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as it was not then known that these were nonoily liquids of low viscosity and that butforane boiled below room temperature.

Ethforane was first obtained from the uncatalyzed reaction between fluorine and carbon (17). This substance was obtained by the electrolysis of acetforic acid in aqueous solution (26) and also by the passage of methforane and difluorochloromethane through an electric arc (15, 27). Ethforene was also first obtained in this manner.

The Catalyzed Reaction between Fluorine and Carbon

A fortunate accident enabled the reaction between fluorine and carbon to be conducted without explosions at a temperature sufficiently low so that a mixture of liquid fluorocarbons was obtained (21). This enabled the isolation of propforane, butforane, pentforane, and hexforane. The quantities obtained from the first set of experiments were insufficient for precise determination of physical properties. It was found that mercury was a good catalyst for the reaction and enabled it to proceed smoothly without explosions and with the formation of significant proportions of fluorocarbons boiling higher than methforane. The first use of the catalyst occurred when an amalgamated copper tube was inadvertently used for the reaction. It was later found that a small amount of any mercury compound added to the carbon served as catalyst (22). The products of the reaction on separation showed 54.5% methforane, 12.6% ethforane, 8.2% propforane, two butforane fractions of 5.3 and 1.3%, 5.5% cyclic C_5F_{10}, 4.4% cyclic C_6F_{12}, 1.3% C_7F_{14}, 5.5% of a mixture boiling 25° to 95°, and 1.5% of a mixture boiling 95° to 160°.

The original isolation and identification of stable fluorocarbons containing four and more carbon atoms per molecule immediately strongly indicated that an entire new field of chemistry would eventually result as further studies were made. This was expressed in the original publication as follows:

> "The substances are colorless and either odorless or very nearly so. They are very stable chemically. Many of the tubes containing these were sealed off while an appreciable pressure of the vapor existed inside. No trace of etching or carbonization could be observed in the Pyrex glass seal, which must have been at least 700°. The different fractions were tested for unsaturation with bromine in carbon tetrachloride solution, and no decolorization could be observed.
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> The formation of stable compounds of carbon and fluorine containing more than three carbon atoms per molecule indicates the possibility of the synthesis of a large number of similar compounds provided that methods can be discovered. Such compounds should be of considerable interest both theoretically and as useful substances.
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> To indicate the relatively low attractive force between the molecules of these compounds, a graph is shown in the figure. The molecular weight is plotted against the boiling point. On the same graph are represented the inert gases, the hydrocar-