RECOVERY OF UNCONTAMINATED CORES

FIG. 1

BORE HOLE

REFRIGERANT FROM DRILL PIPE

DRILL STRING

PACKING

REFRIGERANT PIPE

EXHAUST GAS PORTS FOR SURFACE RETURN

REFRIGERANT IN

GAS RETURN

SWIVEL

COIL

CUTTING BASKET

CHECK VALVE

OUTER BARREL

FIG. 1A

ROBERT C. WEST
GEORGE G. BINDER, JR.
WILLIAM A. FREEMAN, JR.
INVENTORS

BY W. D. HELMCHER
ATTORNEY
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FIG. 1B

ROBERT C WEST
GEORGE G. BINDER, JR.
WILLIAM A. FREEMAN, JR.

INVENTORS

BY

ATTORNEY
The present invention is concerned broadly with the production of oil. The invention is more specifically concerned with the recovery of uncontaminated cores during a coring operation. In oil well drilling practice, a sample of subsurface rock penetrates in the course of drilling operations is referred to as a core. The operation by which such a sample is obtained in order to ascertain the properties of a given formation is known in the art as coring. The devices employed to collect these cores are known as core barrels and are usually so constructed as to be attached to the lower end of a drill pipe. In accordance with the present invention, an uncontaminated core is secured by freezing the core as it is being recovered from the earth's substrata.

The cores obtained by all types of core barrels known at present are essentially similar in the respect that these cores are exposed to a constantly diminishing pressure from the moment the core begins its upward movement until it arrives at the surface. Mineral oil and gas produced in substance foundations are generally under a high pressure which is commonly referred to as the formation pressure. The extent of this pressure depends upon the depth of the formation and in general is proportional to the hydrostatic pressure exerted on the formation in which oil or gas is found. It is a well known fact that when oil or gas-bearing formations are exposed to a pressure lower than the formation pressure, the oil or gas contained in them has a tendency to expand and leave the formation. Consequently, the reduction in pressure on a core obtained by present methods of coring during its travel to the surface brings about a considerable change in the oil and gas content of the core, thereby rendering the core unavailable.

Thus, one difficulty has been to secure a core accurately representing the exact nature of the earth's substrata from which it was removed. This is particularly critical in view of a growing interest in water flooding and other secondary recovery methods, since it is essential that a direct and accurate measurement of residual oil and water saturations be determined prior to employing a selected secondary recovery operation.

At the present time estimates of residual oil saturation in the reservoir can be obtained from past production records, data on core analysis, porosity, pay sand, and the like. However, lack of knowledge of some of the above factors, together with such features and oil migration and water influx, make estimating residual oil saturation in the depleted reservoir prior to secondary recovery operations uncertain. In accordance with the present invention, a core is frozen or cooled in situ as it is being cored, thus preventing or substantially reducing the migration of oil and water from the core, or the adsorption of oil and other contaminants from sources foreign to the core.

The process of the present invention may be more fully understood by reference to the drawings illustrating one apparatus which is satisfactory for freezing or chilling the core in situ as it is being recovered.

Fig. 1 is a sectional view showing a portion of the drill string of the apparatus.

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