# A new method of measuring and maintaining the consistency of the mud fluid in oil drilling operations by means of the DRAGE torsion-viscosimeter

Autor(en): **Henke, J.**

Objekttyp: **Article**

Zeitschrift: **Bulletin der Vereinigung Schweiz. Petroleum-Geologen und -Ingenieure**

Band (Jahr): **18 (1951)**

Heft 54

PDF erstellt am: **21.07.2024**

Persistenter Link: https://doi.org/10.5169/seals-185557

Bull. Ass. Suisse des Géol. et Ing. du Pétrole, vol. 18, No 54, p. 25—28, 2 textfigs., 31. July 1951

# A new method of measuring and maintaining the consistency of the mud fluid in oil drilling operations by means of the DRAGE torsion-viscosimeter

by Dr. Ing. J. HENKE, Basle, Switzerland

As is well known a socalled mud fluid is used in deep boring operations, especially when drilling for oil. The purpose of this is to apply sufficient counter pressure to the initially uncased and loose side walls of the bore hole. The fluid also produces the largest restraining force possible when oil or gas bearing layers, which are under pressure, are being drilled. The circulation of the mud fluid furthermore serves to convey all drill cuttings from the bit to the surface at the rate with which the mud column itself is moving. It also ensures that the drill cuttings which are mixed with the fluid, do not attack, or attack only in a less abrasive manner, the side walls of the bore-hole, the boring fixtures and the slush pumps. Depending on the momentary composition of the geological layers encountered, and on other factors, the density of the mud fluid must be altered and this calls for continuous supervision. The mud fluid is often of paramount importance in determining the success of a boring operation. The circulating fluid usually consists of a slushy mixture of clay, finely ground barite and water, or of crude oil mixtures with chemicals and pulverised barite added; the viscosity lies in the 0—500 cp. range.

Up to the present the quality of the ingoing circulating fluid had to be determined on a specific gravity basis; depending on the individual values of specific gravity noted, pulverised barytes or chemicals were added by hand to make a stiffer mix, or water or oil diluents were used if a less viscous mixture was desired. A definite volume of the fluid was weighed in order to determine the specific gravity or alternatively a dry-gravity-hygrometer was used to determine the amount of solid matter present. With the former method only discontinuous measurements could be made and no continuous control was possible, whereas the latter method did not yield reliable results since solid matter content is not proportional to viscosity.

Once the oil engineers becone aware that the viscosity was the controlling factor, and that the use of too viscous or too thin a mud fluid could occasion serious disturbances, the measurement of viscosity was introduced. At first a type of funnel viscosimeter was used. This is a conical container, of 500 ccs capacity, which is provided with an orifice. The container was filled with the mud fluid whilst the orifice was held closed with a finger. A stop watch was used to determine the time in seconds which the mud fluid took to run out of the funnel. Various factors gave rise to inaccuracies when this method was used. Thus heavier fluids ran out more rapidly than lighter fluids, and quickly flowing fluids were associated with relatively large timing errors; furthermore a relatively long time was necessary to measure the viscosity of very viscous fluids and this made it difficult to maintain the temperature constant. It may also be mentioned that, depending on the shape of the containers and the length of the orifices used, differences of up to 300 % could arise.

An attempt was then made to determine the viscosity with the Stormer-Viscosimeter. The following is said in connection with this appliance on p. 374 of «Subsurface geologic methods» (Le Roy and M. Crain, Golden, Colorado, 1949): «The Stormer Viscosimeter makes quite accurate determinations of both visc. gel strength, but its expense and its need for careful maintenance are disadvantages preventing its common use in the field.»

In the same article the following comment is made about another viscosimeter, the socalled «Shearometer»: «However, most operators find it unsuitable for use with the muds they employ as either extremely high or extremely low gel strength are commonly encountered. They find that the common «Shearometer» tube either sinks to its full length or does not sink at all, a reading being impossible in either case, whereas a tube light enough to give a reading by low-gel-strength mud is too fragile for general utility.»

These instruments did not give satisfactory results. They could only be used for spot checks and not for continuous control purposes; they were thus quite unable to control the compositional uniformity of the mud fluid.

Swiss engineers have recently managed to design a torsion viscosimeter which can be used not only for spot checks but also for continuous viscosity measurements under operating conditions. The viscosity may also be registered continuously with this instrument and it can be regulated continuously as well. This opens up new prospects as regards the supervision and control of the consistency of the mud fluid in oil drilling installations.

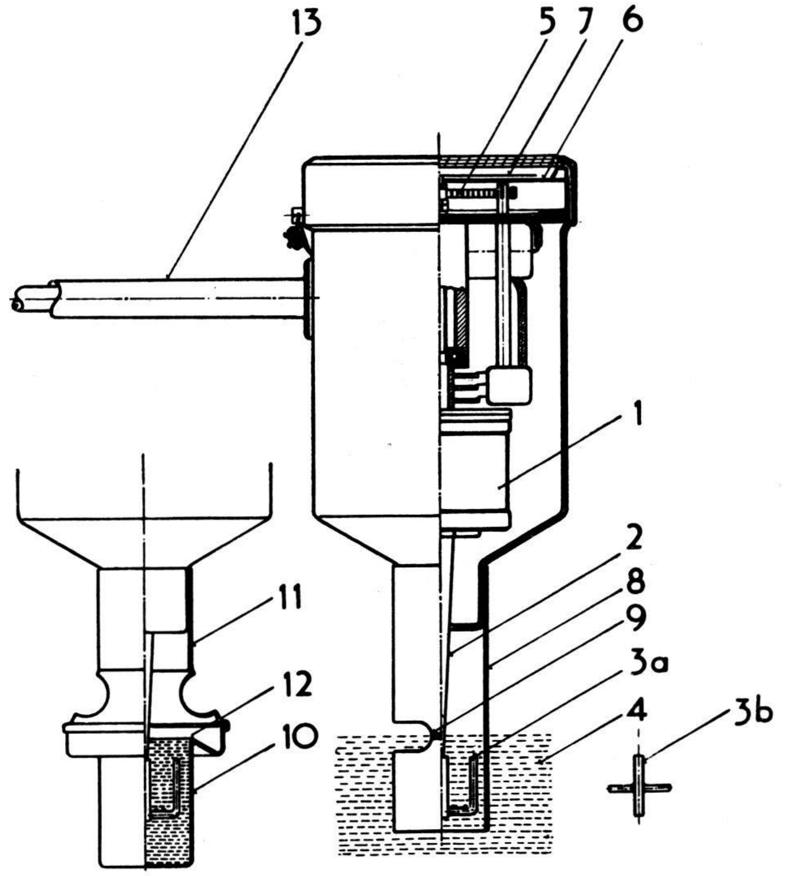


Fig. 1. DRAGE Torsion-Viscosimeter

The design of such a torsion viscosimeter is based on an extremely simple principle (Fig. 1). A synchronous motor (1) drives a measuring element (3a and 3b) which is immersed in the substance under investigation. Depending on the viscosity (in the case of homogeneous media) or on the consistency (in the case of inhomogeneous substances) a larger or smaller turning moment results and this twists the stator of the synchronous motor through a corresponding angle out of its rest position. The stator is mounted in an accurate ball bearing and in twisting it compresses a precision spring (5); this causes the instrument pointer (7) to deflect on the scale (6). The turning moment is a linear function of the viscosity. Since a change of viscosity results in an instantaneous change of turning moment the measurements with this viscosimeter give instantaneous readings. Well known methods may be employed for recording the pointer deflection, for indicating it elsewhere or for using it for control purposes.

This apparatus makes it possible to maintain the consistency of the mud fluid automatically at the predetermined correct value or to control it between two adjustable limits by mechanical means.

Sliding contacts are connected to associated relays in the switch box. Depending on which of the three contacts is actuated the following circuits result. If the viscosity, or as in this case, the consistency, is too high, then water or an oil mixture is fed to the dosing apparatus and this causes the consistency to decrease. If on the other hand, for some reasons or other, the consistency of the medium decreases below the proper value as adjusted on the minimum contact, then another contact is closed and another relay actuated; this closes the switch con-

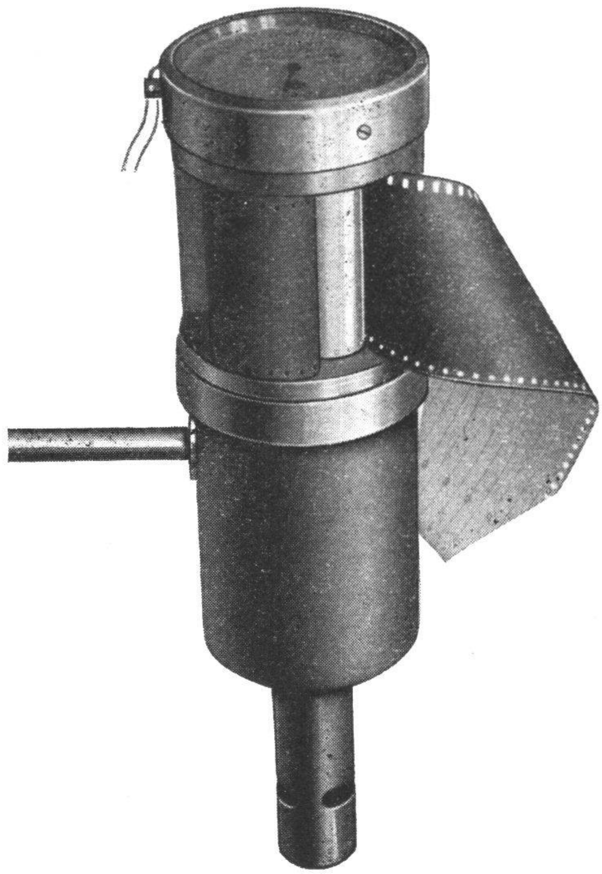

Fig. 2 Direct recording instrument

trolling the supply of pulverised barite or chemical substances, and these are then added until the consistency again attains the nominal value. If the oil engineer thinks he is above an oilsand he can dose the desired increase of fluid consistency very accurately by means of this instrument.

Almost more important is the recording instrument which notes the fluid consistency on the outflowing side. This can change suddenly if water, gas or oil flows out of the well being drilled and any such change is indicated immediately by the instrument. By means of a thermometer attached to the instrument, the temperature of the circulating fluid can be read and simultaneously recorded. Two types of recording instruments have been developed:

1. The direct recording instrument (Fig. 2). This plots the value of the consistency at optional time intervals adjustable between 15 seconds and 15 minutes; the individual readings are recorded.
2. The remote indicating instrument which can be installed in any appropriate position. It can be connected to an alarm system in order to notity the derrik staff of notable changes of consistency without delay. If multiple recorders are used the possibility exists of recording not only the consistency, but also the temperature, the pressure and the pH or other values all on the same roll of paper.

By means of this instrument the consistency of the ingoing fluid may be held constant and notable changes of consistency due to gas, oil or water flowing out with the outcoming fluid may be detected immediately.

---

Manuscript received July 2nd 1951.