months. The advantages of the Faure type are the ease of manufacture, and the capacity, which is greater than that of the Planté type. The disadvantages are in the rapid depreciation and the limited discharge-rate.

In the Macræon battery the attempt is made to take advantage of the good points, avoiding the troubles. This is done in the following way. The negative plate is made according to the Faure process, as distinguished from the Planté. A framework of lead is filled in with active material obtained by fusion. The crossbars making up the frame are thinner than the finished plate, so nothing but the active material is exposed to the liquid. The negative plates are permanently connected to the metallic box, which takes the place of the glass or rubber boxes now generally used.

The positive plates are made according to the Planté plan: the active material is obtained from the support itself by the chemical action of the current. But instead of the forming process taking months to accomplish, as in the original Planté process, it is accomplished in a few hours, the result of the special electrolyte used in the Macræon battery. The form of the positive plate is also an important question. In this cell it is made of corrugated strips of

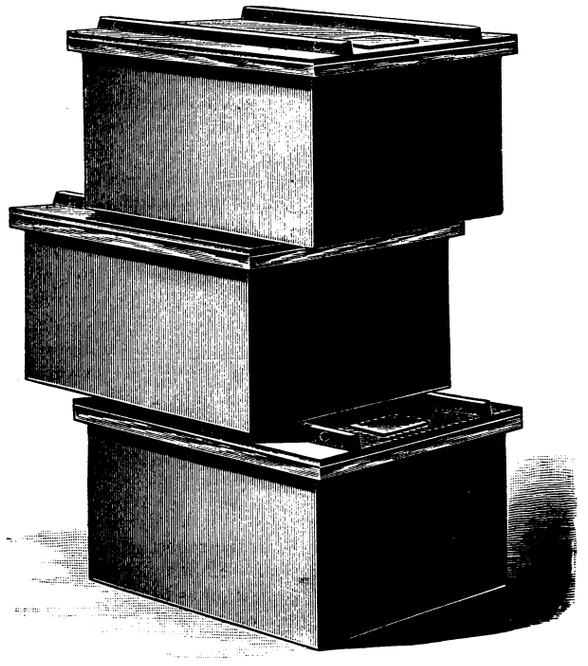

FIG. 2. — THE MACRÆON STORAGE-BATTERY.

lead, fastened at the top to the crossbar of a lead frame, while at the bottom they have a freedom of movement which prevents "buckling" when the strips expand on discharge. These positive plates are fixed to the metallic top of the box. When the cover is in place, the top of the cell is positive, and the bottom is negative, with an insulation between them. The closing of the cell avoids the occurrence of acid fumes, and the evaporation of the acid.

The following tables give some data as to the performance of the cells: —

Stationary or "Central Station" Type.

Size.	Normal Charging Current.	Normal Discharge Current.	External Dimensions.			Weight Complete in Pounds.	Normal Capacity in Ampère Hours.
			Length.	*Width.*	*Height.*		
A	6	1–8	11	5¾	4½	35	50
B	12	1–17	11	5¾	6½	52	100
C	20	1–32	10½	10	6½	80	200

Portable Type for Railroad Purposes.

Size.	Normal Charging Current.	Normal Discharge Current.	External Dimensions.			Weight Complete in Pounds.	Normal Capacity in Ampère Hours.
			Length.	*Width.*	*Height.*		
D	20	1–25	11	5¾	6½	48	200
E	30	1–50	10½	10	6½	78	350
F	1–2	1–3	3	4	6½	–	8–9
G							
H							

ELECTRICAL NEWS.

The Velocity of Light.

ACCORDING to the electro-magnetic theory of light, which recent investigations, mathematical and physical, have rendered so probable, the velocity of light is equal to the quantity v, the ratio of the electro-static and electro-magnetic units of electro-motive force. Sir William Thomson has been engaged for some time on a series of measuring-instruments which will, by electro-static force, measure potentials from 40 to 50,000 volts. The method of calibration allows a determination of v to be made. The easiest way to get known potentials up to 200 or 300 volts is by sending a measured current through a known resistance, the difference of potential at the terminals of the latter being CR, the product of two easily measured quantities. This is the plan Sir William adopts for the calibration of instruments giving the lower readings, and the accuracy is within at least one-twentieth per cent. By the aid of condensers, these potentials are multiplied up to 2,000 or 3,000 with an accuracy of one-fifth per cent; and, by the aid of an intermediary electrometer, this is raised to 10,000 volts, with about the same limit of accuracy. This last measure, based on the original electro-magnetic determination with the resistance and current may now be compared with the electro-static measurement of the same potential made by an electro-static balance. Sir William has not been able to make sure of the accuracy of this last instrument to within more than one-half per cent, but within this limit the comparison of the two methods gives a ratio within one-half per cent of 300,000 kilometres per second. The velocity of light is known to be within one-fourth per cent of this value, — a most satisfactory agreement, speaking well for the accuracy of the new instruments.

The series of ammeters that Sir William lately developed will be of great practical benefit to electricians; their great range, accuracy, and permanence making them almost invaluable for certain classes of work. The series of volt-meters on which he is working will be of equal value, and we look forward to the time when they will have passed through the experimental stage.

ABSOLUTE RESISTANCE OF MERCURY. — In a recent number of *Wiedemann's Annalen*, F. Kohlrausch publishes a redetermination, which he has carried out with elaborate precautions, of the absolute resistance of mercury. The method employed was Weber's method of the damping of a magnet in a coil, with some slight modification of Dorn. The result arrived at is, that the resistance of a cubic centimetre of mercury at 0°C. is 94,060 centimetre seconds. In order to compare this with the B.A. unit, Mr. Glazebrook has compared one of the author's mercury standards with the B.A. unit in the Cavendish Laboratory, and finds, that, according to Kohlrausch's determination, one B.A. is equal to 0.9866 of an ohm. This would give a length of between 106.2 and 106.3 for the column of mercury of one square centimetre in section, having a resistance of one ohm.

ELECTRIC LOCOMOTIVES FOR MINES. — In this country the only applications of electricity to traction in mining, with which we are acquainted, is in Lykens, Penn. In this, current is conveyed to

the motors through an overhead wire. In Europe there are several successful examples of electric tramways in mines, and lately Messrs. Immisch & Co. have built a new mine-locomotive from the designs of Mr. Reckenzaun. Storage-cells are employed for supplying current, and a single motor of four-horse power. The gearing is peculiar. On the armature-spindle is a small phosphor-bronze pinion. This gears into four steel pinions placed in the same plane, and 90° distant from each other. These pinions are bushed with gun-metal, and run on steel pins carried on a cast-iron disk. The disk revolves on a journal turned outside of the end of the motor-bearing. Outside of, but in the same plane with, these pinions, is fixed an annular casting of gun-metal, with teeth cut on the inside. The steel pinions gear into the ring, which forms a fulcrum on which they revolve when the motor-spindle turns. The power is transmitted from the cast-iron disk by a sprocket-pinion keyed to it on the inside next to the motor, and a steel chain connects this sprocket-pinion to a suitable wheel mounted on one of the axles, while the other axle is connected to this by coupling-rods. The storage-battery consists of forty-four modified Tatham cells, each box being 10 inches by $6\frac{1}{2}$ inches, by 11 inches high. The boxes are lead-lined, and arranged in sections of three in wooden trays. Each box contains nineteen plates 7 inches by $4\frac{1}{4}$ inches, by $\frac{7}{32}$ of an inch thick, and has a capacity of 150 ampère hours, the weight being 53 pounds. The rate of discharge varies from 25 to 50 ampères, and sometimes, on starting, this increases to 65 ampères. Taking 40 ampères as the average rate, the weight of these cells for a discharge equivalent to one horse-power is nearly 500 pounds, and per horse-power-hour storage-capacity, 134 pounds. The Messrs. Immisch are now working on some improvements by which the capacity will be increased. This locomotive, on a grade of 1 in 70, would just move, with a load of twenty loaded cars equivalent to eleven tons. With fifteen cars, weighing eight tons and a half, the speed was three miles per hour, the current being 45 ampères at 100 volts pressure. On a grade of 1 in 40 the maximum load was eight cars, and on 1 in 25 it was six cars, the speed being a little over two miles an hour. On the level the locomotive could draw thirty cars, the current employed being 45 ampères.

FELLING TREES BY ELECTRICITY. — Hitherto machines for felling trees have been driven by steam-power, but this is sometimes inconvenient, especially in thick woods; and now the London *Times* reports that electric power has recently been adopted in the Galician forests. Usually in such machines the trunk is sawed, but in this case it is drilled. When the wood is of a soft nature, the drill has a sweeping motion, and cuts into the trunk by means of cutting edges on its sides. The drill is actuated by an electric motor mounted on a carriage, which is brought up close to the tree and shackled to it. The motor is capable of turning round its vertical axis; and the drill is geared to it in such a manner that it can turn through an arc of a circle and make a sweeping cut into the trunk. The first cut made, the drill is advanced a few inches, and another section of the wood removed in the same way, until the trunk is half severed. It is then clamped to keep the cut from closing, and the operation continued until it would be unsafe to go on. The remainder is finished by a hand-saw or an axe. The current is conveyed to the motor by insulated leads brought through the forest from a generator placed in some convenient site.

HEALTH MATTERS.

Public Inspection of Food.

THE following resolutions were offered by Dr. George Strawbridge at a recent meeting of the Philadelphia County Medical Society: —

"The Philadelphia County Medical Society begs to call the earnest attention of city councils and the Legislature of Pennsylvania to the pressing need of provision for the inspection of all meat and milk used as food, with a view of furnishing sound meat and milk to the people.

"The society would also urge the necessity of killing and destroying all animals afflicted with tuberculosis, and the owner should be indemnified by the State.

"The society also recommends that a committee of five be appointed by the president of the society, whose duty it shall be to represent the society with a view of obtaining further information, and to confer with other bodies acting in this matter."

Dr. Strawbridge, in introducing his resolutions, said: "Statistics as reliable as can be obtained make the statement not too broad, that in Philadelphia, about the present time, there is from three to three and one-half per cent of tuberculosed meat used, and from six to eight per cent of tuberculosed milk. Here in Philadelphia to-day there is no inspection of any kind. The best the board of health could do was to obtain an appropriation of fifteen hundred dollars for the appointment of a milk-inspector, who will probably start to the stations to see how much water goes into the milk. Anybody can dump any kind of food in Philadelphia, and we must take it; but if we refuse to eat it, we are told that we are not good citizens. Meat ought to be inspected when alive, and also during the process of slaughtering. Unless you can inspect the animal alive, and also when the internal parts can be viewed, the inspection is useless. In the inspection of milk, the principal thing is to see the cows that give it, so that they are not diseased, and to inspect it at its place of delivery."

The resolutions were adopted, and a committee was appointed consisting of Drs. Leffman, Huidekoper, Shakespeare, Osler, and Cleeman.

CHOLERA CONTAGION IN DRINKING-WATER. — F. G. McKean, chief engineer in the United States Navy, states that during ten days in 1885, nine hundred persons died of cholera on the island of Takashima in Japan, and that the disease often appears on the island. Suspicion was drawn to the drinking-water, which was brought from the mainland. During 1888 the use of this water for drinking-purposes was abandoned, and distilled water was used instead. Although cholera prevailed on the neighboring islands, Takashima was entirely exempt. This exemption may have been but a coincidence; still, it is more than probable, from our knowledge of this disease, that the purity of the drinking-water is to be credited with the immunity which the population of the island enjoyed. To be absolutely certain of this, will, however, require more continued observation.

NOTES AND NEWS.

IN the "Sixth Biennial Report of the State Board of Agriculture of Kansas," Mr. E. B. Cowgill, in the report on the sorghum-sugar industry, says: "The season of 1888 has been looked upon as the one which should settle the question as to the financial success of the sorghum-sugar industry, and, fortunately for the incoming industry, the answer must be taken as an affirmative one. It is true that not all of the factories in Kansas are able to show balances of profit. The fact, however, that the favorable results obtained in 1887 at Fort Scott have been more than repeated at that place in 1888; that a factory at Topeka has demonstrated the practicability of the sugar industry at that place; and the further fact that Conway Springs and Douglass, in the face of adverse circumstances, have shown the industry to be independent of all patented processes and machinery, — will go far toward assuring all diligent inquirers of the success of the Northern sugar industry. Indeed, upon the most careful study of the subject, I have no hesitation in saying that the sorghum-sugar industry is now on such a footing as to invite the investment of capital, where such investment is placed under good business management, efficient, practical skill, and competent, scientific direction."

— A recent invention of Messrs. Randall & Carter, for the preservation of freestone from the effects of weather, was exhibited by them at the Cannon Street Hotel, London, on Feb. 15, in the presence of a large number of architects and builders. Several specimens of well-known oolitic freestones, which had been treated by this process in such a manner as to make their surfaces quite hard enough to be polished, were shown. The process consists of treating the stone with a compound of milk of lime, acetic acid, and cane-sugar (or molasses), which, when applied, soaks into it for a depth of about half an inch, and produces a slight chemical change, materially hardening it. The stone may either be entirely im-