B. Operation at 7 MCFH Fresh Feed Rate

The linear increase in yield with decreased space velocity was not continued during periods BB and CC when the fresh feed rate was reduced from 10 MCFH to 7 MCFH - an amount corresponding to the use of four reactors at Brownsville. The data for these periods are compared with the results obtained in adjacent periods in the opposite Table II.

These data show that the reduction in fresh feed rate from 10.4 to 7.2 MCFH did result in an increase in conversion but that there was a corresponding loss in selectivity which offset the gain. The relation of conversion to space velocity is shown in the following Figure 3, while the relation between conversion and selectivity is plotted in Figure 4, page 10. This latter figure shows that the upward trend of selectivity with conversion which had been established by Runs 46, 48, and 49 was interrupted in Run 51 and that there was a further loss in selectivity in Periods BB and CC.

It will be recalled that Runs 46, 48, and 49 were all made with linear inlet velocities of 1 ft./sec. or higher, increased conversion being obtained by increasing the bed depth. Run 51 was made with the same bed depth as Run 49, conversion being increased by reducing the fresh feed rate from 15 MCFH to 10 MCFH. Figure 4 indicates that this decrease in fresh feed rate, and the corresponding decrease in inlet velocity from 1.0 to 0.65 ft./sec. resulted in a loss of about 2 per cent in selectivity. The further reduction in inlet velocity to 0.47 ft./sec. in periods BB and CC resulted in a further loss of about 5 per cent in selectivity.

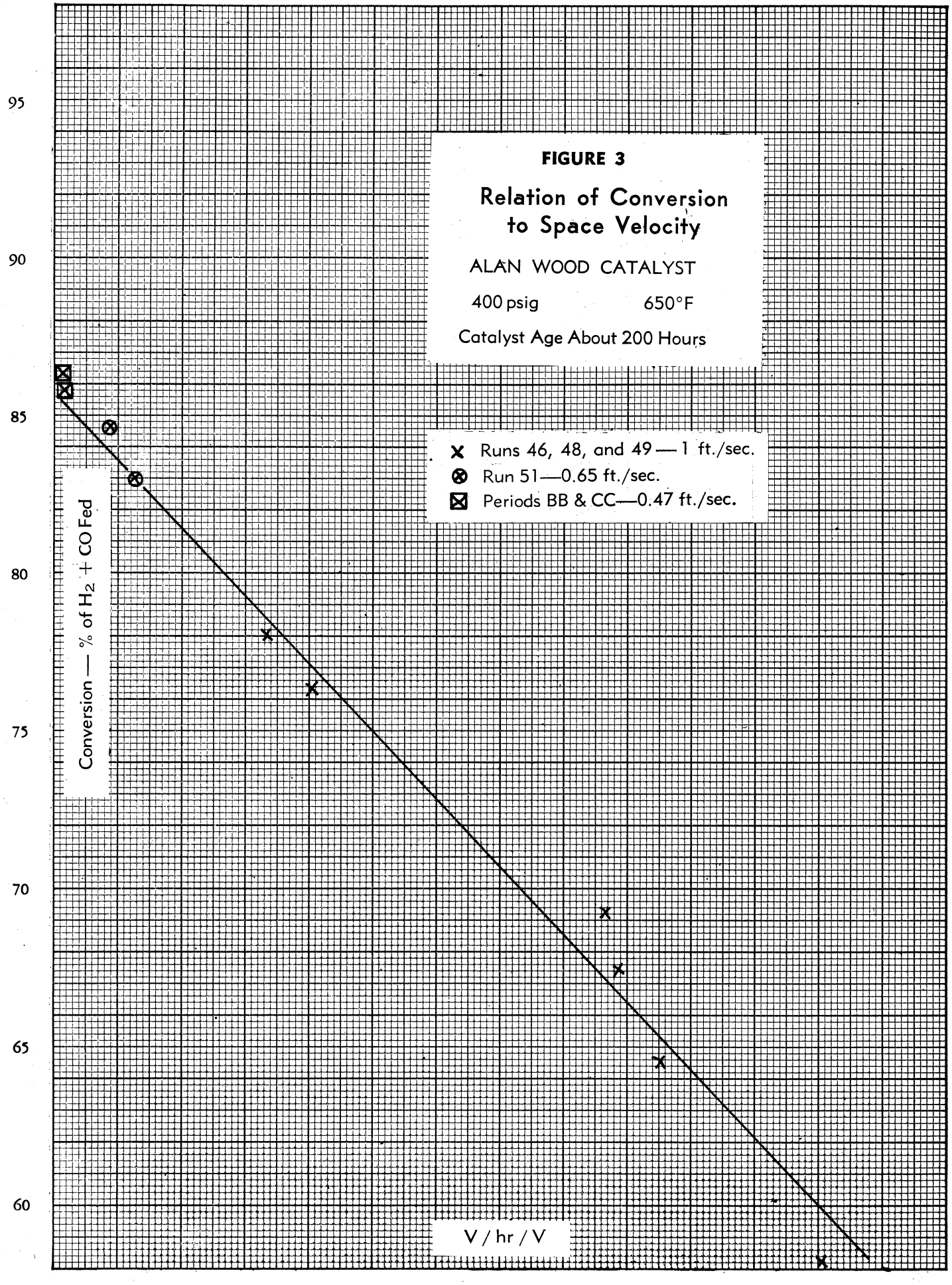


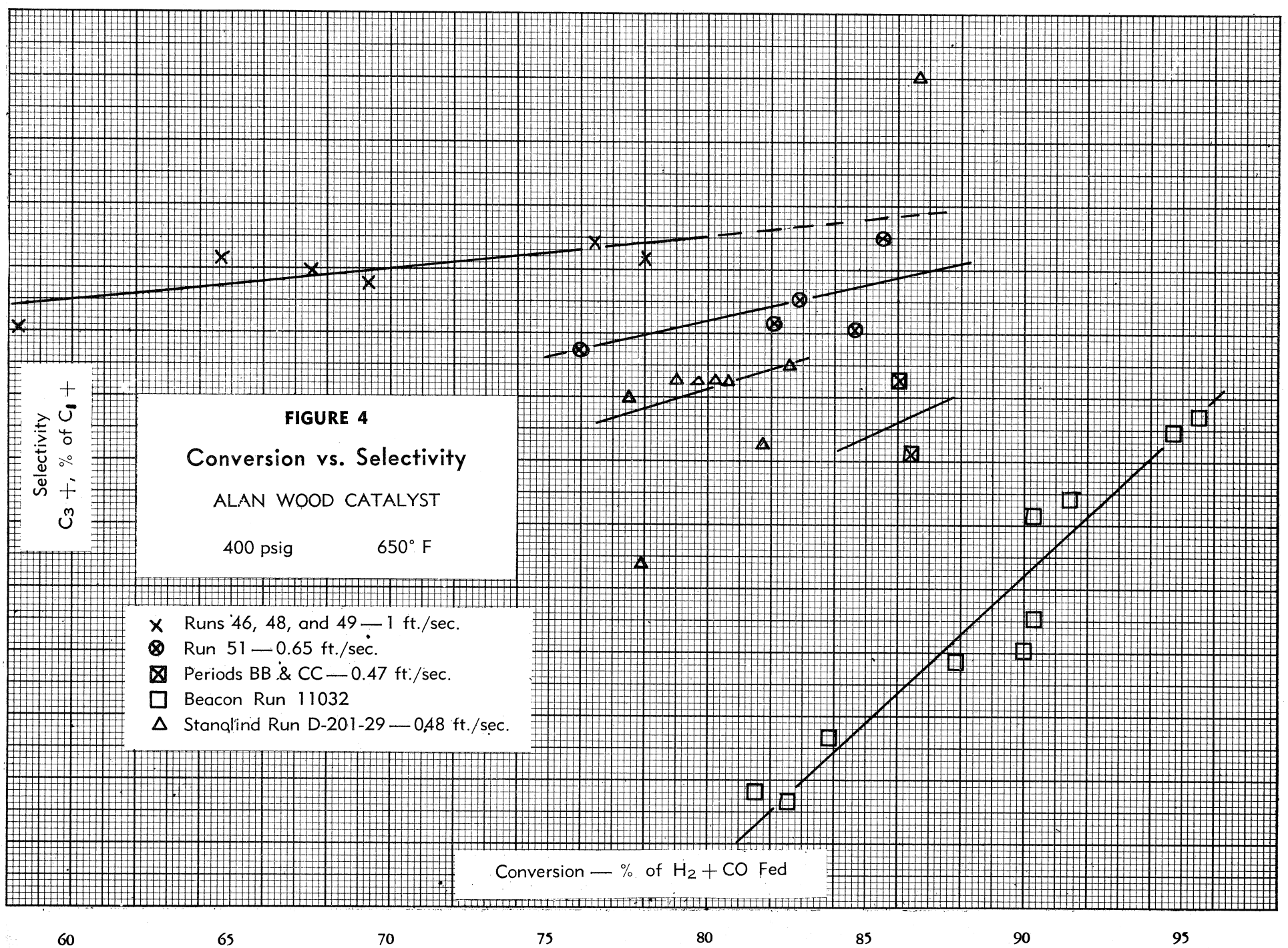
FIGURE 3

Relation of Conversion to Space Velocity

ALAN WOOD CATALYST

400 psig 650°F

Catalyst Age About 200 Hours


90
85
80
75
70
65
Selectivity
C_3+, % of C_1+
60
65
70
75
80
85
90
95
Conversion — % of $H_2 + CO$ Fed
FIGURE 4
Conversion vs. Selectivity
ALAN WOOD CATALYST
400 psig
650° F
Runs 46, 48, and 49 — 1 ft./sec.
Run 51 — 0.65 ft./sec.
Periods BB & CC — 0.47 ft./sec.
Beacon Run 11032
Stanolind Run D-201-29 — 0.48 ft./sec.

This decrease in selectivity with decreased inlet velocity is believed to reflect an increase in contact time due to less active agitation of the bed. This system behaves as though the reactions which produce C_1 and C_2 hydrocarbons are slower than the reactions which produce liquids, so that prolonged contact time results in higher, but less selective conversion. This type of behavior is shown even more clearly by the small baffled reactors at Beacon where even lower selectivities are encountered.

Data from the Stanolind operation of Run D-201-29 are also shown in Figure 4. This run was made with an inlet velocity of 0.48 ft./sec., the same as that used in periods 51BB and 51DD, but with twice the space velocity. The selectivity is intermediate, between the 0.65 and 0.47 ft./sec. Montebello data. The Stanolind catalyst was much more finely ground than that used at Montebello and this may permit operation at somewhat lower inlet velocity.

Summarizing the above, pilot plant data indicate that selectivity increases with conversion when conversion is increased by increasing bed depth at constant inlet velocity. When conversion is increased at constant bed depth by decreasing feed rate and inlet velocity, selectivity decreases. These effects are thought to result from competition between a rapid oil-forming reaction and a slower reaction which produces gaseous hydrocarbons. The Beacon laboratory reactor operates at high inlet velocity but uses a very finely divided catalyst and a baffled capillary tube - a combination which results in excessively smooth fluidization, excessive contact time, and very low selectivities.