THE DREDGER "MARQUESS."

The "Marquess," a bucket dredger with a single ladder, has been recently constructed by A. F. Smolders at Rotterdam for the Cardiff Railway Company. The entire hull is of mild steel. The length of the deck is 136 feet, 3 inches; the width, 24 feet, 7½ inches; and the depth, 10 feet. The bucket ladder is 88½ feet in length. It is strengthened by crossbraces, and fitted with cast steel rollers mounted upon steel axles. The buckets have a capacity of 19 cubic feet, and are of Siemens-Martin steel. The upper tumbler of the dredger is quadrangular and is a single steel casting, while the lower one is cast in two halves. The edges of the tumblers are protected against wear by pieces of hard steel. The height of the upper tumbler above the load water line is 28 feet. The discharge chutes, which are of Martin steel, are provided with friction bearings and are set at 30 deg. from the vertical, one on each two sides of the dredger. The buckets can be made to empty into one chute or the other by means of a valve. The stationary chutes are provided in the center with a slide that recedes from or approaches the bucket chain, so as to reduce the waste to a minimum. They have, in addition, two movable extensions that may be raised or lowered by means of windlasses. All these parts are actuated from the deck. The motive power is transmitted by two camel's hair belts running over pulleys keyed to the crank and transmission shafts. The transmission is so arranged that the buckets pass over the upper tumbler at the rate of 16 a minute. The transmission by belt has the advantage that if the buckets meet with an obstacle, such as a rock say, or a tree-trunk, the belt slides. Consequently, a possible breakage of the chain is prevented.

The engine is of the compound type, fitted with a surface condenser and a reverse. The diameter of the high-pressure cylinder is 19 inches, and that of the low-pressure one, 26⅜ inches, while the stroke of each is 19¾ inches.

The boiler is of the type usually employed on sea vessels. It is of Siemens-Martin mild steel with two furnaces. The diameter of the body is 8 feet, 10½ inches; and the length, 10½ feet. The diameter of the furnace is 2 feet, 9½ inches. There are 112 3-inch tubes in the boiler. The heating surface is 860 square feet. The effective pressure is 105 pounds.

The dredge is provided with five steam windlasses. One of these does duty for the ladder, two others for the two lateral chains, a fourth for the bow chain, and the fifth for the three stern chains.

In addition, there are two hand windlasses for manipulating the discharge chutes. The dredger is lighted entirely by electricity. The current is furnished by a continuous-current dynamo and is capable of supplying a total of 1,600 candle-power.

There are cabins for the captain, mate, the engineer, the fireman, and the crew.

The dredger operates to a depth of 45 feet beneath the surface of the water. At the time of the experiments made in the Cardiff channel, it dredged and discharged 4,536 tons of material into lighters in 319 minutes. The average work was therefore 853 tons an hour. The minimum was 732 tons per hour, and the maximum 1,030. The contract called for 650 tons per hour for work in compact clay, gravel, and sand, and for 325 tons for work in marl. The same chain and buckets naturally had to work in both cases. The requirements of the contract were therefore largely exceeded.

THE BERTHIER ACTINO-ELECTRIC TRANSFORMER.

BY EMILE GUARINI.

Although it is as yet remote, a day will come when we shall be obliged to direct our whole attention to the utilization of natural forces, or at least of such as we do not at present consider the utilization practical.

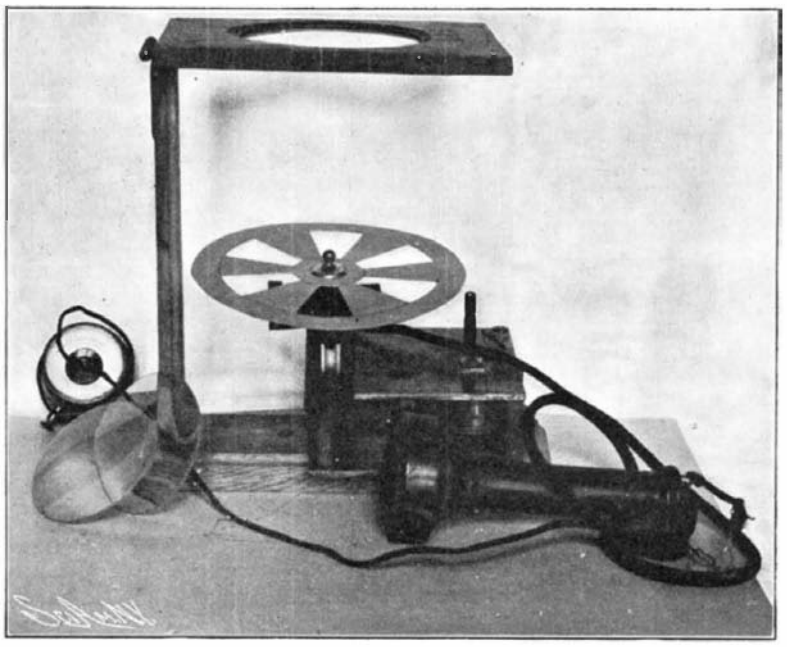


Fig. 1.—Arrangement for Producing an Alternating Current.

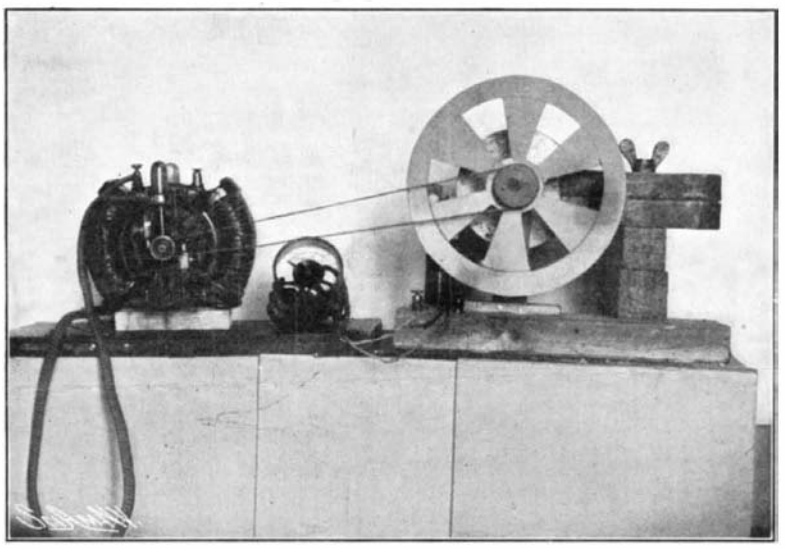


Fig. 2.—Arrangement for Producing a Direct Current.

APPARATUS FOR PRODUCING ELECTRICITY FROM LIGHT.

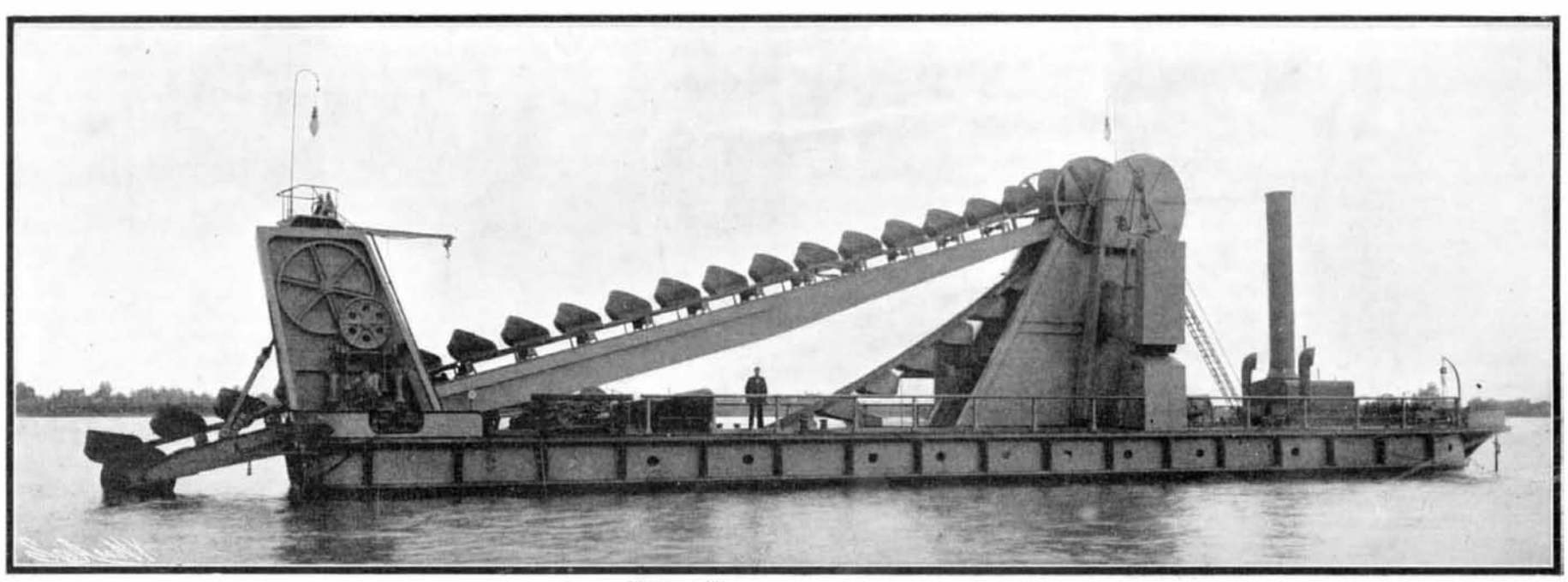
Although it is true that water courses and water falls have received numerous applications—yet far less numerous than they might have received—in the majority of countries there are, on the contrary, other natural forces, such as the wind, which can be made use of everywhere, and the tides, which are very pronounced in certain countries, and the applications of which may be relied upon with confidence. There is one, even, which has as yet been utilized scarcely at all, and that is the sun, at least in countries in which it shines more or less frequently; and perhaps this same sun will, in the years to come, be made to give us nearly all the heat necessary to keep us warm in winter, and a large proportion of the power needed to run the machinery of the world, which is ever increasing in size and quantity. Something, moreover, has already been done in this direction, especially at Los Angeles, where a reflector of about thirty-three feet in diameter has been utilized for concentrating the calorific and luminous rays upon a steam generator that supplies a 15-horse-power motor.

M. Berthier, on the other hand, desirous of demonstrating to us once again the ease with which one of the numerous forms of energy may be changed into another, has entered upon an entirely different path, in aiming at the transformation of light into electric energy; and, with such an idea in view, has devised an actino-electric transformer, an apparatus capable of utilizing the property that selenium possesses of producing an electro-motive force under the influence of light. Such a result may be reached in two different ways: (1) By constructing an apparatus based upon the use of selenium submitted to more or less rapid variations in light, and, consequently, by utilizing the modifications in resistance; and (2) by constructing an apparatus in which the light shall act in a constant manner for the production of a constant electro-motive force capable of being utilized. The second of these methods is not new. Prof. W. E. Adams long ago showed that a ray of light, falling upon a bar of selenium, develops therein an electro-motive force that gives rise to a current, and that the bar by this fact becomes temporarily converted into a small battery. I do not know why this property has not, up to the present, received practical applications, since it seems to me that nothing could be more easy than to form industrial actino-electric elements of the nature of thermo-electric batteries. The bars, connected in multiple, might serve for increasing the intensity of the current, and connected in series, for increasing the tension of the current.

The first of the methods mentioned above is new, and M. Berthier has devised a most interesting apparatus for the carrying out of it.

The inventor gives his apparatus two forms. By means of the first, he obtains an alternating current, and, of the second, a continuous one. The first form is represented in Fig. 1. A disk, provided with apertures and revolved by means of a clock-work movement, serves as a shutter and produces in the luminous pencil, concentrated by a convergent lens, a rapid series of interruptions. The pencil of light itself is directed upon a selenium bottom formed of quite a large number of thin strips of this metalloid and submitted to the action of the magnetic field of two powerful magnets or of two electro-magnets. The battery is placed at the point where the field possesses its maximum strength. The selenium battery is put in circuit with two coils secured to the extremity of the magnets. These latter therefore serve as cores. These coils are provided with another winding, which constitutes the induced circuit. It is connected with a telephone or any other apparatus in which, in a normal state, no sound is heard. There is therefore no current in the

(*Continued on page 478.*)



HUGE ENGLISH DREDGER "MARQUESS," CAPABLE OF EXCAVATING 1,030 TONS OF MATERIAL PER HOUR.

any missing ones. We recently witnessed a very interesting test of this system on a branch line of the Long Island Railway, which proved the efficiency of the apparatus beyond a doubt. The accompanying photograph shows the locomotive used in this test approaching one of the danger signals along the line.

Santos Dumont's New Airship.

Santos Dumont's airship No. 7, which is to be used at St. Louis, has been overhauled and considerably modified in the details of the *nacelle*. A visit to the balloon shed near Paris showed that the No. 7 was already inflated with gas, and is only awaiting a favorable moment for making a sail. The aeronaut states that the trials which he has made of the motor and the mechanical parts have been very satisfactory, and he is confident of the success of the new airship. He expects to make a very thorough series of trials in the air in order to become perfectly familiar with the maneuvers, and will not leave for St. Louis before this is carried out. Beside the No. 7 is a new airship of somewhat similar form, but of smaller size, to the No. 11, which has been sold to an American. It has a long *nacelle* and the basket will contain four persons. The motor is of the Clement-Bayard type with a special carbureter, and is rated at 16 horse-power. The balloon has been constructed at the Lachambre establishment. It is already filled out, and will, no doubt, make a trial trip shortly. The No. 9, the smallest airship yet constructed, with which Santos Dumont made a number of interesting performances last year, has been purchased by another American, Mr. Boyce, who expects to try it soon at New York. Mr. Boyce had previously purchased the No. 8, but had an accident with it during his first ascensions.

The Burning of Troy Polytechnic Institute.

The main building of Rensselaer Polytechnic Institute, one of the oldest and most widely known schools of civil engineering in the country, was destroyed by fire on June 9. This is the fourth fire to visit the institution in a year and a half. Two were in the chemical and one in the electrical laboratory.

The Rensselaer Polytechnic Institute was founded by Stephen Van Rensselaer, of Albany, the last, save one, of the Patroons, on November 5, 1824. Until 1850 it was known as the Rensselaer School, and was devoted to theoretical and practical science. It was reorganized in that year as a general polytechnic institute, and assumed its present name. The purpose of the Institute, as declared in its charter, is to maintain a school for instruction in mathematics, civil engineering, chemistry, mineralogy, geology, botany, literature, and, in their application to the arts, agriculture, domestic economy and manufacturing. In carrying out its purposes it was extensively equipped with apparatus and collections, but the work especially carried on is the instruction of engineers.

The Current Supplement.

The current SUPPLEMENT, No. 1485, opens with a splendidly illustrated account of Creusot ordnance. F. J. Rowan recently read before the Institution of Engineers and Shipbuilders a most exhaustive paper on superheated steam. His treatment of the subject is so valuable that the Editor publishes his paper in full. A novel balanced rotary valve for gas-engines, which controls both functions of induction and exhaust of the gas to and from the motor, and which can be used for two or three cylinders, thus dispensing with two or three sets of valves and gearing, is made the subject of an article that is very elaborately illustrated with diagrams. Charles Fremont's method of testing steel rails is described. Dr. C. A. Herter writes in an appreciative vein on the influence of Pasteur on medical science. Some novel studies of radium will be found among the minor articles.

The Invention of Babbitt Metal.

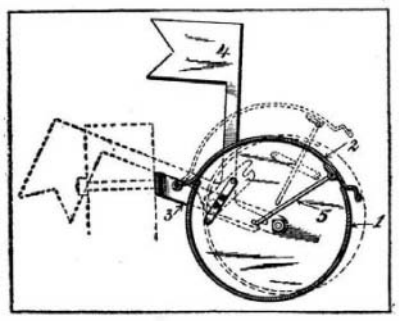
Although Babbitt metal is one of the most common anti-friction metals in use at the present time, but few users of this metal are aware that Isaac Babbitt, whose name it bears, was the inventor and patentee of the method of lining boxes with soft metal rather than of any particular alloy of the metal itself. The Metal Industry recently published a copy of the original patent, No. 1,252, which was granted to Isaac Babbitt, of Boston, Mass., July 17, 1839. In this he claims to have invented a new and improved mode of making boxes in which gudgeons or journals are to run. To quote from that part of his patent relating to the metal used, he says: "I prepare boxes which are to be received into housings or plummer blocks in the ordinary way of forming such boxes; making them of any kind of metal or metallic compound which has sufficient strength and which is capable of being lined. The inner parts of these boxes are to be lined with any of the harder kinds of composition known under the names of britannia metal or pewter, of which block tin is the basis. An excellent compound for this I have prepared by taking 50 parts of tin, 5 of antimony, and 1 of copper. But I do not intend to confine myself to this particular composition."

No claim whatever is made for the composition and, in fact, that specified is somewhat softer than what is now known as "genuine babbitt," which is commonly composed of 96 parts of tin, 8 parts antimony, and 4 parts copper.

Although Babbitt's name is somewhat erroneously applied to the metal, yet, as he was the first to exploit the use of soft metals in the manner in which they are now so commonly employed, it seems but just that his memory should be perpetuated in this way.

MAIL BOX FOR RURAL DELIVERY SERVICE.

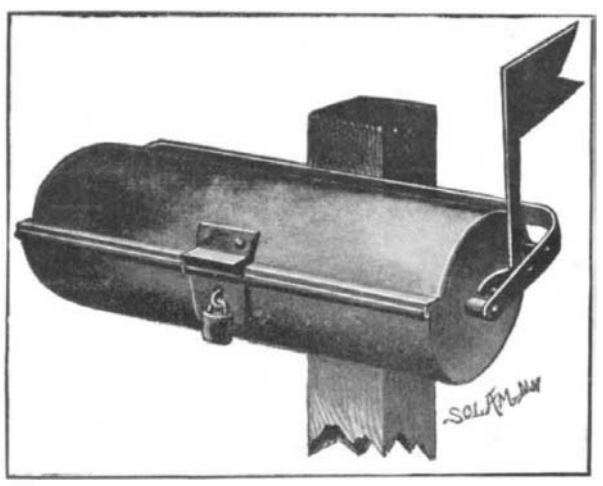
The rural free-delivery system recently introduced by the Post Office has created a demand for a new type of mail box, one which will indicate by a signal whether or not it contains any mail matter. The rural mail box must be situated along the main road, often a considerable distance away from the house it



CROSS SECTION THROUGH THE MAIL BOX.

serves; and it is evident that a signal which would automatically indicate that mail has been deposited in the box, would save the owner many useless trips thereto.

We illustrate herewith a mail box of this type, which was recently invented by Mr. A. M. Hoes, of Palmer, Neb. This box, it will be observed, is of cylindrical shape, the lower half and ends, 1, constituting the main body, and the upper half, 2, constituting the lid. The box is eccentrically mounted in bearings in a yoke piece, 3, which may be secured to a post or other support. The lid is also hinged to this yoke piece at the rear. A bell crank is pivoted to one arm of the yoke, and carries a flag or other signal, 4, at its upper end, while its lower end is slotted to engage the end of a rod, 5, which projects through the end wall of the mail box. This signal serves to notify the owner that mail matter has been deposited in the box; normally, however, the flag is not held upright, but rests against the cross arm of the yoke piece. The rod is secured at its upper end to the lid, as shown in our section view. When the lid is raised, this rod, together with another rod similarly connected at the opposite end of the mail box, serves to swing the body portion, 1, on its eccentric pivots to the position shown in



MAIL BOX FOR RURAL SERVICE.

dotted lines. The projecting end of rod, 5, will, at the same time, tilt back the signal bell crank until the flag falls to normal position. To set the signal, the postman while closing the box, after having deposited mail therein, holds the signal bell crank in such a position that its slotted end will be engaged by the projecting rod, and thereby raised to a vertical position. Owing to the cylindrical form of the box, and to the fact that the lower part rotates eccentrically on opening, the mail matter will slide forward, coming within easy reach, and the entire contents of the box will be brought into view as soon as it is one-third open.

According to the Iron Age two of the largest spiral springs ever made in the United States were shipped recently from Pittsburg. The springs are 27½ inches diameter, and have a height of 34 inches. When closed solid they are 19 inches high. They are made of 1½-inch steel, and the bars were 533 inches in length. The springs are so elastic that they can be moved with the finger, while it requires a pressure of 3,000 pounds to close them down. The rule among spring makers has heretofore been that the inside diameter of a spring must not be over 10 times the thickness of the bars without special appliances to keep the coils in position. These springs, however, are seventeen times the diameter of the bar.

THE BERTHIER ACTINO-ELECTRIC TRANSFORMER.

(*Continued from page* 476.)

induced circuit, since the electro-motive force of the circuit of the selenium battery is constant. When the manipulating disk is revolved, the following phenomena occur: At the moment at which the first pencil of light reaches the selenium, the latter becomes converted into a battery. The current of this latter traverses the primary of the transforming coil, and produces variations in the flux of the magnet and of the electro-magnet. Such variations are made manifest by a current in the induced circuit, that is to say, in the secondary of the transformer or simply of the induction coil. The greater the flux of the magnet is, the greater will be the variations produced therein, and the more intense also will be the induced current—a phenomenon that will be shown by a sound in the telephone. Another induced current is produced at the moment at which the selenium is no longer influenced by the light. We have therefore closings and openings of the circuit, and consequently an alternating current in the secondary circuit of the transformer. The frequency of this current is determined by the rotary velocity of the shutter disk.

The magnet, as I have above stated, may be replaced by an electro-magnet excited by a battery of accumulators, which, according to M. Berthier, may be recharged by the induced circuit if care be taken to put in series with the arrangement, a Nodon electrolytic valve formed of a plate of aluminium and one of lead immersed in a saline solution of phosphate of soda.

Although, up to the present, M. Berthier has desired to produce merely a demonstration apparatus and not an industrial one, his arrangement nevertheless presents a great interest from the viewpoint of the conservation of energy. It would evidently be very interesting to know the exact theory and the efficiency of it.

The second form, which is shown in Fig. 2, is designed for the production of a continuous current. The apparatus resembles the Foucault or the Faraday disk. Nevertheless, while in the Foucault experiment, the disk placed between the branches of an iron horseshoe magnet is movable, it is here stationary. What, on the contrary, is movable is the light-obscuring shutter. The arrangement is plainly shown in Fig. 2. The actinometric disk is this time formed of a sheet of mica covered with sensitive selenium. A disk of porcelain has likewise been tried. The disk is heated to the desired temperature and is then coated with selenium by moving a stick of this material over the surface of the mica, which is afterward kept at a temperature of 210 deg. C. Experiments have been made also with disks of aluminium, copper, etc. It is interesting to observe the current that thus passes over the edges of a stationary disk as the shutter is revolved before it. The edge of the disk is naturally provided with a rim formed of a strip of thin metal. A metallic plate likewise is placed in the center for collecting the current. The current produced should be perfectly continuous. Instead of magnets, it might be possible to employ electro-magnets supplied with current from the battery that runs the motor, although in such a case it is to be apprehended that effects of induction might be produced. M. Berthier purposes to make a series of experiments with slightly different arrangements, especially when employing a liquid conductor. It would be a question then of preventing electrolysis.

The form of shutter need not be exactly that shown in the picture. The apertures, for example, may have the shape of half-crescents. It is possible also to construct the shutter of a disk of mica or glass to which is glued a sector of black paper. The apparatus is inclosed in a tight box having a single window with the shutter in front. Some experiments have been made also with wires of pure nickel coated with selenium and wound into a flat ring and then submitted to luminous variations. The apparatus thus constructed presents, according to M. Berthier, some analogies with the Gramme dynamo with the armature fixed between foliated inductors.

The state of M. Berthier's health has, up to the present, prevented him from pursuing his researches actively. But he has recently secured the assistance of M. Albert Nodon, the well-known inventor of the electrolytic valve that bears his name, and it is probable that under such circumstances the experiments will be actively prosecuted, and that at a period less remote than might be expected, we shall have a definite solution of the very interesting and very important problem of which I have sketched the main features in the above notes.