herd of wild buffalo estimated to number 600. But since this region is exceedingly difficult of access, the herd is likely to increase during the coming years.

THE SIEMENS-SCHUCKERT CONTINUOUS-CURRENT WATTMETER.

By EMILE GUARINI.

The wattmeters constructed by the Siemens-Schuckert

CONTEMPORARY ELECTRICAL SCIENCE.*

THE ETHER AND DOUBLE REFRACTION.—D. B. Brace quotes some experiments to disprove the validity of the FitzGerald-Lorentz contraction hypothesis to explain the negative results of the Michelson-Morley experiment of interference between two rays, at right angles and parallel respectively to the earth's motion. The experiments were conducted by an extension of

A heavy beam was pivoted between the floor and ceiling so as to carry a trough with its horizontal axis intersecting the pivotal axis. This system could be rotated continuously so as to bring it into any desired position. The trough was 413 centimeters long, and built of thick planking so as to give stability to the polarizing and mirror systems which it carried. Sunlight was so thrown into the trough as to keep its path the same whatever its position. The results were negative in every case. The experiments were repeated during the early part of February, 1904, when the earth's orbital velocity conspires approximately with that of the solar system in space. The conditions were quite as favorable as before, but no effect could be detected. The author concludes that the contraction hypothesis cannot explain the negative results of the interference experiments. Either the ether moves with the embedded matter, or the effect of the relative motion on the intermolecular forces and the possible consequent relative change in dimensions are very small.—D. B. Brace, *Philosophical Magazine*, April, 1904.

N'-RAYS.—J. Meyer has discovered some new sources of the extinguishing rays called by Blondlot N'-rays, and has obtained rays of a higher penetrating power than heretofore. If a screen with patches of phosphorescent calcium sulphide is placed in the receiver of an air pump and the pump is worked, the phosphorescence decreases, being restored as soon as the pressure is restored. The same thing takes place if the screen is placed outside instead of inside the receiver. An incandescent lamp through which no current pressure passes, or a vacuum tube, are powerful sources of N'-rays, the strain of the glass under atmospheric pressure being sufficient to account for their production. These rays are not absorbed by a slab of wood 10 centimeters thick, or a sheet of oxidized lead 1 millimeter thick and folded so as to be traversed by the rays eight times, or by a glass vessel 10 centimeters thick filled with pure water. The only bodies capable of intercepting these rays appear to be platinum 1 millimeter thick and "opal" glass 3 millimeters thick. In studying the refractive index of the rays by means of an aluminium prism, the author observed that the aluminium stored the rays in great quantity, and gave them out again for the next twenty-four hours. Ordinary and crown glass store them for a short time, and lead, copper, and pure water do

FIGS. 1 AND 2.—THE SIEMENS-SCHUCKERT CONTINUOUS-CURRENT WATTMETER FOR STRENGTHS OF FROM 3 TO 20 AMPERES.

Company for the measurement of continuous electric currents are characterized by the simplicity of their mechanism, the certainty of their operation, and the almost absolute accuracy of the results which they give. The apparatus belong to the motor type. The field and the armature are devoid of iron. The former, which is of coarse wire, is traversed by the current to be measured, while the armature, which is of fine wire, is connected in shunt circuit. The apparatus is therefore based upon the principle of the wattmeter, the stationary field, or inductor, being sensitive to the current and the movable armature to the voltage. The force of the motor is therefore proportional to the product of the current by the voltage, that is to say to the watts.

In addition to the motor, the meter includes a regulator and a counting mechanism. The former consists of a copper disk mounted upon the shaft of the motor so as to revolve between the poles of a powerful magnet. It regulates the speed of the counting mechanism in such a way as to make the number of revolutions always exactly proportional to watts consumed.

The third mechanism, which serves for counting the revolutions, consists of a brass endless screw secured to the shaft of the motor and imparting motion to a helicoidal wheel, which transmits it to the dials. A pinion keyed upon the shaft of this wheel meshes with a gear wheel, upon the axis of which is placed the first dial. At every revolution, the latter raises a small weight, which, in falling, causes the other disks to advance abruptly. The disk indicates directly the consumption in kilowatt-hours. In order to completely do away with friction, the meter is provided with an auxiliary coil, which is interposed in the circuit of the armature, and is movable. The force of this is exerted permanently upon the armature and exactly balances the friction.

The advantages claimed for the instrument by the manufacturers are simplicity, the use of a single revolving axis, the absence of clockwork movements or complicated electric apparatus, ease of control, absence of variable forces, springs, etc., the possibility of following all fluctuations however abrupt and strong they may be, an almost complete insensibility to short circuits, and the possibility of operating at all times without attention.

A special arrangement permits of raising the armature from its lower bearing so that this will not be damaged when the meter is being carried. The terminals are covered with a sealed box.

This meter is made in three types. The first (Figs. 1 and 2) is designed for currents of from 3 to 20 amperes; the second (Figs. 3 and 4) for currents of from 3 to 100, and the third (Figs. 5 and 6) for those of from 3 to 4,000. The maximum tension is always 600 volts. The three types are constructed either for two or three conductors.

The first type is provided with a regulating magnet and with a field coil placed parallel with the back of the instrument. In the meters for three conductors, the coil is provided with two separate windings. The auxiliary coil is oblique with respect to the armature.

The second type is provided with two regulating magnets and two field coils placed parallel with the back of the instrument. The arrangement is the same in the third type, save that the field coils are at right angles with the base-plate. In both types, the auxiliary coil is within the field coil.

Rayleigh's method, using a system rotating about a vertical axis, and working with either glass or water.

* Compiled by E. E. Fournier d'Albe in the *Electrician*.

FIGS. 3 AND 4.—WATTMETER FOR CURRENTS OF FROM 3 TO 100 AMPERES

FIGS. 5 AND 6.—METER FOR CURRENTS OF FROM 3 TO 4,000 AMPERES.