FIFTY YEARS' PROGRESS IN ELECTRICAL COMMUNICATIONS

STEPHEN GRAY AND FRANKLIN

It is now two hundred years since Stephen Gray discovered that an electrical charge will move with great rapidity along certain substances, called conductors to-day. The motion of electricity began then to attract the attention of the natural philosopher, and it became the subject of many scientific researches, particularly after Franklin had demonstrated that lightning is a motion of electricity. There is no doubt that many a scientist of Franklin's time associated with the destructive power of lightning something resembling the destructive power of a projectile, something endowed with an irresistible momentum. But who would have dared to suggest in those days that moving electricity just like moving matter had a momentum? Nobody suspected in those days that the history of the electrical science of the first half of the nineteenth century would be a record of the gradual evolution of this electrical momentum concept. Oersted's discovery, in 1819, of the magnetic field of force accompanying the motion of electricity marks the first step in the progress of that evolution.

MAXWELL'S CONCEPT OF THE MOMENTUM OF MOVING ELECTRICITY

Faraday was the first to recognize that the magnetic field accompanying moving electricity, and every other magnetic field, gave to the space occupied by it a new physical state; he called it the electrotonic state and saw in the electrical forces of induction which he had discovered a manifestation of the electrical reaction opposing the change of the electrotonic state. Finally the genius of Maxwell succeeded in revealing in Faraday's electrotonic state the momentum of moving electricity. This is one of the two fundamental concepts in Maxwell's electromagnetic theory, and it was destined to play the leading part in the development of the electrical science as well as of the electrical art of telegraphy and telephony. Maxwell showed that the magnetic flux associated with moving electricity is the momentum of that motion, and that the electrical forces discovered by Faraday