Hydraulic Pumping and New Developments

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During the past eighteen years the hydraulic long stroke pumping unit has made an ever increasing entrance into the crude oil production picture. In 1939, two hydraulic long stroke units made their appearance in the oil fields. In the early days of the hydraulic unit, as is true with other new types of equipment, there was a great deal to be learned by the manufacturer's as well as the operators. Often the operator of the early hydraulic long stroke unit felt fortunate if he had a four or five day trouble free period. Nevertheless, the deep wells with high volumes presented problems to the producers which they realized had to be solved.

In the beginning, some producers tried to use larger bore bottom hole pumps with their short stroke beam units to increase production, only to discover instead of increasing production, it resulted in less production. The resulting decreased production was due to the fact that the increased pump bore size increased the amount of sucker rod stretch, which actually decreased the displacement of the pump. For example, if a well were pumped from 7,400 feet using a 1 3/4 inch bore bottom hole pump with a 54 inch surface stroke unit, there would be no production, since a 1 3/4 inch bore bottom hole pump at 7,400 feet causes the rods to stretch 54 inches. In this case the stretch is equal to the amount of surface stroke. From similar cases, the production man realized a longer stroke was necessary to overcome the effects of sucker rod stretch when using larger bore pumps. Even in view of the mechanical difficulties first encountered with the hydraulic long stroke unit, the production man realized that this type unit would produce greater volumes from greater depths than he had heretofore known. After several months of operating the hydraulic unit, the oil man also discovered some other things which at first, had not been noticed or known about the unit. The sucker rod strings were not parting as frequently as they had when they were using a short stroke unit with a high rate of reversals. The tubing was not developing as many leaks, and in addition to all of these items, the bottom hole pump was lasting longer even though greater production was being obtained from the well. All in all, the oil man's willingness to bear with the manufacturer's design difficulties, until they could be corrected, brought forth the present day reliable piece of equipment.

The above items are all well and good from the down-hole standpoint, but what is this hydraulic long stroke unit the production man is to operate. Here is a piece of equipment which is different from anything he has ever seen before. Here is a unit that has an engine on one end, the same as the beam unit, with a traveling polished rod on the other, again the same as the beam unit; but what makes the polished rod on the hydraulic unit move? It is simple enough to see why the beam unit moves, so let us look at the hydraulic long stroke unit. Every hydraulic long stroke unit has the following components:

A. An hydraulic pump which delivers fluid within the system and supplies the fluid pressure to operate the unit.
B. A reversing mechanism which controls the flow of the oil from the pump so that the piston will move up and down. This is accomplished by directing the discharge of the pump to the piston on the up-stroke and back to the balance tank on the down-stroke.
C. An air-oil balance tank which contains the oil used within the hydraulic circuit as well as the air pressure which is used to counter-balance the sucker rod load. The air is used in the system similarly to the counterweights of a beam unit.
D. A piston-polished rod, cylinder arrangement which transmits the hydraulic power into polished rod movement. The polished rod is connected to the sucker rods, which in turn transmits the reciprocating movement to the bottom-hole pump.
E. The V-belt drive which transmits power from the prime mover, or engine, to the hydraulic pump input shaft. The power is transmitted to the hydraulic pump from the engine and is transformed into hydraulic power through the media of oil, this power is in turn applied to the piston and polished rod which causes the rod to move.

The main pump, due to the positioning of the reversing valve, takes supercharged fluid from the air balance tank and discharges it at increased pressure to the underside of the piston on the up-stroke, and conversely takes supercharged suction fluid from underneath the piston and discharges it at increased pressure into the balance tank on the downstroke.

The unit is counterbalanced by adjusting the pressure in the air balance tank to balance the weight of sucker rod, plus one half the well fluid load. The main pump then acts on a constant work cycle, doing only enough work to boost the supercharged suction pressure through a differential equal to one-half the fluid load on both the up-stroke and the down-stroke.

As the operator though, you ask yourself, what can I do to prolong the life of the hydraulic long stroke unit in order to obtain trouble free service. Let us compare the hydraulic long stroke pumping unit to any other piece of machinery such as your automobile. In maintaining your automobile, there are several items you take care of almost automatically such as; oil level in the crankcase; bearing lubrication; wheel seals; filter changes; and even down to the amount of air you carry in your tires. Yes, these things you almost automatically care for to prolong the life of your automobile. These maintenance items all fall in the category of preventative maintenance. Preventative maintenance is used to reduce costly repairs which will occur if machinery is not properly cared for.

The above maintenance items for your automobile may also be compared to those of your hydraulic long stroke pumping unit. For example; (A) When the oil level in the hydraulic pumping unit becomes low, there is a chance that the moving parts will not receive proper lubrication. Insufficient lubrication could easily cause moving parts to become scored and worn excessively. (B) Let us consider bearing lubrication, here again, if the V-belt drive bearings are not lubricated at regular intervals, they will soon fail. (C) Frequent filter element changes on your automobile are not uncommon; since you desire to keep foreign material from entering the engine lubrication system. Filters also keep the oil conditioned since they remove not only foreign material, but also water which tends to breakdown the lubricating qualities of the oil. Here again, frequent filter element changes apply to the hydraulic unit. In fact, regular filter element changes are undoubtedly as important to the extension of your units life as any one item that can be named. (D) The proper amount of air in your automobile tires insures a smoother ride for its occupants as does the proper amount of air in the hydraulic unit insure a smoother ride, so to term it, to the sucker rods. Low air pressure in your automobile tires allows you to hit bottom, when you

drive over a bump, this is also true in the hydraulic unit, since there is not enough air to cushion the fall of the sucker rod string. Conversely true, too much air will not allow the rod string to properly cushioned.

Summing up a preventative maintenance program which will insure more satisfactory operation from the hydraulic unit, let us review them briefly.

A. Maintain a proper power oil level in balance tank. Check weekly.
B. Lubricate bearings at regular intervals. Check weekly.
C. Change oil filter elements at regular 90 day intervals.
D. Maintain the proper amount of air in balance tank. Check weekly.
E. Replace polished rod packing when excessive leakage occurs.

To emphasize "E", it should be pointed out that improper polished rod alignment with the well bore or tubing, forces the polished rod to be misaligned. When the polished rod is misaligned, a side loading is imposed on the packing so that the packing can not properly seal. This results in undue oil leakage from the hydraulic circuit.

As with all types of machinery, the manufacturer's of hydraulic long stroke pumping units are endeavoring to improve their equipment. Some of the recent developments are the 20 foot stroke completely portable test units and the 40 foot standard model production units. The 20 foot stroke portable test unit is so designed that the main cylinder folds back over the length of the unit and is ready to be transported to its next location. Engineering foresight makes it possible to build a unit which is within the legal road limits on weight, height, breadth and length. It is now possible to have an hydraulic long stroke test unit which may be moved from well to well without ever being dismantled. The portable test unit is also built so that it can be set on a temporary wooden beam foundation, thus eliminating the need for a special base or special tie down foundation. The present day portable test unit can be manufactured with a maximum polished rod load of 35,000 pounds and maximum number of 7 strokes per minute. A unit of this type offers the petroleum production industry a piece of test equipment which will give the deep wells a better test.

In addition to the portable test unit, the same manufacturer offers a 40 foot surface stroke unit which is built in a standard production model and is available at this time to the industry. The 40 foot stroke unit affords still higher production rates while keeping the strokes per minute at a minimum.

As demonstrated, by fact that two new long stroke hydraulic pumping units are offered to the petroleum industry, the long stroke hydraulic pumping unit manufactures are continually endeavoring to produce equipment to answer the petroleum industries needs. Your suggestions concerning problems and improvements are always welcomed by the manufacturer.