Franklin's Kite Experiment

The conjecture that lightning is of the same nature as the spark from the Leyden jar or the electrical machine had gained a hold on the minds of others before Franklin. In France sparks had been drawn from a rod ninety-nine feet high, but this did not reach into the clouds. Franklin determined to send a kite into a thunder-cloud, thinking electricity from the cloud would follow the string of the kite and could be stored in a Leyden jar, and used like the charge from an electrical machine. He had felt the power of a Leyden-jar discharge, and through it had nearly lost his life. He knew that lightning is far more powerful than any battery of Leyden jars, and yet to test the truth of his theory, that lightning is an electrical discharge, he was about to draw the lightning to his hand. He knew little of conductors of electricity. Whether the cord would draw little or much of the "electric fire" he knew not. So far as he knew he was toying with death.

The kite was made of two light strips of cedar placed crosswise, and a large silk handkerchief fastened to the strips. A sharp wire about a foot long was fastened to one of the strips. To the lower end of the cord he attached a key and a silk ribbon. By means of the ribbon he held the cord to insulate it from his hand. The kite soared into the clouds, and Franklin and his son stood under a shed awaiting the coming of the "electric fire" (Fig. 17). Soon [48]the fibres of the cord began to bristle up. He approached his knuckles to the key. A spark passed. He brought up a Leyden jar and charged it with electricity from the cloud, and found that with this charge he could do everything that could be done with electricity from his machine. He had proved the identity of lightning and electricity.

FIG. 17—FRANKLIN'S KITE EXPERIMENT

FIG. 17–FRANKLIN'S KITE EXPERIMENT

Taking electricity from the clouds.

The Lightning-Rod

Some time before, he had discovered the action of a point in discharging electricity. He said: "If you fix a needle to the end of a gun-barrel like a little bayonet, while it remains there the gun-barrel cannot be electrified so as to give a spark, for the electric fire continually runs out silently at the point." In the dark you may see a light gather upon the point like that of a firefly or glow-worm. If the needle is held in the hand and brought near to an object charged with electricity, the object is quietly discharged, and a light may be seen at the point of the needle. This action of points explains the light sometimes seen on the tops of ships' masts, called by sailors "Saint Elmo's fire," and perhaps, also, the observation of

Cæsar that, in a certain African War, the spears of the Fifth Roman Legion appeared tipped with fire.

The lightning-rod was the outcome of Franklin's observations, and this was the first practical invention relating to electricity. A building may be electrified by an electrified cloud passing over it. If the building is protected by pointed rods, the electric charge will quietly escape from the points. The lower ends of the rods must be in the[49] moist earth below the surface. The lightning-rod has not proved so great a protection as Franklin supposed it would. He supposed that a lightning-stroke is a discharge in one direction only; but we now know that it is a rapid surging back and forth, and this fact accounts for the failure of the lightning-rods to furnish perfect protection. In surging back and forth, the lightning may skip from the lightning-rod to some metal object within the building, as a stove or radiator. The lightning-rod robbed the thunder-storm of its terrors to the timid, and in time dispelled the superstition of people who believed that thunder and lightning are evidence of the wrath of the Deity.

Franklin was the first to propose an answer to the question: What is electricity? He believed electricity to be a subtle fluid existing in all objects. If an object has more than a certain amount of this fluid, it is positively electrified; if less than this amount, it is negatively electrified.

The "one-fluid" theory of Franklin was soon met by the "two-fluid" theory proposed by Robert Symmer, for Franklin's theory had failed to explain why two bodies negatively electrified should repel each other. According to Symmer, an uncharged body contains an equal quantity of two different electrical fluids. An excess of one of these produces a positive charge, an excess of the other a negative charge.

Symmer's experiments are almost ludicrous. He wore two pairs of silk stockings, and found that white and black silk worn together became strongly electrified. When the two stockings worn on one foot were pulled off together, and then separated, they were found to be electrified, and[50] attracted each other so strongly that a force of about one pound was required to separate them. The two charges, negative and positive, could, however, be separated. He thought, therefore, that there are "two electrical powers," not one, as Franklin believed. His belief was strengthened by examining a quire of paper through which an electric spark had passed, and finding that "the edges of the holes were bent two different ways, as if the hole had been made in the quire by drawing two threads in contrary directions through it."

There was a long controversy regarding the two theories, and neither quite gained possession of the field. Each contained some truth, and each had its weak points. The two had more in common than men at that time thought.