as some power of the distance, produce fringes or images which increase with the distance from the direct rays.

Prop. 9.—It is proved by experiment that the fringes or images increase as the distance increases from the direct rays.

These propositions are illustrated by particular instances, and their truth is shown by experiments and by some mathematical investigations. The author concludes his paper by a few observations tending further to illustrate and confirm the foregoing propositions, and for the purpose of removing one or two difficulties which had occurred to others until they were met by facts, and also of showing the tendency of the results at which he had arrived.—*Proc. Roy. Soc.*, Jan. 10, 1850.

Translated for the Journal of the Franklin Institute.

Examinations of the Velocity of Propagation of Electricity. By MM. H. FIZEAU and E. GOUNELLE.

The authors have hit upon what appears to be an entirely different method for the delicate determination of which they were in search. After referring to the method of Professor Wheatstone and Mr. Walker, they proceed as follows: "The researches which form the subject of this memoir were made by a method different from the two preceding ones. The principle upon which it rests consists in interrupting a current at intervals of time rapidly succeeding each other, and at two points very far apart, of a conductor; and in observing upon a galvanometer the deviations produced, which vary with the number of the interruptions, and becomes a maximum for a certain number of interruptions, and a minimum for another."

"These experiments were made upon the wires of the Electric Telegraph from Paris to Rouen, and from Paris to Amiens, which were at several different times placed at our disposal by the great kindness of M. Lemaître and M. Foy, successively chief managers of the telegraphic lines. The two wires of each of these lines could be united at Rouen and Amiens, and thus present conductors of great length, the extremities of which terminated in the same room of the office of the Minister of the Interior. We had thus on the Amiens line a length of 314 kilometres, (195 miles,) on that of Rouen 288 kilometres (179 miles.) The first is constructed of iron wire, the second of iron wire for about one-third of its length, and for the other two-thirds of copper wire. This circumstance was very fortunate for our researches, since it allowed us to perceive that the velocity is not the same in the two conductors. The interruptions were produced in the following way: a wooden wheel of 50 millimetres (2 inches) (*in diameter?*) carried upon its circumference thirty-six equal divisions, eighteen of platina and eighteen of wood, alternately with each other. This wheel was mounted upon the axis of a rotary machine of M. Froment, in which a counter permits the velocity to be measured. Platina plates disposed in pairs, and insulated from each other rested upon the divisions, each pair thus forming a distinct interrupter. They may all be so regulated as to procure concordant or alternate interruptions. The experiment was arranged in several ways; the best arrangement con-

sists in the employment of a differential or double wired galvanometer, and three interrupters, A B and C. These last being so arranged that A alternates with B, and accords with C."

"Let a pile be in communication with the earth by one of its poles, by the other with A, then with one of the telegraph wires; the two wires being united at the other extremity of the line, the current returns by the other wire; this latter is put into communication with B and C, each of these latter with one of the wires of the galvanometer, finally, each of these wires with the earth. The current may thus reach the earth by two ways which are alternately opened and closed; and, according as the passage takes place by the one or other, the needle of the galvanometer is deviated in opposite directions. During the rotation of the wheel only discontinuous currents pass through the galvanometer; but it is known by the experiments of M. Pouillet, that when the interruptions succeed each other rapidly, the needle is deviated in a stable manner as if the current was continuous. In this arrangement the velocity of propagation is shown by the periodical changes in the deviations, corresponding to increased velocities of rotation, but the periods are not all alike; the second is less marked than the first; the third is scarcely sensible. For the Amiens line, the first period took place with a velocity of 9 turns per second; for the Rouen line, with the velocity of 13.58 turns."

"The experiments which we have made by this method lead to the following results:—

"1st, In an iron wire of 4 millimetres (0.16 in.) diameter electricity is propagated with a velocity of 101,710 kilometres per second, say 100,000 kilometres (62,159 miles.)

"2d, In a copper wire of a diameter of 2.5 millimetres (0.1 in.) this velocity is 177,722 kilometres, say 180,000 kilometres (111,886 miles.)

"3d, The two electricities are propagated with the same velocity.

"4th, The number and nature of the elements of which the pile is formed, and consequently the tension of the electricity and the intensity of the current, have no influence upon the velocity of propagation.

"5th, In conductors of different natures, the velocities are not proportional to the electric conducting powers.

"6th, When the discontinuous currents are propagated in a conductor, they experience a diffusion, in consequence of which they occupy a greater space at its point of arrival than at its point of departure.

"7th, The velocity of propagation appears not to vary with the section of the conductors; our experiments lead us to consider this principle as very probable.

"8th, If this principle is true, the velocity of propagation changes only with the nature of the conductor, and the numbers which we give represent the absolute velocities in iron and copper."—*Comptes Rendus de l'Acad. des Sciences de Paris, tom. xxx. p. 437.*

We cannot say that we completely understand the plan thus rapidly described in the *Comptes Rendus*, and we shall anxiously wait for further developments when the memoir is published at length. The tabulated experiments will also be of great interest. In the meantime, we may safely confine ourselves to the expression of the opinion, that the method of

MM. Fizeau and Gounelle is less advantageous for this purpose than those used by Wheatstone and Walker; and that their deduction that the intensity of the current has no influence upon the velocity of propagation is in contradiction with the results of former experiments.—ED.

For the Journal of the Franklin Institute.

Description of Simpson's Hydro-Pneumatic Lift for Furnaces and Railway Elevators. Condensed from the Practical Mechanic's Journal, Glasgow, for March, 1850.

In this apparatus the principle on which the lift is effected is that known as *Flotation*. An air-tight sheet metal case, of sufficient displacement for the greatest weight which it is designed to raise, being immersed in a well containing water, and attached by means of a large vertical pipe of the same material to an upper platform rising between guides; when the case is released, it will of course ascend, carrying upon its platform the articles to be raised. The valve apparatus for governing the motions, etc., constitutes the novelty of the machine, and is worthy of notice. The "float case" is made spheroidal, and is connected as has been described, to the platform by a hollow pipe, closed above by the platform, and below perforated, so that in the movement of the machine, its bulk shall not materially affect by a greater or less degree of immersion the usual level of water in the well. The float case itself is provided with a small pipe rising in the centre of the large one, which opens to the air above by means of a governing valve, and also serves to protect a valve rod connecting the operator on the platform, with a small screw valve in the bottom of the float case, designed for the ingress and egress of water. The large hollow pipe is also provided with a small valve above for governing the outlet of air.

An induction pipe enters at the top of the well, and is *always open*. A discharge pipe at the bottom is provided with a valve, opening outward, whose lever is weighted so as to counterbalance the pressure of water tending to open it.

The operation of the machine is as follows:—

Let us suppose the float case full of air, and at the bottom of the well which is empty; all the valves shut. If then water be allowed to fill the well, the buoyancy of the float causes it to ascend, carrying upon its platform the goods to be elevated. When it is desired to descend, open the screw valve in the float case, and its governing air valve, until a sufficient body of water has entered to destroy buoyancy, when, the air valve to the large pipe being also open, the machine will descend with any desired velocity. On approaching the bottom, the open screw valve comes in contact with the weighted lever governing the discharge, and has just had time to open it, when the float *subsides* into the bottom of the well, made of exactly the same shape as that of the float, thus opening a passage between the *float case* and the discharge pipe, permitting water to escape until its buoyancy is sufficiently restored for a *reascend*. As the float case exactly fits in the bottom of the well, (the *fit* being secured by packing,) no water is permitted to escape from the well itself.