrel and plunger might as well be replaced so that the pump will be as good as new when pumping is resumed. Due to shut down time, the fluid level has been increased, thus indicating an increase in production when the well has resumed pumping. This satisfies the operator at the time though the result of this frequent well pulling is often excessive and unnecessary lifting cost.

If the Load Indicator had been used, it is entirely possible that the pump condition could have been observed and other steps taken to avoid any unnecessary pulling and expense.

While the Load Indicator will simulate some of the functions of a Dynamometer it should never be used as such. It is the author's opinion that the Dynamometer as well as the Load Indicator have their individual applications.