between a voiced and a voiceless sound have been touched upon; where there is friction noise, its intensity tends to be less in the case of the voiced sound, since some of the energy is being used up by the larynx tone generator.

The English fricative consonants

In order to illustrate typical patterns for the fricatives we shall use examples containing the voiceless member of each pair of sounds, placed in intervocalic position so that the beginning and end of the consonant sound may be seen. Fig. 48 gives spectrograms for five sounds in these conditions: [ʃ], [s], [f], [θ]and [h]. The first four illustrate a progressive narrowing of the noise band passed by the vocal tract filter. In [ʃ] the noise energy begins quite low in the frequency scale, at about 1800–2000 Hz and extends upwards for a considerable distance, to 6000 Hz and beyond. In [s] the filter suppresses most of the noise energy below about 4000 Hz but the band extends upwards to 8000 Hz. Both [f] and [θ] have the main noise energy in the high-frequency band from about 6000 to 8000 Hz.

The [h] sound has a different character from the other fricatives because the noise generator in this case is at the level of the larynx and the sound is more in the nature of a whispered vowel; although it consists of noise, it has marked formant bars which correspond very closely in frequency with the formants of the following vowel sound.

The English plosive consonants

The occurrence of a plosive consonant is marked by a short silence or near-silence followed by a short burst of noise if the stop is released. The duration of these component parts of the sound depends very much upon the tempo of the utterance; the silence is likely to last something between 70 and 140 ms, being shorter in the voiced sounds than in the voiceless. The burst of noise is of very short duration in contexts where the sound has little or no aspiration; here it may last no more than about 10 or 15 ms; where there is marked aspiration, it may be of the order of 50 ms. During the burst the noise energy is spread rather widely over the spectrum but peaks of energy tend to occur at different frequency regions according to the place of articulation of the consonant. In the bi-labial sounds, [p] and [b], the maximum is generally in the low frequencies, at about 600–800 Hz; for the velar sounds it is in the region of 1800–2000 Hz and for the alveolars, in the higher frequencies at about

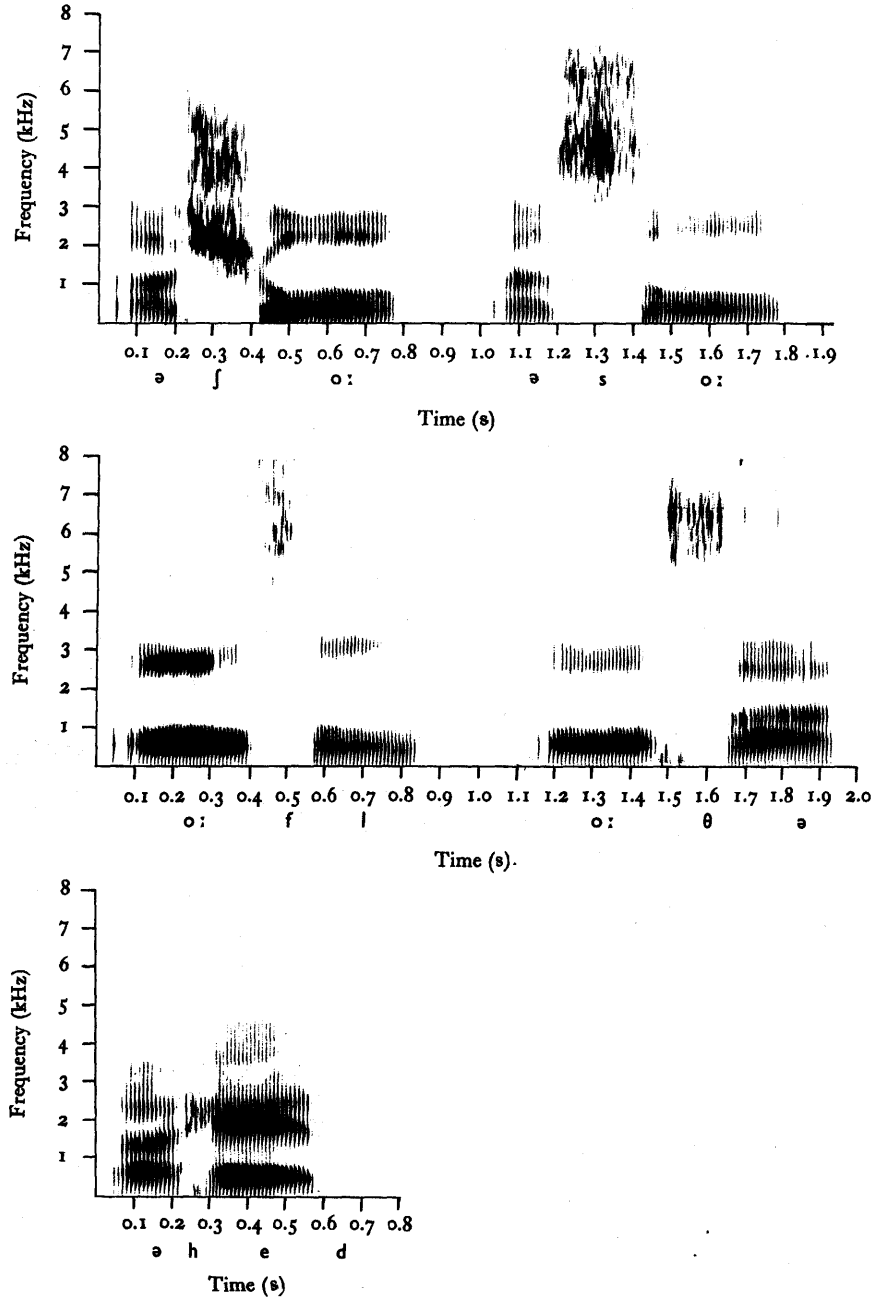

Fig. 48. Spectrograms of English voiceless fricatives, intervocalic.