l'abaissement du quart de ton qui a été fixé par la commission. Je voulais, avec quelque raison, je crois, fixer le ton du diapason à 888 vib. qui avait pour base l'*ut* de 32 pieds égal à 33 vib. par seconde, le *la* géometrique = à 880, et le *la* tempéré 888, ainsi que je l'ai expliqué dans la petite brochure, 'De la Détermination du Ton Normal ou du Diapason pour l'Accord des Instruments de Musique,'" published originally in *L'Ami de la Religion*, February 6, 1859, before the normal La was fixed. At the close of this paper M. Cavaillé-Coll says, in favour of 888 v. s., besides his present remarks, "Ce nombre, qui se trouve de 8 vibrations plus élévé que le *la* normal du congrès de Stuttgard et de 8 vibrations plus bas que le diapason de l'Opéra de Paris [en 1857] aurait, suivant nous, le mérité, s'il était adopté, de concilier les exigences de la science physique et les besoins de l'art musical." The peculiarity that C 264 gives a just A $440 = \frac{5}{3} \times 264$, and a tempered A 444, has been productive of some confusion. The committee called together by the Society of Arts in 1859 recommended the Stuttgart pitch A 440, which they considered would give C 528, whereas on equal temperament it would give C $523\frac{1}{4}$. But they made C 528 their standard, which would give the tempered A 444, and the Society of Arts commissioned the late Mr. J. H. Griesbach to make them such a fork, for which he employed the instrument now in room Q of the South Kensington Museum, and to this he endeavoured to make an equally tempered A. His results in place of C 528, A 444, were, when reduced from Appunn's to Scheibler's standard, C 535 and A 446, which do not even agree with each other, for his C requires an A 450, and his A requires a C 530, both being rather sharper than was intended. In the organ of the cathedral of St. Denis M. Cavaillé-Coll measured the pitch as A 444·25, by means of the siren, but before the application of his bellows of precision. The Bolognese fork, already mentioned as being nearly A 444, was also measured at Bologna by the siren, but the result is not stated in the report preserved by the Society of Arts.

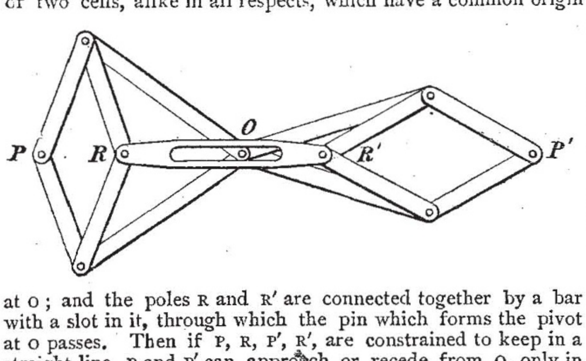
As regards the introduction of equal temperament into France, M. Cavaillé-Coll informs me that up to 1834 their house tuned on the old mean-tone principle, but that subsequently to 1834 he has consistently laboured to carry out the equal temperament. He thinks, however, that equal temperament was used for pianos before that date. I may mention that the change was made at Broadwood's, in London, between 1841 and 1846. That at the first Great Exhibition of 1851 in London, only one organ (by Schulze) used equal temperament, and that at least three organs had not adopted it a year ago (St. George's, Windsor, Turvey Abbey, and Norwich Cathedral).

Kensington, W., July 13 ALEXANDER J. ELLIS

Peaucellier Cell

THE following application of the Peaucellier Cell may possibly interest some of your readers. The object of this arrangement is to make two points—one on each side of a lens—move in such a way as always to remain at conjugate foci.

In the accompanying wood-cut P, R, and P′, R′, are the poles of two cells, alike in all respects, which have a common origin



at O; and the poles R and R′ are connected together by a bar with a slot in it, through which the pin which forms the pivot at O passes. Then if P, R, P′, R′, are constrained to keep in a straight line, P and P′ can approach or recede from O, only in such a way that, if there is a lens of proper focal length at O, P and P′ will always be conjugate foci.

This is easily proved thus:—

Suppose $PO = p$, $P'O = r'$,
$RO = r$, $R'O = p'$,

and the bar $RR' = l$.

From the property of the cell,

$$r = \frac{k}{p} \quad r' = \frac{k}{p'}, \text{ where } k \text{ is a constant,}$$

$$l = r + r' = k\left(\frac{1}{p} + \frac{1}{p'}\right)$$

$$\frac{1}{p} + \frac{1}{p'} = \frac{l}{k}.$$

Hence, if $\frac{k}{l}$ is the focal length of the lens, P and P′ are conjugate foci.

Mr. Francis Galton wanted to use the above arrangement, but found he could not get sufficient range unless the cells were made of unwieldy size. HORACE DARWIN

The Microphone

IN reproducing the experiments first made by Prof. Hughes with the microphone, I interposed in the circuit a galvanometer, and first found with the battery used (made with three small glass cones, as used by Prof. Hughes), when the microphone was not in the circuit, the current was sufficiently strong to deflect the needle to 40°. Now interposing the microphone, made of mercurised carbon peas in a small glass tube, it acted well as a transmitter only when the pressure on the carbon peas was so adjusted that the needle of the galvanometer stood about 15°.

When the pressure was very slight and the resistance to the current so great that the needle swung only to 5° or 8°, then the "continuous distant waterfall roar" of the telephone was plainly audible. The slightest sound of the voice in the room would produce the painful *pat, pat*, indicating an intermittent current and not a continuous one of varying intensity.

This "distant waterfall roar" emitted by the telephone, not unlike the "murmur of the sea-shell," was in all respects similar to the sound familiar to those who have attempted to use a telephone whose line was greatly affected by the induced currents of a number of proximate telegraph lines in active use. When the pressure of the carbon peas was so slight and consequent resistance great, the vibrations of the air in the room, when most quiet, so increased and diminished the resistance to the electric current as to cause the incessant tremor of the tympanic plate of the telephone, and thus rendered audible the constant murmur.

Among many other methods I tried a torsion pendulum, made by suspending, with a small cotton cord, a double cone of mercurised carbon an inch long, between two pieces of carbon less than an inch apart, to which the connecting wires were attached. The pressure was regulated by the torsion of the cord. In this simple manner any required delicacy was easily attainable.

Vanderbilt University, Nashville, Tenn., July 1 WM. LEROY BROUN

OF the many ingenious forms the microphone has taken—and I believe I am acquainted with most of them—none is, I think, more efficacious than the one I offer for your inspection. The jarring sound in the principal instruments in use, which, by vibration, may emanate from passing vehicles, &c., is entirely obviated, and the sound of a piece of fine silken thread, or the now well-known tramp of a fly, is heard with double the distinctness of any microphone I have listened to.

It consists simply of a cup and ball of carbon, the cup being fastened to a small piece of board, and one of the insulated wires attached to it in the usual manner, while the other is carried through the bottom of the cup sufficiently far to touch the ball without disturbing it in its socket.

From this little instrument I have obtained the most satisfactory results, and have heard distinctly that which I had to strain my hearing to catch before. Unless my "idea" is already anticipated, might I ask you to make it known to your numerous readers? GERALD B. FRANCIS

23, Bessboro' Gardens, S.W., July 24

A Simpler Form of the Phoneidoscope

MOST of your readers will be familiar with Messrs. Tisley and Spiller's beautiful instrument, known as the phoneidoscope. In using it, however, I have found certain defects, which my improvement on it is intended to obviate.