

## The Effect of Perforated Tipping Paper on the Yield of Various Smoke Components\*

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### INTRODUCTION

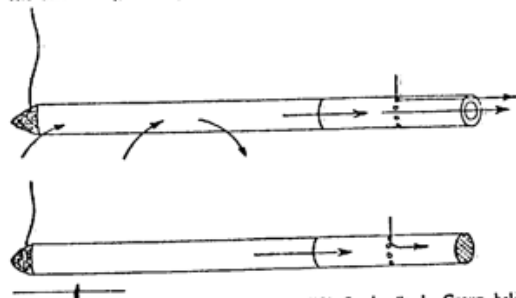
There have been numerous publications dealing with ventilation through porous cigarette paper during the smoking of a cigarette (3, 4, 6, 7, 9, 10, 11, 14, 17). The current presentation is not concerned with cigarette paper but deals with the effect that perforations in the tipping have on the composition of smoke. The idea of tipping perforation is rather old and there is a British patent issued in the neighborhood of 1890 that covers this principle. Nevertheless, there have been very few publications that deal with the investigation of this system. Morie and Sloan (13) and Mikami, Naito and Kaburaki (12) have briefly reported the effect of filter perforations on carbon monoxide and carbon dioxide yields. Kiefer (5) and Roper (16) have compared the effect of filter perforations on the relative yields of carbon monoxide, nicotine-free-dry-smoke and nicotine.

A perforated filter is a somewhat simpler system than porous or perforated paper since, unlike cigarette paper which burns up during smoking, the tipping perforations stay intact throughout the life of the cigarette.

### EXPERIMENTAL AND APPARATUS

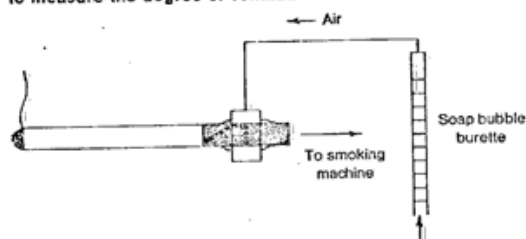
The two ventilation systems used in the experiments are depicted in Figure 1. One system consisted of an empty mouthpiece tube and an impervious peripheral insert positioned such that all

Figure 1. Two ventilation systems used in the study. The arrows depict the principal gas flow patterns.



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Figure 2. Schematic representation of the device used to measure the degree of ventilation.



the diluting air stream enters through the periphery whereas the smoke stream comes in predominantly through the central passage. This system eliminates filtration complications and provides more information about what happens in the cigarette cone when the air flow through the cigarette is varied.

The second model was equipped with a cellulose acetate filter with the air stream entering directly into the filter tow. This system reflects the additional complicating influence of varying filtration efficiency which would be mainly due to different smoke volume flow rates through the filter.

In the test cigarettes the tobacco column, paper, filter, etc. were kept constant and only the draw resistance of the ventilating passages was varied by varying the number of perforations.

Figure 2 shows the device that was used to measure the degree of ventilation. Basically, the volume of air that was pulled into the cigarette through the perforations during smoking was measured directly with a bubble

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Figure 3. A typical puff-by-puff course of ventilation volume during the smoking of a cigarette.

