

Floyd Farris, senior in the college of Engineering, has completed several interesting research problems in connection with classes at the University. The results of one of his projects are outlined on this page.

# Acid Treatment in Limestone

By FLOYD FARRIS, '35

**T**HE present process of acidizing oil wells producing from lime horizons, is the outgrowth of experiments performed by Dowell Chemical company, Michigan, on some brine wells which produced from lime formations. It was found that by treating the brine wells with acid a marked increase in production would result.

During these experiments on brine producing formations, neighboring oil-well owners became interested, and as a result of the combined efforts of the Dowell Chemical company and the Pure Oil company, oil production was likewise increased. The patents relating to the process taken out by both companies were assigned to Dowell, Inc.

The patent relating to acid treatment calls for a mineral acid, preferably hydrochloric, the strength of which should be between ten and fifteen per cent, to which is added a small amount of a substance capable of inhibiting attack of the acid upon the metal surfaces with which it is in contact. As an inhibiting agent, arsenic compound soluble in the acid solution is preferable.

In 1933 the writer experimented with acid on various lime samples, in the petroleum engineering laboratory, the object of which was to determine the per cent concentration of hydrochloric acid which would produce the maximum removal of carbonates, which in turn yields the maximum increased production per quantity of acid.

A series of experiments were performed on a given lime sample, keeping all related variables constant and varying the per cent concentration of hydrochloric acid and finding the amount of carbonates removed by each per cent. Related variables are temperature, pressure, quantity of acid, quantity of sample, and size of sample.

A curve was plotted of the results using grams of carbonates removed as ordinate and per cent concentration of acid as abscissa. The per cent of hydrochloric acid was varied from one to twenty-four per cent. The quantity of carbonates removed increased steadily up to nine per cent,

where the values decreased to end of test, twenty-four per cent. Thus the resulting curve showed that the concentration for the highest efficiency was nine per cent, and that an eighteen per cent solution of acid was less efficient than a six per cent solution on the same sample.

Dilute hydrochloric acid when placed in a well producing from a lime formation does one and only one thing, i.e., reacts with the carbonates, principally calcium carbonate, to give calcium chloride, water and carbon dioxide. If an increased production is noted, then it is caused directly as a result of this action. Therefore, it is very important that the correct per cent concentration of acid be used both from the standpoint of maximum increased production and economy.

In the treatment of a well, the engineer in charge will make a complete survey of the well conditions before anything is done. Diagnosis consists of: Fully recording the well log from casing point of oil string to total depth, casing record, production record, shooting record, salt water source, and analyze core from formation that is to be treated. On the basis of the diagnosis, the type of treatment to be used is selected and recommendations made on basis of same.

The mechanics of the treatment consist of filling the casing with oil and pumping in the proper amount of acid at the recommended per cent concentration through the tubing. This solution is followed with an amount of oil sufficient to force the fluid out of the tubing and into the hole and out into the drainage system. The well is then closed in and allowed to stand for a period of time not less than 48 hours. During the period the well is closed in pressures have been known to reach as much as 2000 pounds per square inch, but in the majority of cases a vacuum will prevail throughout the greater portion of this period due to the static head built up.

The process of treating oil wells with hydrochloric acid may or may not be of value for wells in a given lime horizon, but in many cases this may be predetermined to treatment and proper recom-



mendations made. It is likely that improper treatment is the greatest reason for no results with wells which have been recommended for treatment.

Although all things point toward the increasing importance of acid treatment, it has an undetermined value as an aid to recovery and production of petroleum from limestone horizons.



## Crowe Report To Be Published

A survey of juvenile delinquency in Oklahoma City, conducted by Hugh Price Crowe, University graduate student, Tahlequah, for the Oklahoma City Rotary club will be published in the near future.

Crowe addressed members of the Rotary club recently and presented the results of his research in juvenile delinquency. The Rotarians will concern themselves with assisting delinquents and preventing other children from becoming delinquent.

Crowe's survey shows that delinquency among young girls in Oklahoma City was below the national level due to civic activities in that direction. Figures he collected showed, however, that thirty per cent of the youths who appeared before probation courts were "repeaters." He declared that this was a high percentage.



## Mrs. Muldrow Heads Teachers

Mrs. Edna Muldrow, '18as, '27M.A., of Norman, was elected president of the State Council of English Teachers at the annual Oklahoma Education association convention during February in Tulsa. Mrs. Muldrow, who has been interested in creative writing, is an English teacher at the Norman high school.