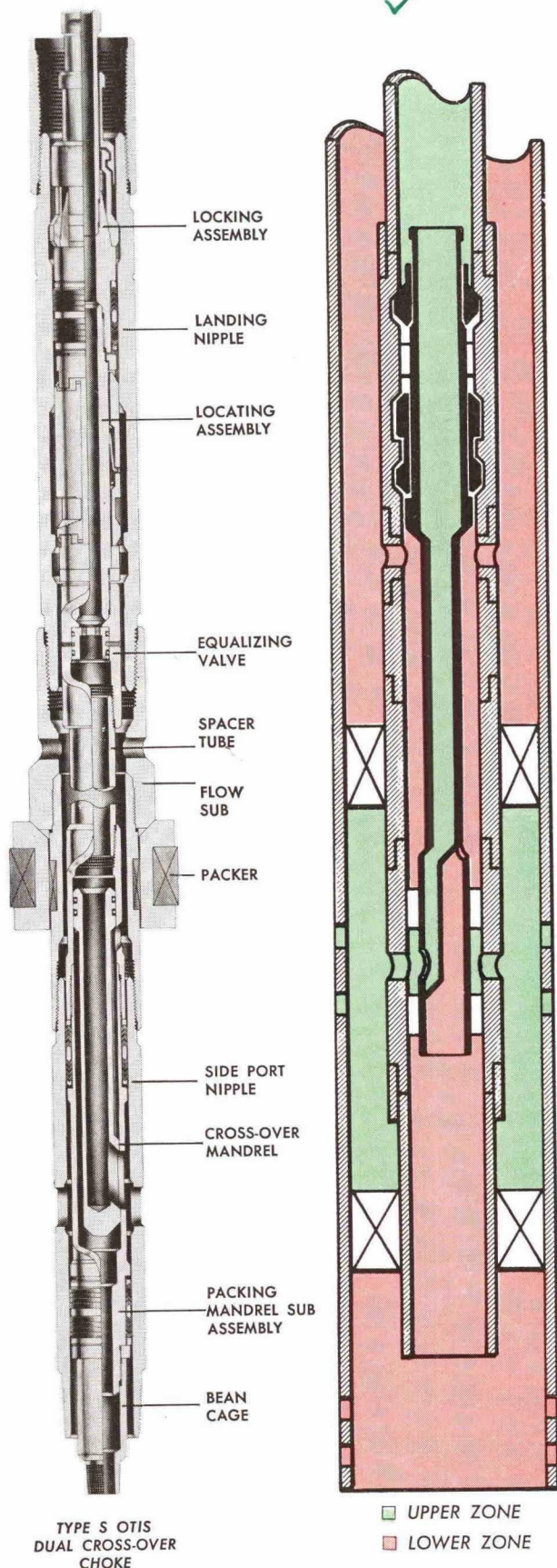




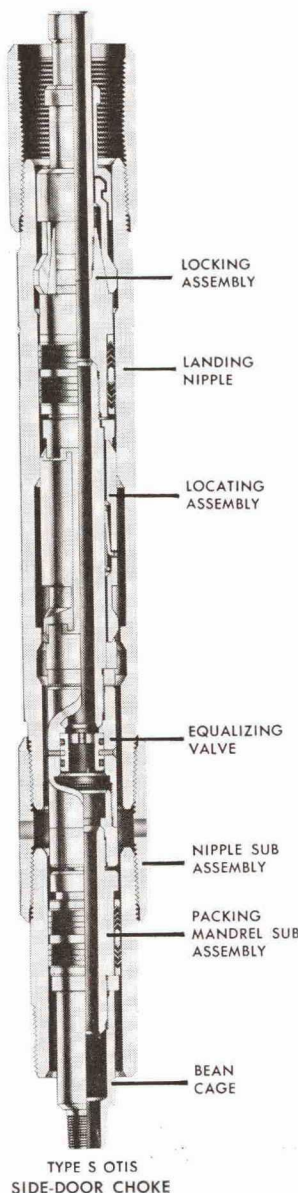
TYPE S OTIS DUAL CROSS-OVER CHOKE

A Type S Otis Dual Cross-Over Choke consists of a locking mandrel assembly, equalizing valve assembly (combination type), concentric cross-over mandrel assembly, and a bean cage. The tool is designed to land in a Type S Otis Landing Nipple with a side-door nipple sub-assembly and a side-port nipple assembly.

With the dual cross-over choke assembly properly installed in the dual-completion landing nipple assembly, production from both zones of a dual-completion may be crossed over—i.e., the upper zone produced through the tubing and the lower zone through the casing. Because this selection of flow courses is available by wire line methods, there is no need to disturb the packers by pulling the tubing string. The tools are designed to pack off above the lower ports and below the upper ports in the nipple assembly and to allow the two flow courses to be interchanged within the choke assembly. With the dual cross-over choke in the tubing string and Otis safety valves above and below the hookup, storm choke protection is afforded the annulus.



TYPE S OTIS
DUAL CROSS-OVER
CHOKE



TYPE S OTIS
SIDE-DOOR CHOKE

TYPE S OTIS SIDE-DOOR CHOKE

The Type S Otis side-door hookup is usually located above a single packer rather than straddling the upper packer as the dual side-door does. The Type S Otis side-door hookup can be used in a single completion, a conventional dual completion, a multiple string completion, or an alternate zone completion. It can be used to provide both the circulating ports and the extension hanger landing nipple for P. T. W. C. remedial work. (See Introduction to Otis Side-Doors & Separation Tools).

The Type S Otis Side-Door Choke can be run or pulled under pressure with a wire line and is designed to pack off ports in a Type S Side-Door Nipple hookup, thus eliminating communication from the tubing to the tubing-casing annulus. It is equipped with an equalizing sub, whereby any pressure differential may be equalized before the side-door is pulled, giving the installation an added safety factor. With the side-door choke out, the nipple hookup is full-opening and will pass all other types of wire line tools and equipment.

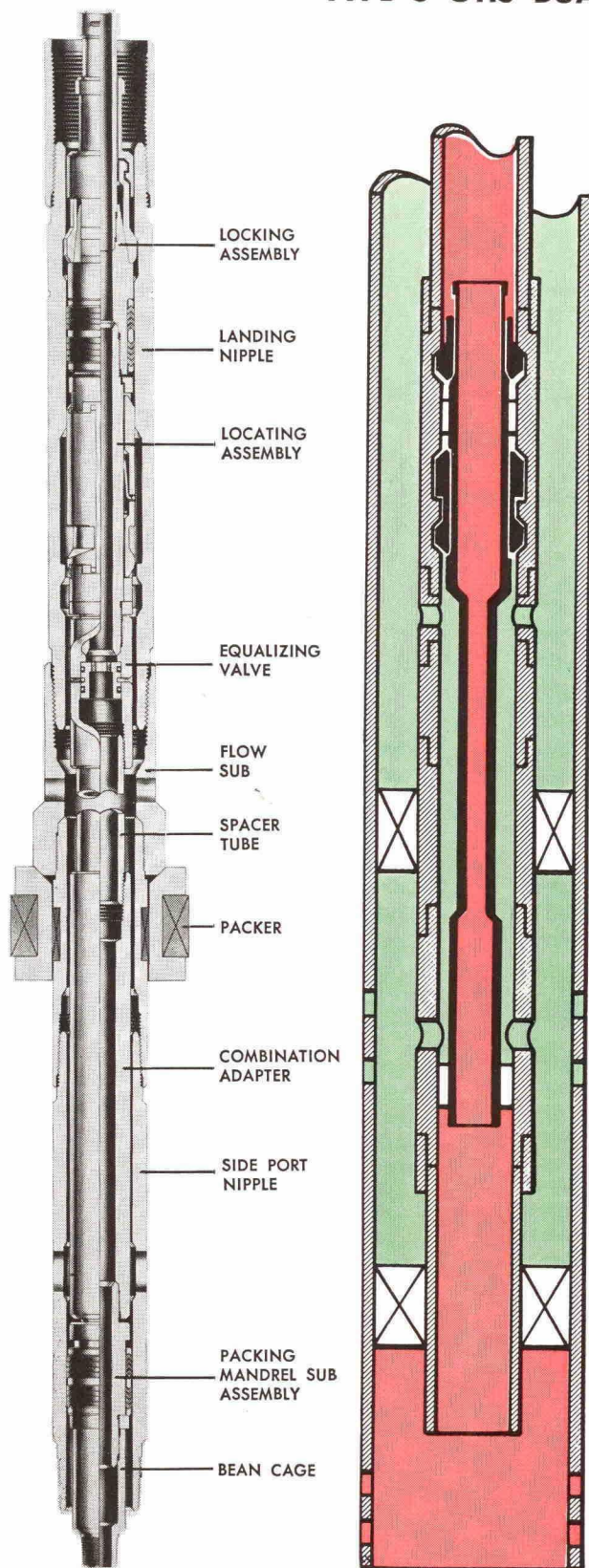
COMPLETION EQUIPMENT



OTIS ENGINEERING CORPORATION

Dallas, Texas, U. S. A.

TYPE S OTIS DUAL REGULAR FLOW CHOKE

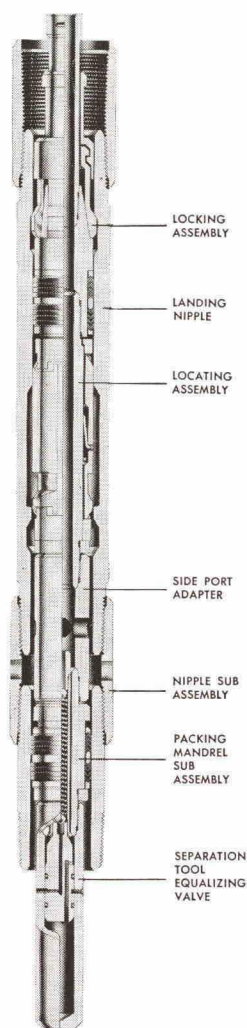


TYPE S OTIS
DUAL REGULAR
FLOW CHOKE

A Type S Otis Dual Regular Flow Choke consists of a locking mandrel assembly, locator mandrel assembly, equalizing valve assembly (combination type), bean cage, packing mandrel sub-assembly, and a spacer sub. The tool is designed to seat in a Type S Landing Nipple with a side-door nipple sub-assembly and side-port mandrel assembly.

The tool serves to allow the flow of dually-completed wells to be produced parallel—i.e., the lower zone up the tubing in an uninterrupted course and the upper zone through the annulus, in the conventional manner. If it becomes necessary to cross over the flow courses, this choke may be removed by wire line methods and a cross-over flow tool run in its place.

TYPE S OTIS SEPARATION TOOL



TYPE S OTIS
SEPARATION TOOL

The Type S Otis Separation Tool is designed to be exchanged with the Type S Side-Door Choke in a dual-completion if the bottom zone is to be blanked off and the upper zone is to be produced or merely unloaded through the tubing. The plug bottom on the separation tool is also an equalizing assembly which facilitates the wire line work involved in servicing the separation tool. Both the side-door and the separation tool utilize the same nipple hook-up and can be used in a single-completion, conventional dual-completion, alternate-zone completion, or multiple-string completion.

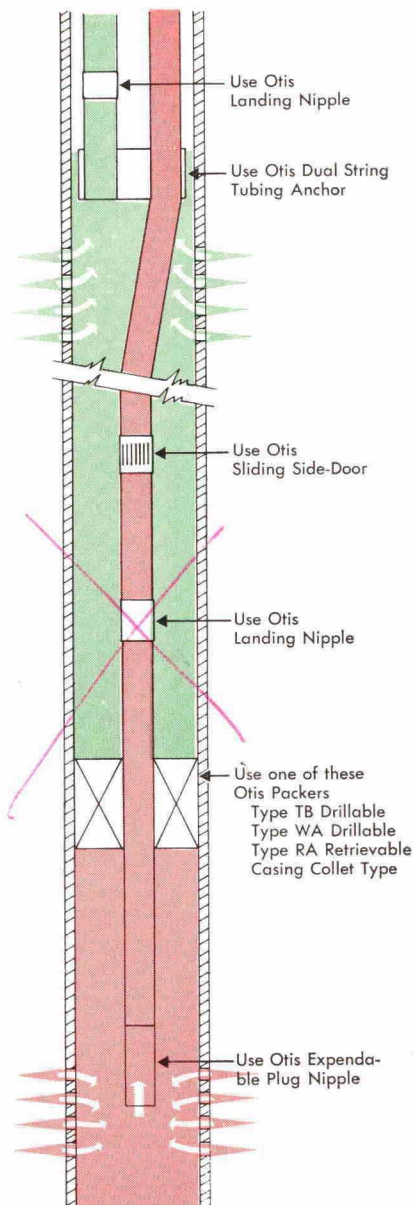
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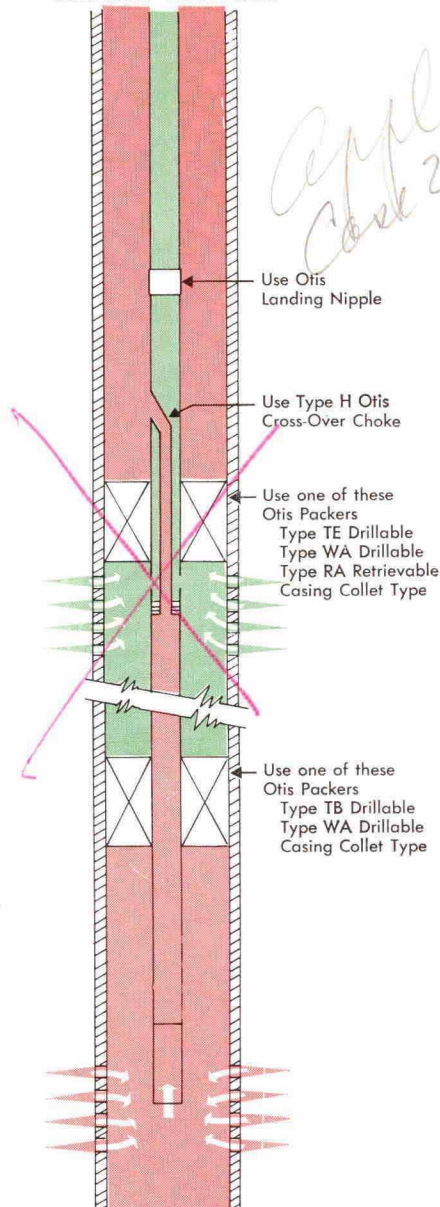
COMPLETION EQUIPMENT

PARALLEL STRING PRODUCTION
DUAL ZONE—SINGLE PACKER



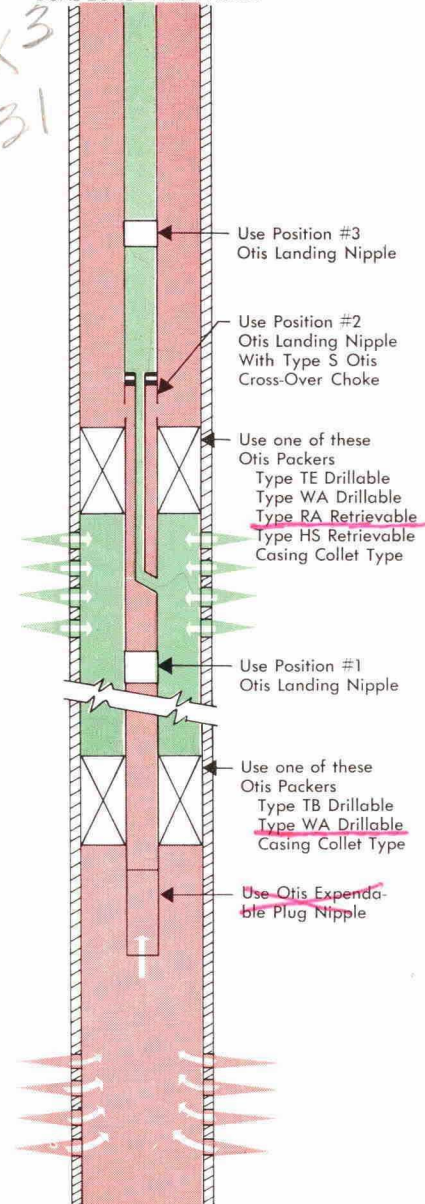
The landing nipple made up in the short string may be used to land an Otis Plug Choke or various other bottom-hole controls. The sliding side-door in the long string serves as a circulating device to wash around the long string, the short string, and the annular space. The landing nipple located below the sliding side-door in the long string is designed to accommodate a plug to permit the short string to be pulled without killing the lower zone. The long string remains full opening when Type S Otis Landing Nipples and Type A Otis Sliding Side-Doors are used.

TYPE H CROSS-OVER
SELECTIVE TUBING—ANNULUS PRODUCTION
DUAL ZONE—TWO PACKER



This installation incorporates the Type H Otis Cross-Over Nipple Assembly to afford selective production of either zone through the tubing or annulus. This selectivity is possible through the use of two different retrievable chokes run or pulled under pressure with a wire line. The landing nipple above the Type H cross-over head is designed to accommodate any number of different Otis bottom-hole controls. In this type of installation the tubing is not full-opening with all chokes removed.

TYPE S CROSS-OVER
FULL OPENING, PTWC OPTIONAL
ON LOWER ZONE
DUAL ZONE—TWO PACKER



This installation utilizes the Type S Otis Cross-Over Nipple Assembly for P.T.W.C. and permits complete selectivity of production of either zone through the tubing or the annulus with the option of any type remedial work on the lower zone, using the Type S Otis Dual Test Tool and Extension Pipe. The landing nipples above and below the cross-over assembly may be used to land any number of different Otis bottom-hole controls. With the cross-over in place, and Otis Safety Valves in the nipples above and below the assembly, storm choke protection is afforded both the upper and lower zones. With all retrievable equipment out of the hole, the tubing is full-opening.

COMPLETION EQUIPMENT

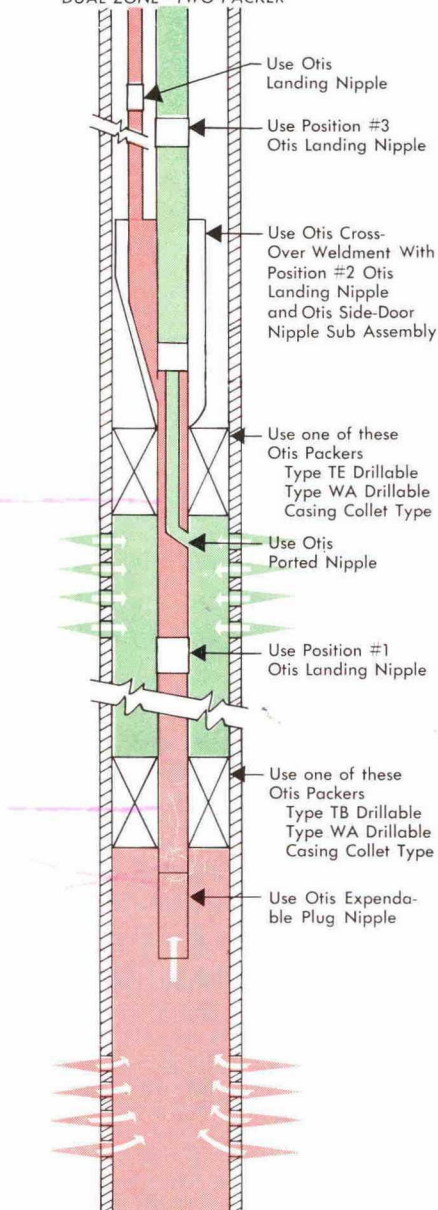


OTIS ENGINEERING CORPORATION

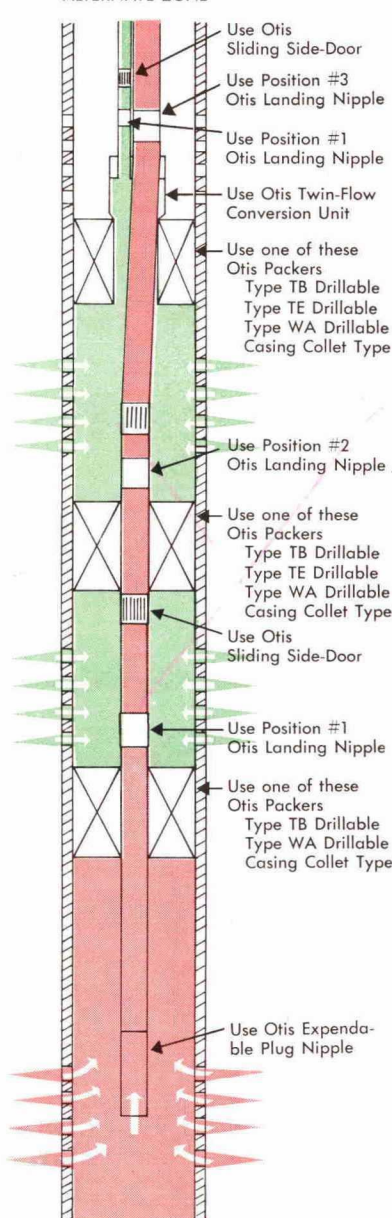
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DUAL STRING CROSS-OVER WELDMENT
FULL OPENING, PTWC OPTIONAL
ON LOWER ZONE

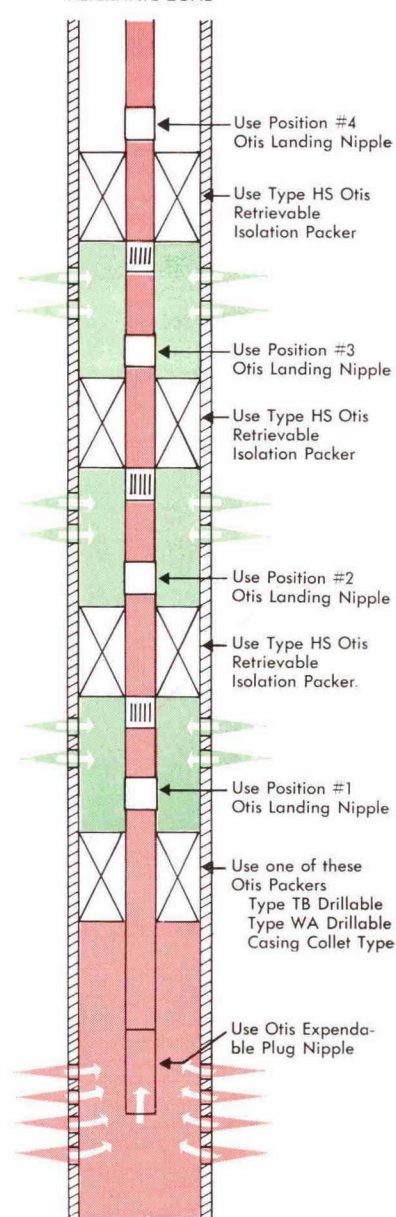
DUAL ZONE-TWO PACKER



DUAL STRING
ALTERNATE ZONE



SINGLE STRING
ALTERNATE ZONE



The Otis Dual String Cross-Over Weldment is available in three sizes— $1\frac{1}{4}'' \times 2''$, $1\frac{1}{2}'' \times 1\frac{1}{2}''$, and $2'' \times 2''$. It is designed to be used with two single string packers and offers selective production of either zone through either string. Complete remedial work on the lower zone is possible without pulling tubing. Otis bottom-hole controls may be set in either string as desired, utilizing the Otis landing nipples. The long string is full-opening in this type of completion.

This type of installation utilizes an Otis Twin-Flow Conversion Unit with two Otis Sliding Side-Doors. With this equipment, selective production of the middle and lower zone is possible through the long string while the upper zone is being produced through the short string. The sliding side-door in the long string opposite the upper zone may be used as a circulating device on initial completion or for remedial work. The sleeve in the short string also serves as a circulating device and by plugging the long string at the position No. 3 Otis Landing Nipple the short string may be pulled after killing the top zone without killing the other two zones. The long string is full-opening in this type of completion.

This installation is designed to permit the production of any of the four zones through the long string at any time. Upon depletion of the bottom zone, it may be plugged off by setting a plug choke in the position No. 1 Otis Landing Nipple just above the bottom packer and the next zone produced by means of opening an Otis Sliding Side-Door. The upper landing nipples may be used to land and seat various Otis bottom-hole controls. The tubing is full-opening in this type of completion.