shapes, and for the time plays the part of a resonator. Suppose then that the vocal chords produce a certain note. This in reality consists of a fundamental and several harmonics. When the mouth is formed to pronounce the vowels in succession, the cavity becomes a resonator which reinforces different harmonics. All the vowels can in fact be pronounced on the same fundamental, and, in order to pass from one to another it is not necessary, therefore, to change the vibration of the vocal chords—it is sufficient to modify the form of the mouth and so add to the effect of certain harmonics. Different harmonics are thus found to be characteristic of different vowels. As the vowels are pronounced differently in different languages and dialects, it is, of course, necessary, in determining these characteristic tones, to employ a fixed mode of pronunciation. For the German language this determination has been effected with great precision by Helmholtz, Kœnig and others. Tuning forks, giving these characteristic tones, with the accompanying resonators, are made by Kœnig, of Paris. These forks may be set in sympathetic vibration by the voice when pronouncing the corresponding vowel, or the vibrating fork may be used to set in vibration the air in the mouth when merely formed to pronounce the vowel.

One more illustration of the use of tuning forks, and I have done. For the purpose of tuning (the piano, for instance,) either one fork may be used, or thirteen. In the former case the tuner having tuned a certain note in unison with his standard fork, depends on his ear for tuning the remaining notes. This he does by carefully adjusting the intervals of octaves and fifths, fourths and thirds being also employed by some tuners. In the other case, he simply brings the thirteen notes of one part of the scale into unison with the forks, and then tunes the remainder by octaves. Now neither of these methods is to be depended on if we wish to attain to extreme accuracy, the source of error lying in the fact that the ear is only capable of deciding within certain limits between two notes lying very near to each other. If one fork, for example, performs 60 vibrations per second and another 61, the difference in the tones may be detected by the ear, but not so if the vibration-numbers are say 200 and 201. By taking account, however, of the phenomenon of the beats which are heard when two notes very near to one another are sounding, we can tune with extreme accuracy. The beats are easily recognized by a rising and falling in intensity, and their number per second is equal to the difference between the vibration-numbers of the two notes. Thus, if one fork vibrates 256 times per second and another 260, they will, when sounding together, produce four beats per second. If, therefore, we wish to make an exact copy of the former, it is only necessary to make a fork which shall produce four beats per second when sounding with the latter. So, also, if we wish to tune a piano very accurately, instead of employing the thirteen forks of a scale of equal temperament, we should employ forks which give each four vibrations less. With such a set a note at this part of the scale will only be correct if it gives four beats per second when sounding with the corresponding fork. This adjustment can be effected with the aid of a metronome with the utmost accuracy, and the remaining notes are then tuned by octaves.

I might continue to describe many other uses of the tuning fork, some of which would possess still greater interest for you; but I trust that the illustrations already adduced are sufficient to indicate that this plain and