SOLAR PHOTOGRAPHS.

Photography has proved an invaluable aid in the study of solar physics. By its help astronomers now obtain pictures of sun spots accurate in all their details, of the different phases of eclipses, and of phenomena of too short duration for the eye fully to appreciate. At the observatory of the Roman College, Rome, Italy, Father Secchi photographs the sun daily by means of the instrument represented in Fig. 1; and having carried on this operation for several years, he is now possessed of a record of occurrences on the solar surface which has served as the basis of many important conclusions regarding our luminary. By comparing these pictures, the periodicity of the spots has been determined; and from data thus obtained, astronomers have reached the belief that the sun acts not merely as a center of attraction and luminous source, but that it exercises a potent effect on magnetic phenomena.

The engravings herewith given were reproduced from Father Secchi's photographs, in order to show that astronomer's new work on the sun. Figs. 2, 3 and 4 show very perfectly the wavy, unequal, and granulated surface of the sun, as exhibited by a telescope of high power. Fig. 2 represents the normal condition of the surface projected (much magnified) on a white screen. Fig. 3 exhibits the granulations with their interstices, observed directly. Fig. 4 is a facula on the surface thrown upon the screen. Fig. 5 is a photograph of a sun spot, showing its rounded form at the moment of complete development; and in Fig. 6 are several such spots, grouped together.

The depth of the immense cavities forming the spots is usually about one third the earth's diameter, and never exceeds 4,000 miles. The cavities are by no means empty, as the resistance which they offer to the passage of luminous currents shows that they are filled with more or less transparent vapors. They are produced in the luminous exterior envelope of the sun—the photosphere—and are craters therein, filled with dark vapors which cut off the light from the lower strata. They are the result of violent crises in the interior of the solar globe, which sometimes take place over large areas with great rapidity: at other times they occur quite slowly, last for a considerable period, and are seemingly intermittent in their violence. The material which composes the penumbra of the spots, and the cloudy bridges which cross or float over the dark portion are masses of photospheric matter. These masses are the result of violent action taking place occasionally in the interior of the sun. Sometimes these actions are sudden; at others they take place slowly, and sometimes their action is renewed from time to time; and the interior trouble, of which they are but the manifestation, perseveres for a long period after their first appearances. In fact, in a great number of instances, there is a movement constantly going on, from the interior to the exterior of the sun; and this movement is shown to us by the upheaval and the projection of the luminous matter, the latter becoming visible under the form known to us as *facula*. But generally, if we study the luminous masses which are seen as spots, we find that they are comparable to vaporous clouds suspended in a transparent medium. The currents and the particles of the photosphere are driven towards the center of the spots, where they dissolve and cease to be luminous. They are often seen suspended at different heights in the solar atmosphere; and frequently the higher ones hide the lower from our view.

Solar spots are principally seen on two zones parallel to the sun's equator, one on each side of it, between 10° and 30° of latitude. The rotation of the sun was discovered by the displacement of these spots; but it is remarkable that this rotation is not similar on all points of the sun's surface. The angular speed is greatest at the equator, and diminishes as the degrees of latitude augment in number. The sun does not revolve according to the laws which we suppose to govern the movements of a solid body, whence it follows that we should regard it as a mass of fluids. The sun's rotation is accomplished in a mean period of 25 1-3 days; and we cannot as yet explain whether this rotation affects the solar atmosphere as well as the globe itself, for the interior regions are entirely hidden from us; but we can cite an indirect proof which has some importance, although it appears at first to be a little singular.

Herr Hornstein, discussing the magnetic phenomena observed at Prague, found in the movement of the magnetic needle a variation of which the period was 26·33 days. On comparing it with certain data, he attributed the phenomenon to the magnetic influence of the sun; and if we admit that the magnetic period above referred to is the same as that of the solar rotation, we find that the sun turns on its axis in 24·55 days. Magnetic phenomena thus give us a new idea of the period of solar rotation, which differs from that which we derived from study of the whole solar surface, but which is similar to that formed on a study of the sun's equatorial region.

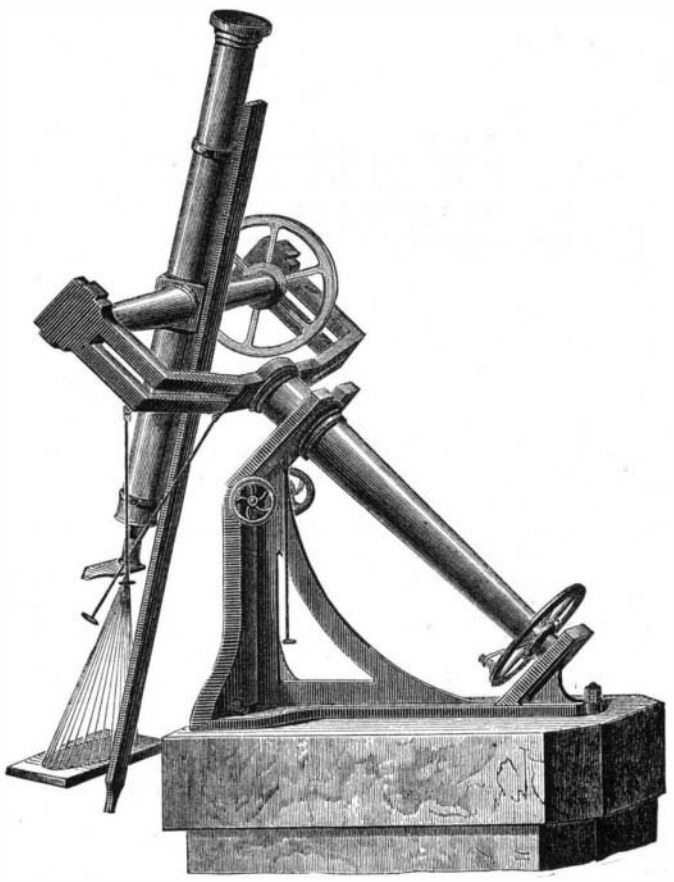


Fig. 1.—SECCHI'S SOLAR PHOTOGRAPHIC INSTRUMENT.

Fig. 2.

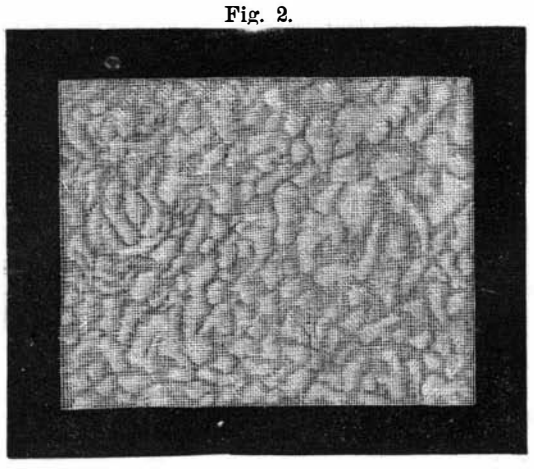


Fig. 3.

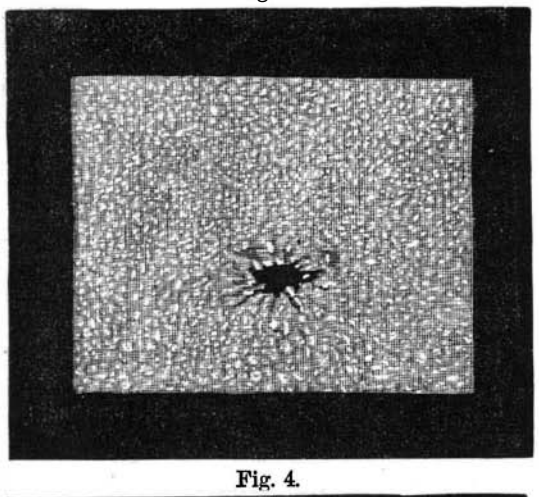


Fig. 4.

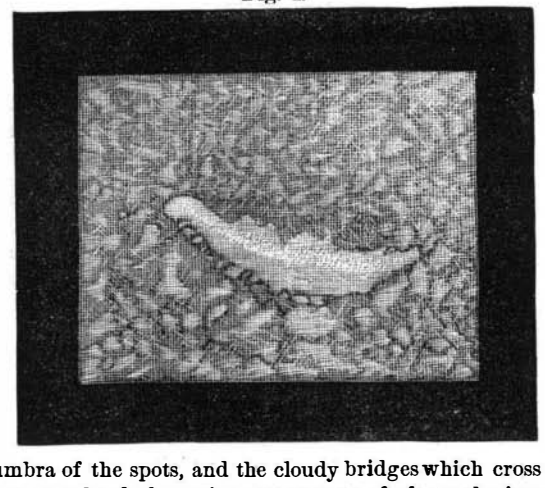


Fig. 5.

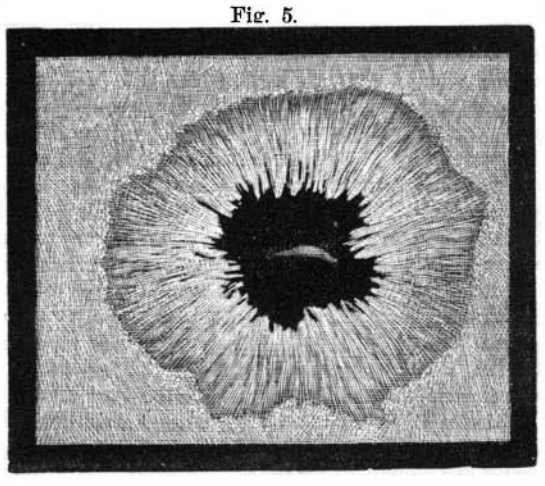
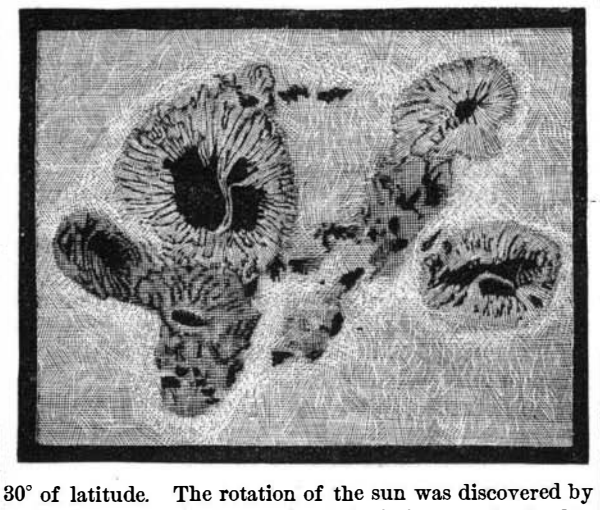


Fig. 6.

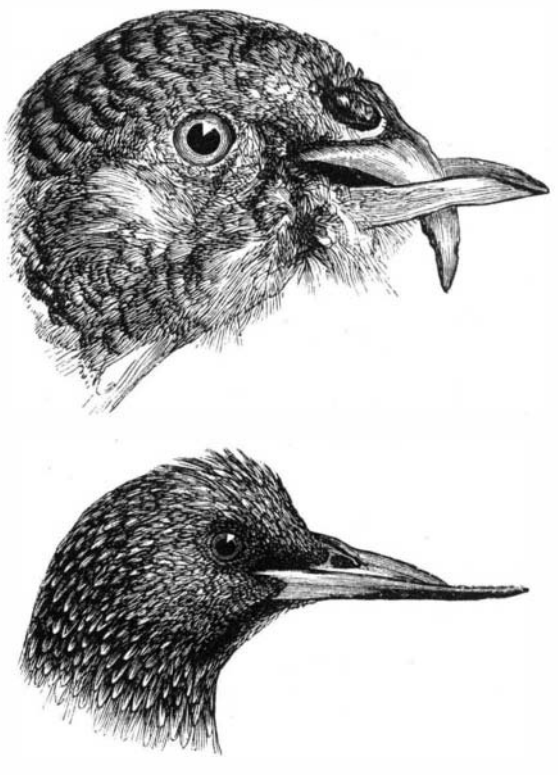


Inventions.

Among the general public it is thought that great inventions are the result of what is called "lucky hits," and that chance has more to do with them than brain work. It is undoubtedly true that the most wonderful inventions are the simplest, and that the truths on which they are founded appear obvious. However commonplace some inventions may seem when they have become familiar to everybody's understanding, it must not be overlooked that for centuries their truths had lain concealed from the busy brain of man. If the real nature of great discoveries is fairly considered, as well as the intellectual processes which they involve, none can seriously hold the opinion that such inventions have been the effect of mere accident; but, on the other hand, it must be apparent that such *soi-disant* accidental discoveries never happen to ordinary men. We believe that inventions dawn gradually on the contemplating mind; a certain fixed idea becomes, step by step, developed, by patiently weighing the *pros* and *cons*, until at last a sort of electric spark convulses the brain, momentarily sending a glow of joyful spasm to the heart, and true genius is born to the world.—*British Mail.*

ORNITHOLOGICAL DEFORMITIES.

Mr. W. B. Tegetmeier, a naturalist whose writings on ornithology are widely studied in Europe, asserts that the struggle for life finds one of its best examples in the malformations which are occasionally found in animals of different species. A whale has been known to hurt its lower jaw so that it could not close its mouth; yet it lived and thrived, and when killed it was in excellent condition. He also states that he has in his possession the head of a salmon which weighed 12 lbs., of which the upper jaw had been entirely torn off. Yet it lived, and attained a fair average development. In birds, too, such deformities are not uncommon; and our engraving shows two remarkable instances.



The first specimen is the head of a hen pheasant, of which the upper mandible is so curved that it has cleft the lower mandible in half, and grown down so as to cause the bird to die of starvation. The second instance is that of a starling, of which the lower mandible grew to an inordinate length. The reason of this prolongation cannot be found in any necessity for it; for the bird uses its beak simply to dig for worms in soft earth, and the prolongment was formed entirely of a species of horn. In caged birds, such formations can be accounted for, as the captives do not employ their bills as they do in their native state. Sometimes the protuberance has been clipped off, but it rapidly grows again.