

M. Wiley

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF MINES
COAL TO OIL DEMONSTRATION BRANCH
LOUISIANA, MISSOURI

1593

TCM Reel #27, Frames 32..169 - 32..170
Frames 33..171 - 33..173

P-454

W. M. Sternberg
May 3, 1948

TWO PAPERS ON THE OIL CIRCULATION SYNTHESIS PROCESS

1. Oppau, January 5, 1942, Frames 32..169 - 32..170

The oil circulation process makes use of an iron catalyst of the kind used in ammonia synthesis, and the oil produced in the process is recirculated over the fixed bed catalyst. The process differs from processes with indirect heat removal in that the catalyst is not distributed in thin layers and it permits the use of reaction towers without any insets. This process will supposedly lead towards the development of the largest synthesis units, which will offer advantages from the standpoint of construction.

Water gas with $\text{CO}:\text{H}_2 = 1:0.7-0.55$ is used at 25 atm pressure. No CO conversion will be necessary when the synthesis is combined with the large capacity gas producers (e.g. the Winkler gas producer). With a 90% conversion in two stages, a space/time yield of 0.72 kg total product/li of catalyst/day, one cbm $\text{CO} + \text{H}_2$ will produce 150 gm total products of which

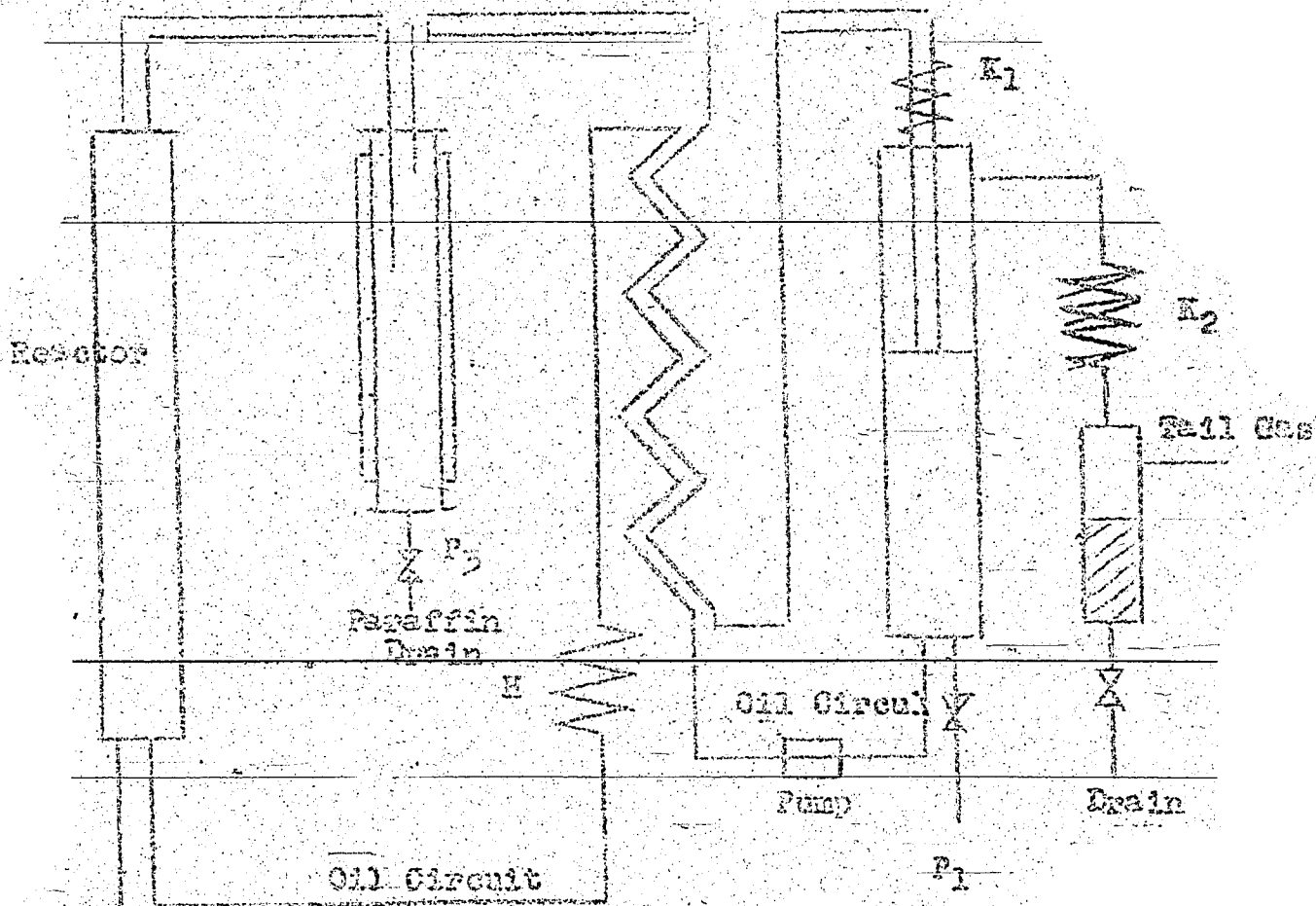
40% arc primary gasoline (octane number = 65)	} around 50% olefins
20% gas oil (octane number = 85)	
20% paraffin wax (m.p. 95°)	
15% gasol (80% olefins)	
<hr/>	
5% alcohols (C ₁ -C ₅)	

The "synol" installation will produce 5,000 te/yr of paraffin and liquid products with the utilization of off-gases (butyl pressure release installation + carbon monoxide in the off-gas) and furnishes the data for the future large scale installations.

Experiments on the production of higher alcohols by the same process (synol method) are in progress and have not yet been concluded.

Signed - DeFischmip

SKETCH OF THE OIL CIRCULATION-SYNTHESIS PROCESS



Make up gas.
 $CO:N_2 = 55:45$

II. December 1942 Frames 33.171 - 33.173

In connection with some former communications on the difficulties of procurement of cobalt we wish to inform you as follows:

We already have previously pointed out the importance of the conversion of the existing installation with the cobalt catalysts to the more accessible, more readily procurable iron catalysts, with their reactivation properties.

In our opinion your suggestion for direct replacement of the cobalt catalysts with the available iron catalysts will be impossible because all the known iron catalysts operate at a higher reaction temperature of 230 - 240°C, while the cobalt catalysts operate at 180 - 190°C. This would require an operating pressure of at least 30 atm on the vapor side in the Fischer equipment; according to our information the Fischer units cannot be used at such a pressure on their vapor side, and the maximum permissible pressure corresponds to the reaction temperature of 220°C maximum and the corresponding steam pressure.

We see, however, possibilities of converting the Fischer installation without too great changes and additions to our oil circulation process. Such a conversion, subject to exhaustive tests, would be possible for middle

pressure installation with a permissible operating pressure of 14.5 atm in the following way:

The gas production (water gas waste) would remain unchanged. The conversion of part of the gas stream would be unnecessary, and the required equipment would not be put to use. This would set aside also the CO_2 scrubbers used in the conversion, and they will be included in a different part of the oil circulation process. The synthetic oil production would be changed over and in the following way, based on our calculations on units for production of 100,000 to/yr units.

For 100,000 to/yr Fischer waste in the gas stage some 120 reactors (2.5 m diameter, 5 m high, 2,116 double tube insets). We expect to require less than half of the reactors, and about 60 reactors will have to be changed by removing the double tube insets and using the reactors without any insets as our reactor vessels. The double tubes made available may be sufficient to be installed in the oil circuit possibly as a heat exchanger in the oil circuit. It is probable, however, that in this case the idle reactors themselves could be used as heat exchangers in the oil circuit, leaving the tubular insets.

The coolers behind each stage could be used as catchpots and practically only the circulation pumps would have to be added. The oil scrubbers can again be

taken over, and in this place the CO₂ scrubbers, made
idle through the omission of the gas conversion, could
be installed.

We may mention that the available catalyst plants
cannot be used, but the production of the catalysts is
exceedingly simple and can be installed at no great
expense, by using only one single oxygen melt as in the
catalyst production for the ammonia synthesis. The
concentration is done very simply by reacting in the
air.

The paraffin oils, compared to the synthetic products
which are obtained with iron, they are generally of
a stronger olefinic nature than when obtained with the
cobalt catalysts. This applies as well to the products
obtained by our process. It might therefore be desirable
to hydrogenate the paraffin fraction with the required
length of the chain for the paraffin oxidation which
forms 10 - 12% of the total weight of the product
and the production of the soap fatty acids, leaving
about 10 - 15% hard paraffin wax for the production of
detergents and for similar purposes.

Naturally this conversion plan still requires an
extensive engineering study.

The point which at present we can discuss with the
least assurance is the use of the large reactor cross
section of 2.5 meters, because our present reactor units

(1.5 cbm reactors in the first reaction stage and 0.2 cbm reactors in the second stage) furnish us no information on the uniformity of the distribution of gases over the whole cross section, nor have we sufficient industrial experience on the second stage, and which we hope to obtain in the contemplated experimental unit. A pressure of 18 atm as used in the Fischer installation should be possible without added difficulties, compared to our intended pressure of 25 atm.

We suggest repeating the present suggestions to permit our having the necessary experience in case of the urgent need, which we can already anticipate.

(Some patents and patent applications on the process are added but unfortunately the figures cannot be read with any certainty in the original).