# SCIENTIFIC AMERICAN

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. XXXVIII.—No. 22. [NEW SERIES.] NEW YORK, JUNE 1, 1878. [$3.20 per Annum. [POSTAGE PREPAID.]


## AN ELECTRICAL GYROSCOPE.

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The gyroscope, though now a common toy and familiar to every one, is still a puzzle to scientists. It has been properly called the "mechanical paradox," for, while it depends on gravitation for its peculiar action, it appears indifferent to it.

To render the operation of the gyroscope as nearly continuous as possible, so that its movements may be more thoroughly studied, and to combine another influence with those that unite in the gyroscope of the common form to produce the almost miraculous phenomena exhibited by the instrument, I have applied electricity as a motive agent.

The gyroscope illustrated by the engraving has a weighted base piece, from which projects a pointed standard that supports the moving parts of the instrument. The frame, of which the electro-magnets form a part, has an arm in which is fastened an insulated cup, that rests upon the point of the standard. One terminal of the magnet coil is connected with this cup, and the other terminal is connected with the bar that connects the cores of the two magnets.

Upon the top of the magnet bar a current-breaking spring is supported by a hard rubber insulator, and is arranged to touch a small cylinder on the wheel spindle twice during each revolution of the wheel.

The wheel, whose plane of rotation is at right angles with the magnet cores, carries a soft iron armature, which turns very near the face of the magnet, but does not touch it. The armature is arranged in such relation to the contact surface of the current-breaking cylinder that twice during each revolution, as the armature nears the magnet cores, it is attracted, but immediately the armature comes directly opposite the face of the magnet cores, the current is broken, and the acquired momentum is sufficient to carry the wheel forward until the armature is again within the influence of the magnet.

The current-breaking spring is connected with a fine copper wire, that extends backward as far as the pointed standard, and is coiled several times to render it very flexible, and is finally bent downward so as to dip in mercury contained in an annular vulcanite cup placed on the pointed standard near the base piece.

The base piece is provided with two binding posts for receiving the battery wires. One of the binding posts is connected with the pointed standard, and the other communicates by a small wire with the mercury in the vulcanite cup.

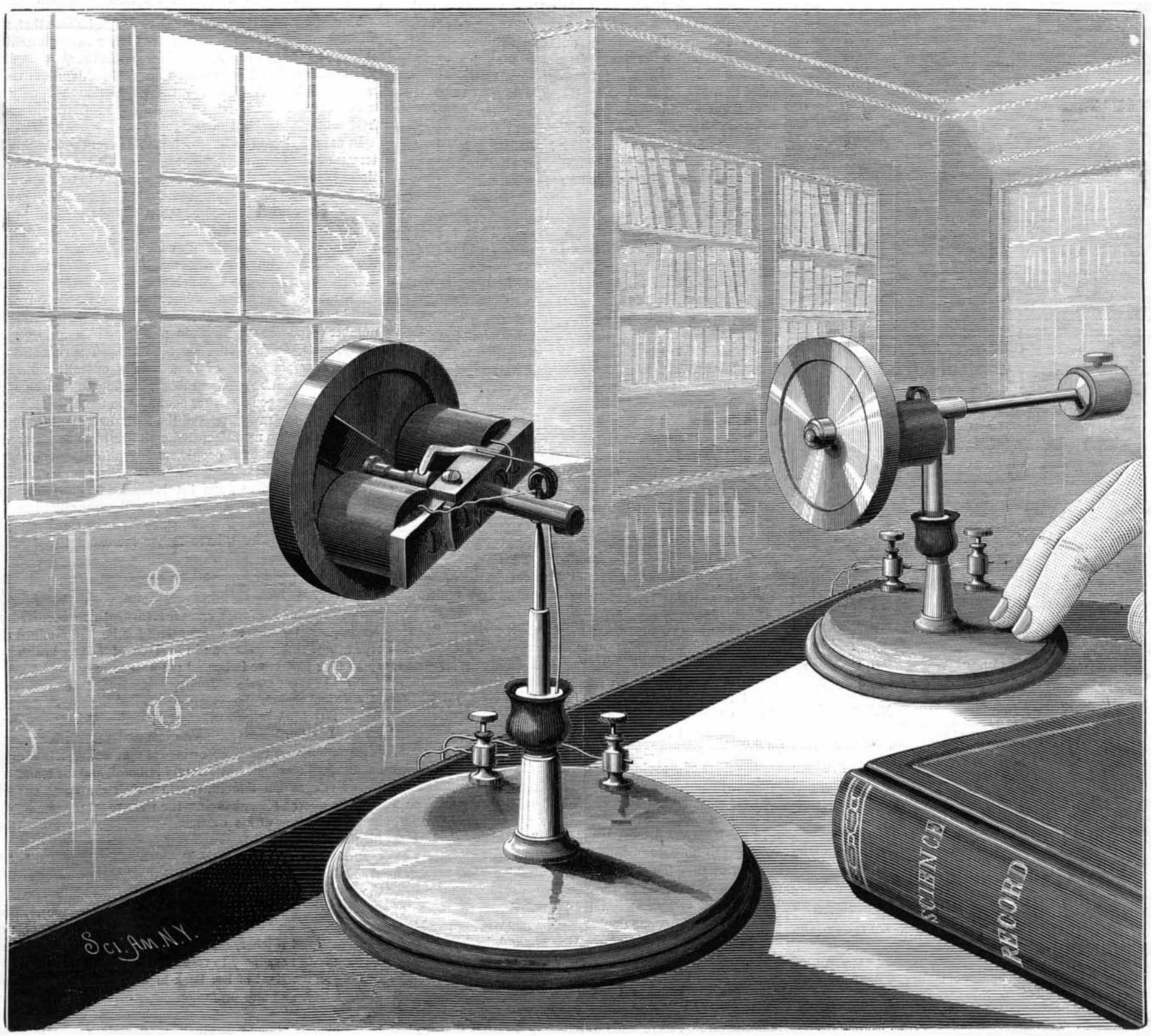
The magnets and wheel, and all of the connected parts, are free to move in any direction on the point of the standard. When two large or four small Bunsen cells are connected with the gyroscope, the wheel revolves with enormous velocity, and upon letting go of the magnets (an operation that requires some dexterity), the wheel sustains not only itself, but also the magnets and other parts between it and the point of the standard, in opposition to gravity. The wheel, besides rotating rapidly on its axis, sets up a slow rotation about the pointed standard in the direction in which the *under side* of the wheel is moving.

By attaching the arm and counter balance shown in the engraving, so as to exactly balance the wheel and magnets on the pointed standard, the whole remains stationary. By *overbalancing* the wheel and magnets, the rotation of the apparatus around the standard is in an opposite direction, or in the direction in which the *top* of the wheel is turning.

This gyroscope illustrates the persistency of a rotating body in maintaining its plane of rotation against the force of gravitation. It also exhibits the result of the combined action of two forces tending to produce rotations about two separate axes lying in the same plane.

The rotation of the wheel upon its axis, produced in this instance by the electro-magnet, and the tendency of the wheel to fall, or rotate in a vertical plane parallel with its axis, result in the rotation of the entire instrument upon a new axis, which is coincident with the pointed standard.

A MODE of equalizing the wear of the cylinders and pistons of horizontal engines, suggested by an English engineer, consists in making the piston-rod with a camber or upward bend, so that, when loaded with the weight of the piston and placed in the cylinder, it assumes a straight line, and transfers the weight to outside guides.

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