

GUNPOWDER: According to the legend on the original engraving, "Thunder and lightning shaken with the hand seem to have been granted by the jealous underworld powers."

New Discoveries of the Middle Ages

by E. C. WATSON

SOMETIME during the last decade of the sixteenth century (the exact date is uncertain) a set of twenty beautifully engraved plates, entitled *Nova Reperta* (*New Discoveries*) and illustrating the most important discoveries and inventions of the Middle Ages, was executed at Antwerp by Philipp Galle from designs painted or sketched by Joannes Stradanus. These delightful engravings represent one of the early attempts to popularize new scientific discoveries—attempts which have multiplied since that time almost as rapidly as have the new inventions themselves. And it is a peculiarly interesting attempt because it appeared at the beginning of our modern scientific period. Consequently it portrays the state of science and invention—as well as of various trades and handicrafts—as they were before the "experimental method" was consciously and systematically used in either science or industry, and before the rapid acceleration in the rate of scientific invention (brought about by that method) had begun.

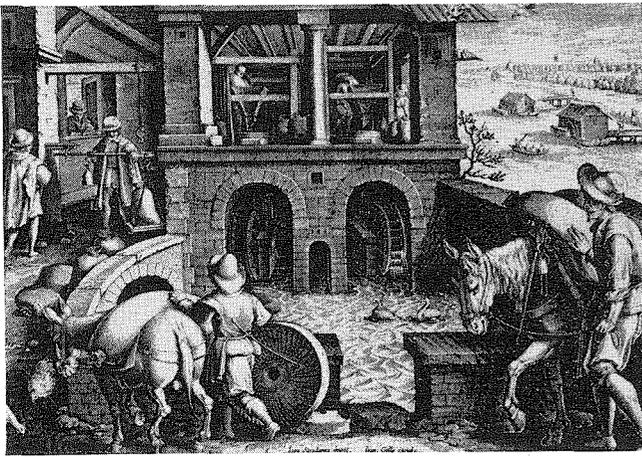
The discoveries and inventions portrayed in the *Nova Reperta* are: The Continent of America, The Magnetic Compass, Gunpowder, Printing, Clocks and Watches, Guaiacum Wood as a Remedy for Syphilis, Distillation, Silk from Silk Worms, Stirrups (it is interesting that this is rated as a discovery of equal importance to that of printing or gunpowder), Water Mills, Wind Mills, Olive Oil, Sugar, Oil Pigments for Artists, Spectacles, The Determination of Longitude from the Declination of the Magnetic Compass (this suggestion, which is credited to Peter Plancius, has turned out to be erroneous), Armor Plate, the Astrolabe, and Copper-Plate Engraving.

Each plate shows with considerable accuracy and detail the various tools and implements used and the processes followed. (Thus printing, copper-plate en-

graving, oil-painting, distillation, the manufacture of cannon, of clocks and watches, of sugar, and of olive oil, and the cultivation of the silk worm are shown very clearly as they were practiced in the sixteenth century.) The shop of a spectacle-maker, with his stock of spectacles of different types, and their use by various people, makes a most interesting picture. Quite different, but no less interesting, is the plate showing a man suffering from venereal disease and the preparation of the remedy—a decoction of guaiacum wood or lignum vitae, which, from 1508 until about 1800, was considered a certain specific for syphilis. A map of the American continent is given on the title plate and the discovery of America is correctly attributed to Columbus, with Americus Vespuccius as explorer and namer.

"The Magnetic Compass" (opposite page) shows the floating loadstone of the Middle Ages, with a navigator studying its uses, surrounded by the various instruments of his profession. The legend under this plate assigns the discovery of the magnetic compass to Flavius of Amalfi, Italy. As pointed out by Silvanus P. Thompson in his article on the compass in the *Encyclopaedia Britannica*, this was a belief which took shape early in the seventeenth century and probably arose as follows:

The historian, Flavius Blondus, in his *Italia Illustrata*, written about 1450, stated that the floating magnet (which was commonly used by Italian sailors at least as early as the twelfth century) was introduced by traders belonging to the port of Amalfi, but added that its origin was uncertain. In 1511, Battista Pio, in his *Commentaries*, repeated this statement as the first use of the magnet and quoted Flavius as his authority. Gyraldus, while writing his *Libellus de re nautica* in 1540, apparently misunderstood this reference and stated



WATER MILL: "Whoever thinks that water mills were discovered anciently is totally mistaken."



DISTILLATION: "In fire the juice of all bodies, by means of art, becomes a vigorous liquid."

that the pole-seeking property of the loadstone had been handed down as the discovery of "a certain Flavius". As time went on this statement grew into the story "that the compass was invented in the year 1302 by a person to whom was given the fictitious name of Flavio Gioja, of Amalfi."

This is a good illustration of the way in which many popular beliefs have arisen. The real inventor of the magnetic compass remains unknown; in fact it is peculiarly characteristic of the so-called discoveries of the Middle Ages that when first mentioned by historians they are already in general use.

The picture, "Spectacles", not only makes it clear that spectacles were in general use in Europe before 1600 (actually they came into use in Italy near the end of the thirteenth century), but it is of special interest because of the place (Antwerp) and the time (c. 1600) at which it was executed. For it was in Middleburg, less than 50 miles from Antwerp, in just such a spectacle-maker's shop, in 1590 or thereabouts, that a lens-grinder by the name of Zacharias Jansen combined two spectacle lenses to form the first compound microscope. And it was in a neighboring shop in the same town, in 1608, that another spectacle-maker, Hans Lippersley by name, combined two other lenses to produce the first practical telescope.

This legacy from Stradanus and Galle enables us to understand at a glance how the practical discovery of

both the compound microscope and the telescope came to be made. Indeed, we do not need to be told, as we have been, that Lippersley, while holding two lenses, one in each hand, happened to direct them towards the steeple of a neighboring church and was astonished, on looking through the nearer lens, to find that the weathercock appeared closer and more distinct—and that he subsequently fitted the lenses into a tube in order to adjust and preserve their relative distances. Nor is it surprising that, once a telescope of this kind was made, the discovery was claimed for many people. The surprise is rather that it was not made in clean-cut fashion much earlier.

Several of the plates have an added interest because of the care and detail with which many of the tools and instruments of the period are delineated. Thus, the picture entitled "The Water Mill", shows two steelyards in some detail. They are modern in type, with fixed pin pivots, and each instrument has two fulcrums—one for light, the other for heavy loads. The stop adopted to limit the movement is similar to that used in Roman times. Apparently, in the sixteenth century, farmers in the Netherlands carried their own steelyards with them when they took sacks of grain to the mill.

Taken as a whole these twenty plates, five of which are reproduced here, give a beautiful as well as a fairly accurate picture of the state of science and invention at the very beginning of the modern period.



SPECTACLES: "Spectacles are invented which clear the obscure mists of the eyes."



MAGNETIC COMPASS: "That stone has disclosed to Flavius its own hidden love of the pole."