DISCUSSION ON "THE MEASUREMENT OF ROTARY SPEEDS OF
DYNAMO MACHINES BY THE STROBOSCOPIC FORK."
ATLANTIC CITY, N. J., JUNE 29, 1908

J. B. Taylor: The stroboscopic disc illuminated by an alternating-current arc or incandescent lamp has been used for a number of years to determine the speed of induction motors, synchronous machinery, and other pieces of apparatus. This method of obtaining intermittent illumination is much simpler than by means of the fork described in this paper, and for some purposes gives the desired information with greater accuracy.

The distinction between the two methods is that the fork gives very accurate speed determinations, while the illumination by an alternating-current source of light gives even more accurate relative speeds of apparatus and frequency in alternating-current systems. In operating and testing alternating-current machinery the electrical engineer is more often interested in the relative speeds of generator and motor than in the exact determination of speed referred to the clock. For example, in testing an induction motor it may be desirable to know whether the slip under a given load is, say, 2 or 2.1%, while it is immaterial to know whether the motor is actually running at say 1800 or 1795 rev. per min. For this test the alternating-current illumination gives the slip directly, while the fork would require simultaneous observations on the motor, the generator or the synchronous motor.

When studying pulsation of synchronous machinery or angular lag of synchronous motors, synchronous converters, etc., with variable loads, excitations, and reactances in circuit, the alternating-current arc is again superior to the stroboscopic fork; for while the fork can give general indications of pulsation, it can give no indication of the angular lag referred to.

I have found these stroboscopic discs useful in another way not mentioned in the paper—in the determination of the speed of very light pieces of apparatus which have insufficient power to drive speed indicators or tachometers. For this or any work where actual speed rather than relative speed is desired the fork will be found useful, and I think that the authors of this paper should be thanked for having brought it to such a compact and convenient form.

C. A. Perkins: I have been doing some work with the stroboscopic fork, and any one who will try it in the laboratory will be interested to find how it smooths out characteristic curves, or any curves depending on frequency, to have an accurate device for determining the speed.

I wish to call attention to the range of speed obtained without having any shifting device. Use a tuning fork making thirty vibrations a second, or 1800 per minute, and the speeds given in the first column will be obtained. A fork which makes twenty-five vibrations instead of thirty gives the speeds in the

second column, while a fork with twenty vibrations gives the speeds in the third column.

Vibrations.....	30	25	20
full-speed.....	1800	1500	1200
one-half.....	900	750	600
one-third.....	600	500	400
one-fourth.....	450	375	300
one-sixth.....	300	250	200

The first fork gives, without any slider, all the speeds called for in 60-cycle, alternating-current machines.

The method that I have used for observing synchronism is different from that described by Dr. Kennelly, and was suggested to me by the device which I mentioned at the Asheville meeting, for measuring the slip of motors, by means of a disc on the shaft, with a hole or slit in the disc. If such a disc, provided with a single hole, is placed on the end of the shaft of the machine whose speed is to be measured, and if the experimenter stands so that he looks through this hole at the fork, he will have one look at the fork at each revolution. Suppose the shaft to be rotating at a speed of 1800, then the two are in exact synchronism, and the fork will seem to stand still. Now if the motor speeds up five revolutions per minute, he will see the fork apparently make five vibrations per minute. Instead of adjusting the fork, the experimenter counts the apparent vibrations of the fork. They can be counted up to 150 vibrations per minute, so that the one running at 1800 vibrations can be used for all speeds between 1650 and 1950, the one running at 1500, from 1650 down to 1350, and so on. Therefore, without any slider it is possible to use three tuning forks for all speeds in ordinary testing work. At the higher speeds, one hole in the disc is sufficient, but at the lower speeds the fork is seen at such long intervals that it seems to flicker, and it will be necessary to have two or three slots, according to the speed which is to be used. I have used this fork especially for alternating-current work; it is a simple, satisfactory, and inexpensive apparatus for this purpose.

C. H. Sharp: I think most of us are more or less familiar with the various applications of the stroboscopic method to speed measurement, but I wish to express my sense of our indebtedness to Dr. Kennelly and Mr. Whiting for having reduced this method to such a practical and convenient form for actual use.

It is not difficult in a well-equipped laboratory to assemble a combination of tuning forks and rotating discs, or something of that kind, and make it work nicely there, but here is a thing that can be picked up and taken to any place where a test is to be performed, where we merely attach a disc to the rotating element and measure the speed accurately, or measure the slip or variation of speed accurately.

A. E. Kennelly (by letter): It has been found that no target is ordinarily required when the fork is used to measure the speed of alternating-current machines for 60-cycle frequency. It suffices with such machines to illumine the polar projections of the rotor, and examine these through the fork, in order to measure their speed, unless the speed and frequency should be more than 5% in error.