inquire how much of the loose thinking, the hazy perception of truth, which characterize the majority of even the educated portion of mankind, might be traced back to the absence of any *definite* impressions made in childhood in connection with the instructions given to them. Outside the school-room they acquire definite impressions, but they are acquired at random, and may be wholly wanting in accuracy."

(To be continued.)

ELECTRIC TIME TELEGRAPHS.

Read before the Franklin Institute at its meeting March 17th, 1880.

By LOUIS H. SPELLIER.

There are two classes of electric clocks—the electric clock proper, or the electro-magnetic pendulum, and the electro-magnetic time telegraph. The former has been to this day more of a scientific curiosity than a useful invention. It is only the latter, the electric time telegraph, which has proved a partial success. As the name indicates, they are instruments which receive the time telegraphed. For this purpose a standard clock, which in certain intervals of time completes or breaks the circuit of a galvanic battery, is needed. Although many and various in construction, they all resemble each other very closely in their most essential parts.

They mainly depend upon the action of one electro-magnet and one armature. The latter is a piece of iron, which is attracted by the poles of the electro-magnet, when the telegraphing clock completes the circuit of a galvanic battery connected with it. As soon as the clock breaks the circuit again the armature is repelled to its former position by a spring or weight. This movement of the armature turns a wheel which drives time-indicating machinery, and is repeated as often as this machinery requires to indicate the time of the clock, which makes or breaks the electric circuit.

Such instruments work very well, if the action of the armature is needed about once every minute, but if repeated every second or two, then its imperfections become apparent. The movement of the armature is sudden and rapid. With a lightning-like velocity the armature moves toward the magnet, and is checked instantaneously in its rapid progress just at a time when nearest the magnet and most powerfully

attracted. Naturally the wheel, which receives its moving impulse directly from the armature, moves with the same rapidity and is checked as suddenly. Those sudden checks, offered to the armature and wheel, show their damaging results in a comparatively short time, and soon impair the correctness of such instruments.

In correcting these destructive evils I never succeeded completely until an entirely new system suggested itself to me, and of which the accompanying figure shows the principle.

Instead of one armature I have a number of them, *C*, fastened at equal distances around the circumference of wheel *B*. With *B* on the same axle another wheel is fastened, having as many cogs, of the peculiar shape shown in the figure, as *B* has armatures. *F* is a lever with its oscillating centre at *g*, and has a pulley, *D*, which presses against the circumference of the wheel *B* by the weight *H*. *Ii* is the electro-magnet. The electro-magnet is connected with a gal-

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vanic battery, of which the circuit is closed and opened by the oscillations of a pendulum. The instrument acts in the following manner :

When the current of the galvanic battery is closed, the armature *C* will be attracted by the electro-magnet, and move *A* and *B* in the direction indicated by the arrow, and stops as soon as *C* is directly over it. When in this position the pulley *D* rests upon the upper part of the cog, and presses against it. As soon as the electric current is disconnected, and the electro-magnet discharged of its magnetism, the pressure of the pulley *D* against the cog moves *B* in the direction indicated by the arrow, and stops moving when the pulley has reached the deepest point of the cog. This movement of *B* has brought the next armature, *C*, near to the magnet. This armature will now be attracted at the next closing of the electric current. Then *B* will be moved again, and the cog will take the first position, and the pulley *D* presses upon it, ready to move the wheel as soon as the electro-magnet is again discharged of its magnetism ; and so on, alternately, the electro-magnet and the pulley will interchange their action, and keep *B* revolving in the manner as the pendulum of the clock connects and disconnects the electric current.

The object in view, to avoid the sudden check to the armature, is hereby accomplished. No sudden check is offered to the armature, but when attracted it swings for a moment in short vibrations over the magnet before it comes to rest. It is comparatively noiseless in its movements, its sound being hardly perceptible. In this respect it is very much unlike other time telegraphs, whose clapping noise is their constant companion.

A time telegraph of this kind in operation at the monthly meeting of the Franklin Institute had, like the accompanying figure, fifteen armatures (the wheel on which they were mounted measuring five inches and one-half in diameter), and two electro-magnets. With six cells of a Daniell Battery it proved to have ample power to drive four dial works for dials 5 feet 6 inches in diameter. It may have as many electro-magnets as it has armatures. This is a circumstance of some importance, since it will increase its driving capacity with each additional electro-magnet without adding materially to the size of the instrument.

Whatever the reason may be, there is no doubt that, to this day, the time telegraphs have not received such notice as they really deserve.

Their service can be more useful and general than is mostly admitted. If we consider that we can control by one correct time-piece just as many time telegraphs to indicate true time as necessity or fancy requires, providing there is battery power enough to move them, we have reason to believe that they still may come into general use in hotels and public buildings, where true and equal time in every room of the house is desirable.

But there is still another field of great importance for the time telegraph.

It has been a problem of great perplexity, to this day, with the most ingenious minds of the horological world, how to construct clocks which will overcome the effects of wind and storm beating against the exposed clock dials of public clocks. It is true, Remontoires and Gravity Escapements have been invented to remedy the evil, and clocks may go better with them than without them; but, nevertheless, all these ingenious contrivances have almost as many evils, on account of their complication, as they are designed to avoid. And here it is where the time telegraph has its future. A well-regulated clock, kept at a place of even temperature, will show but very little variation of time. If such a clock controls a time telegraph adapted for tower or public clocks, it will show the time with only such slight variation as will hardly be noticed by the public.

One objection raised against time telegraphs—the use of the galvanic battery—can be an objection no longer. Its treatment is now almost generally understood since it has found its way into so many branches of business of every-day life. There is little room left to doubt that when the utility of the time telegraphs is once recognized it will receive more deserved notice and be brought into more general use; and the time may not be far distant when the subtle power of electricity will regulate all our better class of tower or other public clocks.

International Postage Stamps.—France and Belgium have entered into negotiations for the establishment of a joint postage stamp. If the plan is carried out the payment of small sums could be made between the two countries in stamps. Moreover, in letters requiring answers, stamps could be enclosed for the reply, a thing which is now impossible.—*Chron. Indust.* C.