engine. Scientific men in all parts of the world were now gathering the material necessary for the invention of the electric telegraph. It fell to Samuel F. B. Morse to make this knowledge practical, and in 1837 he exhibited in New York a working instrument. An experimental line between Washington and Baltimore was completed in 1844, and, on May 27th of that year, was sent the first message ever forwarded by a recording telegraph.

Consult Maxwell's "Electricity and Magnetism"; Tyndall's "Lessons in Electricity"; "Faraday's "Lectures on the Physical Forces" and "Researches in Electricity"; Noad's "Manual of Electricity"; Art. on the Microphone, in "Scribner's Monthly," Vol. XVI., p. 600; Prescott's "The Speaking Telephone, Talking Phonograph," etc.; Foster's "Electrical Measurements," in "Science Lectures at South Kensington," Vol. I., p. 264; Thomson's "Papers on Electrostatics and Magnetism"; Guillemin's "The Forces of Nature" and "The Applications of Physical Forces"; "American Cyclopedia," Articles on Electricity, Magnetism, Electro-magnetism, etc.; Smith's "Manual of Telegraphy"; Jones' "Historical Sketch of Electric Telegraph"; Watts' "Electro-metallurgy"; "Barnes' Hundred Years of American Independence," Sec. on Morse, p. 442; "Fourteen Weeks in Zoology," Sec. on Torpedo, p. 186; Gordon's "Electricity and Magnetism"; Hospitalier's "Modern Applications of Electricity" (specially commended for latest discoveries); Urbanitzki's "Electricity in the Service of Man"; Mendenhall's "A Century of Electricity"; Thompson's "Dynamo-electric Machinery"; Daniell's "Principles of Physics," and Anthony and Brackett's "Text-book of Physics."

CONCLUSION.

"Science is a psalm and a prayer."—PARKER.

NOWHERE in nature do we find chance. Every event is governed by fixed laws. If we would accomplish any result or perform any experiment, we must come into exact harmony with the universal system. If we deviate from the line of law by a hair's breadth, we fail. These laws have been in operation since the earliest beginnings of the development of our world, and all the discoveries of science prove them to extend to the most distant star in space. A child of to-day amuses itself with casting a stone into the brook and watching the widening curves; little children of ten thousand years ago may have done the same. A law of nature has no force of itself; it is but *the manner in which force acts.*

We can not create force. We find it every-where in Nature; so that matter is not dumb, but full of inherent energy. A tiny drop of dew sparkling on a spire of grass is instinct with power: Gravity draws it to the earth; Chemical Affinity binds together the atoms of hydrogen and oxygen; Cohesion holds the molecules of water, and gathers the drop into a globe; Heat keeps it in the liquid form; Adhesion causes it to cling to the leaf. If the water

be decomposed, Electricity will be set free; and from this, Heat, Light, Magnetism, and Motion can be produced. Thus the commonest object becomes full of fascination to the scientific mind, since in it reside the mysterious forces of Nature.

These various forces can be classified either as attractive or repellent. Under their influence the atoms or molecules resemble little magnets with positive and negative poles. They approach or recede from one another, and so tend to arrange themselves according to some definite plan. "The atoms march in time, moving to the music of law." A crystal is but a specimen of "molecular architecture" built up by the forces with which matter is endowed. Forces continually ebb and flow, but the sum of energy through the universe remains the same. In time all the possible changes may be rung, and the various forms of energy subside into one uniformly-diffused heat-quiver, but in that will exist the representation of all the forces which now animate creation.

XI.

APPENDIX.