a brief stroboscopic illusion was noted on the revolving fan blades. This was more clearly seen with the room lights turned off. Every stroke did not produce exactly the same illusion on the fan blades. A number of flashes caused the revolving blades to appear practically motionless; with others they seemed to revolve slowly in the direction of their original rotation. Some flashes produced no effects. During the present observations it was estimated that at least 80 per cent. of the flashes created a stroboscopic illusion upon the whirling fan blades. Noticeable flickering of the flash frequently characterized those strokes creating this illusion. No flashes were observed that caused the fan blades to appear to revolve backwards.

Recent researches upon lightning by McEachron and McMorris[1] have demonstrated that what appears to be a single stroke is often a series of flashes, spaced a fraction of a second apart. Such multiple strokes may consist of as many as 40 separate discharges, the interval between them varying from 0.0006 to 0.53 second. Their observations have indicated that about 90 per cent. of the strokes in some storms were multiple. This paper should be consulted for details impossible to cite in a short note.

These researches have clearly indicated that certain bolts of lightning are made up of a rapidly occurring series of separate flashes. A multiple stroke of lightning may, therefore, create the same type of illusion upon the revolving blades of an electric fan as do the intermittent light flashes produced by a stroboscope.

H. L. DEAN

DEPARTMENT OF BOTANY,
STATE UNIVERSITY OF IOWA

ADVANTAGES OF $F_g = kma$

THE much-debated and troublesome gravitational measure of force can be handled in only two essentially different ways. These are $F_g = kma$ and $F_g = \frac{wa}{g}$. Each has its advantages and each has its ardent advocates, so that further discussion may be a waste of time. However, I should like to point out one or two possibly new reasons which seem to me to give the weight of argument in favor of *kma*.

In this method k is a numerical constant which, in the metric system, converts dynes to grams of force (F_g). In the form $F_g = kma$, it equals approximately 1/980 and is exactly analogous to the number 12, which converts a length measured in feet to the same length measured in inches. Such a number has no dimension as the word is usually understood. It is simply the quotient of one foot divided by one inch. The result is twelve, not 12 *in/ft*. If you ask how many quarters make a dollar, the answer is four, not 4 quarters/dollar. The latter would amount to saying: "four quarters per dollar quarters make a dollar"; which is certainly redundant. Thus we may write $L_{in} = 12L_{ft}$, or $F = 980\ F_g$, where 12 and 980 are numerical ratios of the same physical quantity, and are therefore numbers having no dimensions.

The other method is based on a force-length-time system of units instead of a mass-length-time system. The force (weight) w is converted to a mass by dividing by g, and this new mass, measured in units of 980 grams, gives force in grams when multiplied by the acceleration measured as usual. The numerical labor involved is identical in both methods, so the only question is as to which makes for the least confusion. It seems to me that *kma* is the least confusing, since it does not depart from the c.g.s. system in calculating the non-c.g.s. quantity, force measured in grams. The trouble with $F_g = \frac{wa}{g}$ is that it introduces practically two non-c.g.s. quantities, namely the weight w, and the mass w/g measured in 980-gm units. Possibly this system would be preferable if we always used gravitational units and nothing else. That is why it appeals to the engineer, who clings to the good old pound weight and ignores the possibility of a pound mass. But the use of the metric system either with c.g.s. or m.k.s. units is certainly increasing. So it seems to me that since we can not yet ignore force pounds and force grams, we should use that method of dealing with them which is the least confusing and which deviates as little as possible from the concept of force expressed by $F = ma$.

HENRY A. PERKINS

TRINITY COLLEGE,
HARTFORD, CONN.

QUOTATIONS

THE PHYSIOLOGICAL CONGRESS AT ZURICH

AMID auspicious surroundings the International Physiological Congress had its sixteenth, or jubilee, meeting at Zurich from August 14th to 19th. The president, Professor W. R. Hess, in a happy address of welcome, pointed out that the congress had been conceived in England in 1888, but was born at Basel in September of 1889 when a group of 129 physiologists met to hold their first congress. It was highly fitting, therefore, that the congress should return to Switzerland to celebrate its fiftieth anniversary; this time with a registration of more than 1,600 members.

[1] K. B. McEachron and W. A. McMorris, *General Electric Review*, 39: 487–496, 1938.