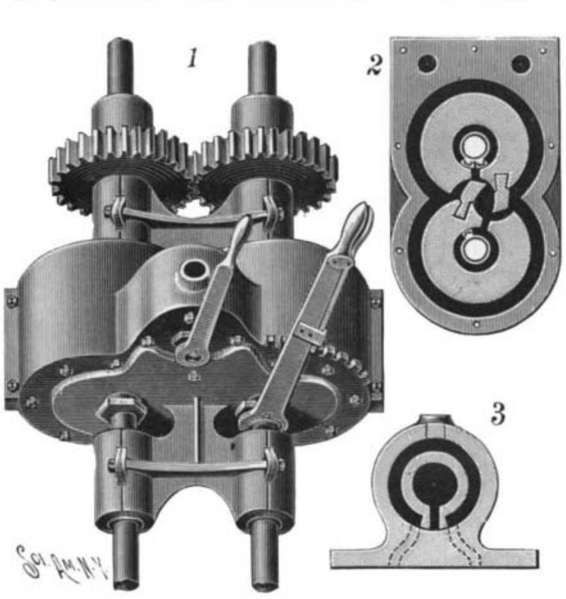
Action of Cathode Rays.

Goldstein was the first to discover that common salt is colored brown and potassium chloride violet by the action of the cathode rays, says The Engineering and Mining Journal. The discoverer attributed this phenomenon to some physical change undergone by the salts. Wiedemann and Schmidt attributed it to their partial conversion into subchloride, and Giesel actually succeeded in preparing similarly colored subchlorides in a chemical way. But the chemical hypothesis is now invalidated by the researches of R. Abegg. He obtained the salts in question in a pure and finely powdered state, so as to be able to color them all through. His first experiments showed that the coloring does not spoil the vacuum in the tube, as it would if chlorine were evolved. The salts were rendered colorless again by high exhaustion, producing rays with a strong heating effect. The substances could be colored and uncolored any number of times in succession. When the colored salt was dissolved it produced no reducing or alkaline reaction. When undissolved in a saturated solution it retained its color. All this tells against a chemical change. Moreover, an easily reduced chloride is not reduced by the cathode rays. It is well to remember that the coloration of these alkaline salts is a phenomenon not produced by light. On the other hand, cuprous chloride is blackened by light, but not acted upon by the cathode rays.

AN IMPROVED ROTARY ENGINE.

In the engine shown in the illustration all the movements are rotary, enabling the engine to be run at very high speed, as high as 8,000 to 10,000 revolutions per minute being claimed for it. It is fitted with valve gears adjustable to cut off the steam as desired, thus enabling the steam to be used expansively, and the valves are arranged to take up their own wear and always remain perfectly tight. The invention has been patented by Carl Engberg, of St. Joseph, Mich. Fig. 1 represents the engine in perspective, Fig. 2 being a sectional view of the cylinders and pistons and Fig. 3 a section of the steam chest and inlet valve. The shafts on which the pistons are secured are connected with each other by gear wheels, one of which is adjustable to bring the pistons in proper relation to each other, at the same time permitting the rotary motion of one shaft to be transmitted to the other, and in the body of each piston is dovetailed a piston head, the piston heads being adapted to pass each other in recesses formed in the pistons. The ends of the pistons, as well as their outer faces and the cylindrical heads adjacent



ENGBERG'S ROTARY ENGINE.

thereto, are fitted with suitable packing to prevent leakage and take up wear. The recesses at either side of the piston heads are connected by ports with annular recesses in the pistons, surrounding the shaft, and into each of these recesses extends a sleeve whose outer end is adapted to receive a hand lever adapted to be locked to a notched segment, whereby the steam may be cut off at different points of the revolution of the piston. The annular recesses are also connected with ports leading to the steam chest, the inlet valve controlling which may be readily adjusted to reverse the engine. The engine is perfectly balanced, so that it can be run at a high speed without the least vibration, being thus especially valuable for running dynamos, and is very light for the power it is designed to develop.

PHOSPHORUS may be prepared in the electric furnace from calcium phosphate. A mixture of this salt with carbon and sand or alumina is heated in an atmosphere of some gas neutral to phosphorus, such as coal gas, and the phosphorus which distills over is collected under water. According to Mr. Readman, 86 per cent of the phosphorus contained in the original mixture is obtained, and the product is found to be very pure.—Stahl und Eisen.

THE PLANET VENUS.

Of the planets, Venus is the one that approaches nearest to the earth; and her dimensions are almost the same as those of the latter. Nearer to the sun than we are, she effects her revolution around it in 224½ days; but her distance from the earth greatly varies. As her distance from the sun is about two-thirds of the radius of the terrestrial orbit, it will be seen that when she is in inferior conjunction, that is to say, between us and the sun, her distance from the earth is only a third of that of the sun from the latter. Her apparent dimensions naturally vary in inverse proportion; and, moreover, she presents the phenomenon of phases. At the epoch of inferior conjunction she turns toward us that one of her two hemispheres which is not illuminared and is consequently invisible to us.

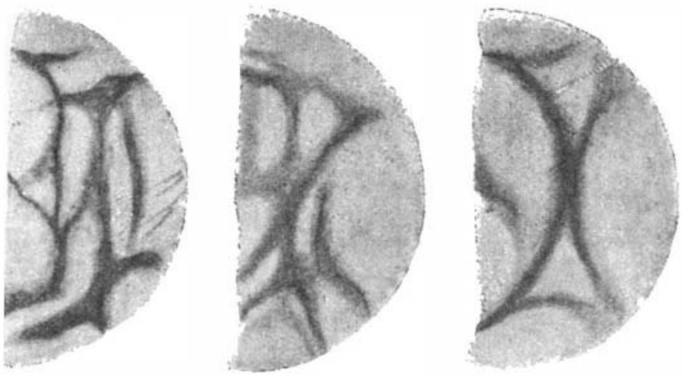


Fig. 2.—VENUS AS OBSERVED BY M. FONTSERE.

Fig. 1.—VENUS AS OBSERVED BY SIR WILLIAM HERSCHEL.

A few days afterward she appears to us in the form of a slender crescent, which continues to widen more and more in measure as she seems to become more distant from the sun on the west side. It is then that we see her shining in the morning before sunrise and that she is called the "Morning Star." She gradually assumes the form of a half moon, and then the visible part further enlarges, and finally comes the superior conjunction, in which she presents to us the whole of her illuminated hemisphere. Unfortunately, she then appears alongside of the sun and is lost in the splendor of his light. Then her apparent figure undergoes the same modifications in an opposite direction, while she appears in the evening to the east of the sun until the epoch of the new inferior conjunction. It must be added that, on account of the variations in the distance of Venus from the earth, the apparent diameter of the planet is so much the greater in proportion as the phase is more pronounced. It is when she appears in the form of a slender crescent that her diameter seems greatest. Fig. 4 shows the different aspects of the planet, with their relative apparent sizes. We shall not dwell upon this farther, but we have thought it well to recall all these circumstances in order to show how unfavorable they are for observations; added to which, among other difficulties, is the fact that we never see the planet's entire disk. So it is not surprising that the knowledge that we possess as to this planet is much less advanced than that which we have been able to acquire concerning the moon or the planet Mars.

There is one thing certain, however, and that is that Venus is surrounded by an atmosphere much denser and much higher than that of the earth. The existence and thickness of this atmosphere reveal themselves to our eyes (1) by the penumbra that accompanies the internal limit of the crescent, and that corresponds to the twilight of the places on Venus for which the sun rises and sets; (2) by the prolongation of the horns of the crescent beyond their geometrical limit; (3) by the fact that the external edge of the planet is always more brilliant than the central region; and (4) by the observations made at the time of the last passage of Venus over the sun's disk, and which showed, at the moment at which Venus' disk had half entered upon that of the sun in the form of a black semicircle, that the part of Venus remaining external to the sun was surrounded by a narrow luminous ring produced by the illumination of the atmosphere (Fig. 5). M. Bouquet de la Grye, who has discussed these observations, estimates that the atmosphere of Venus is five times higher than that of the earth. Finally, spectrum analysis has shown aqueous vapor in this atmosphere, and hence it is allowable to conclude that more or less opaque clouds exist. So this atmospheric stratum, which acts as a veil to conceal the solid part of the planet from us, constitutes still another difficulty.

The first problem to be solved would be that of the determination of the rotation of the planet and of the position of its axis. Now, as regards this, the opinions of astronomers have singularly varied. The reason of this is that, in order to solve the problem, it would be necessary to distinguish persistent spots upon the surface of the planet and follow their apparent motion, as has been done with the moon, the sun, Mars and Jupiter. Unfortunately, we see almost nothing upon the planet Venus. Many astronomers have never seen here anything but a surface of a uniform white. Others have seen, or thought they have seen, dark or white spots. But such spots are scarcely perceptible and without exact contours, and are nothing more than fugacious and ill-determined shadows. Another curious circumstance is that, although the drawings made by the same observer present some resemblances to each other, those obtained by different observers are entirely dissimilar, as one may convince himself by examining the engravings which accompany this article. It has never been possible to identify upon Venus, as it has been upon Mars, two spots seen by different observers. So the maps of Venus that have been published a little too hastily are absolutely illusory.

The first observations date back to Dominique Cassini, who made them at Bologna in 1666 and 1667. We give (Fig. 3, No. 1) one of Cassini's sketches repro

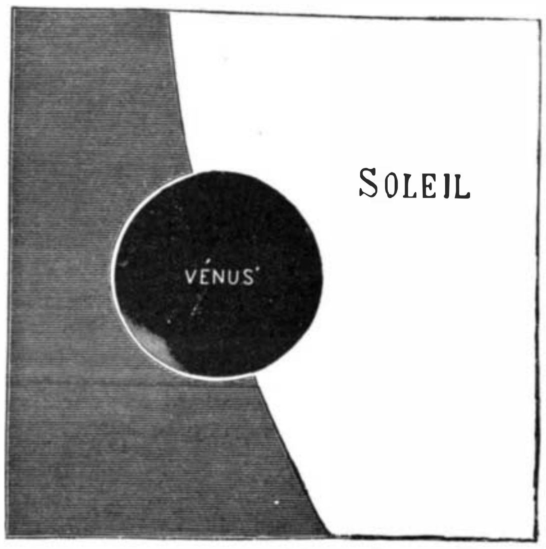


Fig 5.—LUMINOUS RING PRODUCED AROUND VENUS BY THE REFRACTION OF THE SOLAR LIGHT THROUGH ITS ATMOSPHERE AT THE MOMENT OF ITS PASSAGE OVER THE SOLAR DISK.

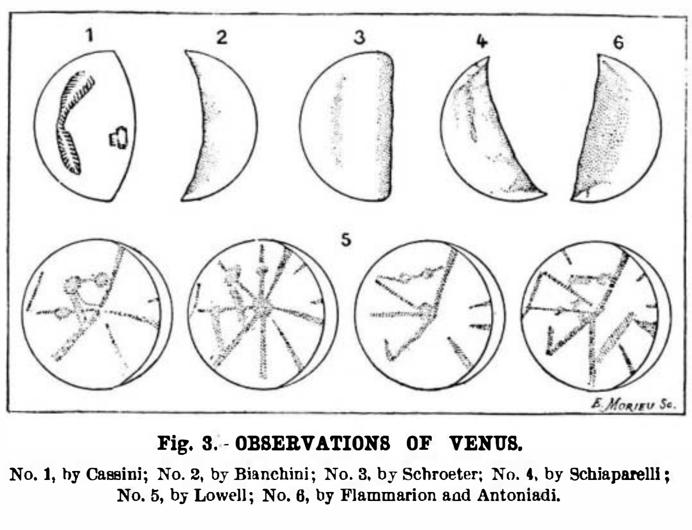


Fig. 3.—OBSERVATIONS OF VENUS.

No. 1, by Cassini; No. 2, by Bianchini; No. 3, by Schroeter; No. 4, by Schiaparelli; No. 5, by Lowell; No. 6, by Flammarion and Antoniadi.

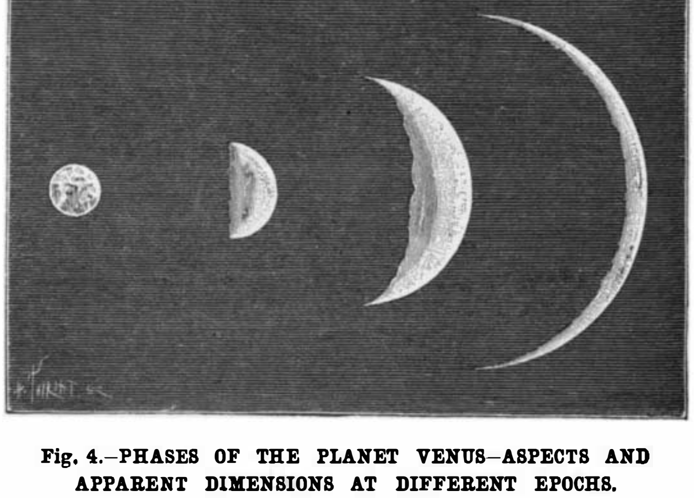


Fig. 4.—PHASES OF THE PLANET VENUS—ASPECTS AND APPARENT DIMENSIONS AT DIFFERENT EPOCHS.