New Developments In Rod Pumping Dually Completed Wells

By R. M. ERSKINE
Emsco Manufacturing Co.
Dallas, Texas

The costs of drilling, completing, and producing oil and gas wells are continuously increasing. Therefore, the present day operator is seeking new and improved methods to more efficiently produce oil and gas. The savings available in dually completing a well are forcibly evident over the costs of drilling and completing two singly completed wells.

Dual completions were developed as an expedient measure during World War II, primarily because of the critical shortage of steel in the form of tubular goods, and also for the increased demand for petroleum products. The economical advantage was placed in the background of the all out war effort.

Single completition practices and equipment were pressed into service of dual wells because insufficient time and personnel did not enable the development of the proper techniques and tools. Needless to say, numerous failures resulted when this equipment was used in the more rigorous service of dual completions.

Because of these inevitable failures, costly work-overs resulted. Dual completions were then critically curtailed in the first years following World War II. The following approximate figures show this definite trend. Even though they are limited to the State of Texas, it is believed that they are indicative of a general trend throughout the industry. The figures for the years 1940-1947 were obtained from an API Survey; 1948 and 1949 were estimated, and 1950 thru 1955 were obtained from Texas Railroad Commission permits. 1.

1. Petroleum Engineer, "Dual Completions," by Mr. G. Prutzman, Sun Oil Company.

1940 — 0	1948 — 100
1941 — 25	1949 — 100
1942 — 25	1950 — 325
1943 — 120	1951 — 480
1944 — 160	1952 — 465
1945 — 315	1953 — 550
1946 — 210	1954 — 785
1947 — 170	1955 — 940

In the late 1940's technical personnel became more readily available and oil operators, service companies, and manufacturers diligently set to the task of improving on the results previously obtained in dual completions. Considerable effort and money has been and is being expended in developing new and better dual completion techniques and equipment. Stage cementing, selective fracture work and acidizing, improved logging techniques, retainer type packers, wire line retrievable tools, dual gas lift, hydraulic pumps, and rod pumps have all materially aided in the dual completion growth.

Interest is still being shown in the intermittent method of producing dual wells. This method enables the operator to produce one zone while the other is sealed outside of the tubing string at the bottom of the well bore. This method operates satisfactorily when each zone is able to produce its allowable in a half-month period. The actuation of the equipment is accomplished by rotating the tubing at the surface. The tubing head is generally mounted on ball bearings, which allows ease in manipulation. Intake ports in the tubing string are opened and closed in an assembly above a production packer placed between the two zones. A hydraulic tubing anchor is recommended between the assembly and production packer in order to eliminate rotation of the tubing at the production packer. These ports operate and are sealed in their respective sealing sections. This type of equipment has its limitations in wells having high differential pressures, sand, and a crooked hole.

The simultaneous type dual pump is still the most widely used of single rod string duals. Of the various competitive equipment on the market all consist of similar basic overall design and fluid flow pattern.

Simultaneous type dual pump consists of (1) an upper pump (2) a polished section in the sucker rod string and its respective sealing section, (3) a lower pump and seating shoe, and (4) an annular packer and cross-over assembly. A production packer is necessary for any dual completion, and it is placed between the two zones. The cross-over and annular packer is placed above the upper zone, thereby straddling the upper zone with the two packers.

The lower zone fluid is produced from below the production packer through the tubing string to a point at the bottom of the cross-over assembly. Here the lower zone fluid is diverted into the tubing—casing annulus above the cross-over and annular packer, and thence to the surface. The upper zone fluid is accepted into the cross-over assembly and produced to the surface through the tubing string.

One piece of equipment that has found wide acceptance in the past year is the use of removable sub-surface chokes in conjunction with the simultaneous type dual pump. These chokes have created additional flexibility in dual pumps in that they may be used to flow both zones or flow one and pump the other. Also certain completion and remedial operations may be performed through the use of these chokes. Their use is restricted from high volume injection rates, but moderate pumping rates can be handled with ease. These chokes may also be used to run tubing into the well under pressure on relatively low pressure flowing wells. This eliminates the need of loading the hole with a weighting fluid.

More dual pumps were installed employing parallel tubing strings. This included 5 1/2" x 2" x 1" and 7" x 2 1/2 x 1 1/4". This type eliminates the upper annular packer and enables the operator to vent gas from the upper zone, contain a lower zone corrosive fluid in the small string of tubing or circulate inhibitors or solvents down the annulus.

A few operators have added a third small string of tubing to vent the lower zone gas from below the production packer. In 5 1/4" casing this is generally 3/4" and 1 1/4" in 7" casing.

One major oil company designed and patented their own cross-over for 7" casing to employ a 2 1/2" main string and two 1 1/4" strings. With this special cross-over head, which is run above a 7" x 3" retrievable production packer, they are able to utilize most any manufactured dual pump. There are several of these in operation in Southern Oklahoma.

One of the most recent developments in the parallel string type dual pump is the use of a latching device for the small string of tubing. Built into the top of the cross-over is a specially designed honed sealing surface and latching recess. On the lower end of the small string of tubing is a sealing section and a spring loaded anchoring device. This enables the operator to run in the main string of the tubing separately and set the production packer. Then the small string of tubing is run and seated in the latching recess at the top of the cross-over. The small string of tubing may then be placed in tension or compression. The use of tubing clamps has been eliminated and thereby decreasing rig time during service operation and also decreasing the safety hazard. In 5 1/2" casing the main string of tubing has been limited to the use of flush joint.

A large growth in pumping dual wells has been noted in the method utilizing parrallel tubing strings and two pumping units. Manufacturers on all equipment have kept pace with this change in dual pumping, which gives the operator greater flexibility in his producing program.

Unit manufacturers have developed streamlined carrier bars to give the maximum clearance between the horses heads. Included in some of these carrier bars are specially designed polished rod clamps to also cut down on the size. However, there are standard polished rod clamps available, which give ample clearance.

Steel guards have been made to prevent the collision of the two carrier bars during the pumping cycle. These are often constructed from 1/4" steel plate and can be attached to the well head. These guards act as a stationary separator between the two polished rods. Another type is constructed from similar material, but is curved around the carrier bar and attached to the wire line and polished rod. These guards provide a certain amount of safety in the event any motion of either carrier bar occurs during the pumping cycle.

Well head equipment has been developed to accommodate any combination of 2" tubing in 7" casing. Each string of tubing can be suspended, sealed, and anchored independently of the other. This offers considerable ease in the initial installation or workover when the tubing must be serviced. Sufficient center-line distance has been provided to enable the juxta position of certain dual packed stuffing boxes.

Various 2" tubing combinations are available to be run in 7" casing. External flush joint and External upset, both strings external upset with turned down O. D. and tapered end N-80 tubing collars have been commonly used in deeper applications. Where depths has been of no concern, the use of 2" regular non-upset tubing has been employed. Mechanical seating shoes for any tubing thread have been made available. These shoes may be used for either a top or bottom hold-down and have sufficient opening to allow the passage of the tubing type perforating gun.

Mechanical tubing anchoring devices have been developed to anchor both strings. The long string may be anchored either in tension or compression at the joint of the production packer, which is placed between the two producing zones. A latching device may be installed in the long string at a point where the short tubing string will terminate. A latch is then installed on the bottom of the short string, enabling the operator to place the short string in tension. This method eliminates, to a great extent, the amount of tubing collar wear on each string and also on the I. D. of the casing.

Servicing the pumps and/or rod string in the two pumping unit method may become a problem if certain precautions are not taken into account on the initial installation. In order to efficiently "wrench" the rods, it is necessary to remove the polished rod on the string that is not being serviced. A common practice is to unseat the pumps, loosen the polished rod on the rod string. After setting the rods back on bottom, the polished rod is "backed off" the rods and removed. A mechanical type hold-down can easily be seated and unseated a number of times without damage to the hold-down. But often cup type hold-downs present more of a problem and often cause additional rod jobs. On and off attachments near the surface have been utilized. This eliminates the necessity of unseating the pump.

A few installations have included a small third tubing string in order to vent the lower zone gas from below the production packer.

It has been reported that a few installation in 5 1/2" casing have been set up with two strings of 1 1/2" upset tubing. The rod string is a straight string of 5/8" rods with 1 3/8" O. D. slim hold couplings. A small bore insert type pump is utilized. Depth and volume of fluid produced are definitely limitations in this specific size application.

It is considered a generally accepted fact that the pay out period for a dual well has been decreased over that of two single wells, but all of these many advantageous features easily may be lost if proper techniques and equipment are not utilized. Considerable advancement has been made in the past year to make dual completions more attractive to the operator. The present day operator is more or less compelled to investigate the possible advantage of dualling a well with this new equipment before starting on new drilling and for work-over programs.