the hole is precisely what would be cut off by **a** disk which fits the hole, and the complement of fig. 1, in which the fight and shade are interchanged, would give therefore the effect of four equal sources of light shining on a wall through a circular hole. The umbra in the former case becomes the fully illuminated portion, and vice versa. The penumbra remains the penumbra, but it is now darkest where before it was brightest, and vice versa.

Thus we see how, when a small hole is cut in the window- shutter of a dark room, a picture of the sun, and bright clouds about it, is fôrmed on the opposite wall. This picture is obviously inverted, and also perverted, for not only arc objects depicted lower the higher they are, but also objects seen to the right are depicted to the left, *&c.* But it will be seen unperverted (though still inverted) if it be received on a sheet of ground glass and looked at from behind. The smaller the hole (so far at least as geometrical optics is concerned) the less confused will the picture be. As the hole is made larger the illuminated portions from different sources gradually overlap; and when the hole becomes a window we have no indications of such a picture except from a body (like the sun) much brighter than the other external objects. Here the picture has ceased to be one of the sun, it is now a picture of the window. But if the wall could be placed 100 m. off, the picture would be one of the sun. To prevent this overlapping of images, and yet to admit a good deal of light, is one main object of the lens which usually forms part of the camera obscura *(q.v.).*

The formation of pictures of the sun in this way is well seen on a calm sunny day under trees, where the sunlight penetrating through small chinks forms elliptic spots on the ground. When detached clouds are drifting rapidly across the sun, we often see the shadows of the bars of the window on the walls or floor suddenly shifted by an inch or two, and for a moment very much more sharply defined. They are, in fact, shadows cast by a small portion of the sun’s limb, from opposite sides alternately. Another beautiful illustration is easily obtained by cutting with a sharp knife a very small T aperture in a piece of note paper. Place this close to the eye, and an inch or so behind it place another piece of paper with a fine needle-hole in it. The light of the sky passing through the needle-hole forms a bright picture of the T on the retina. The eye perceives this picture, which gives the impression of the T much magnified, but turned upside down.

Another curious phenomenon may fitly be referred to in this connexion, viz. the phantoms which are seen when we look at two parallel sets of palisades or railings, one behind the other, or look through two parallel sides of a meat-safe formed of perforated zinc. The appearance presented is that of a magnified set of bars or apertures which appear to move rapidly as we slowly walk past. Their origin is the fact that where the bars appear nearly to coincide the apparent gaps bear the greatest ratio to the dark spaces; *i.e.* these parts of the field are the most highly illuminated. The exact determination of the appearances in any given case is a mere problem of convergents to a continued fraction. But the fact that the apparent rapidity of motion of this phantom may exceed in any ratio that of the spectator is of importance—enabling us to see how velocities, apparently of impossible magnitude, may be accounted for by the mere running along of the condition of visibility among a group of objects no one of which is moving at an extravagant rate.

SHADWELL, THOMAS (c. 1642-1692), English playwright and miscellaneous writer, was bom about 1642, at Santon Hall, Norfolk, according to his son’s account. He was educated at Bury St Edmund’s School, and at Caius College, Cambridge, where he was entered in 1656. He left the university without a degree, and joined the Middle Temple. In 1668 he produced a prose comedy, *The Sullen Lovers, or the Impertinents,* based on *Les Fâcheux* of Molière, and written in avowed imitation of Ben Jonson. His best plays are *Epsom Wells* (1672), for which Sir Charles Sedley wrote a prologue, and the *Squire of Alsatia* (1688). Alsatia was the cant name for Whitefriars, then a kind of sanctuary for persons liable to arrest, and the play represents, in dialogue full of the argot of the place, the adventures of a young

heir who falls into the hand of the sharpers there. For fourteen years from the production of his first comedy to his memorable encounter with Dryden, Shadwell produced a play nearly every year. These productions display a genuine hatred of sbams, and a rough but honest moral purpose. They are disfigured by indecencies, but present a vivid picture of contemporary manners.

Shadwell is chiefly remembered as the unfortunate Mac Flecknoe of Dryden’s satire, the “ last great prophet of tautology,” and the literary son and heir of Richard Flecknoe:—

“ The rest to some faint meaning make pretence,

But Shadwell never deviates into sense.”

Dryden had furnished Shadwell with a prologue to his *True Widow* (1679), and in spite of momentary differences, the two had been apparently on friendly terms. But when Dryden joined the court party, and produòêd *Absalom and Achitophel* and *The Medal,* Shadwell became the champion of the true-blue Protestants, and made a scurrilous attack on the poet in *The Medal of John Bayes: a Satire against Folly and Knavery* (1682). Dryden immediately retorted in *Mac Flecknoe, or a Satire on the True Blue Protestant Poet, T.S.* (1682), in which Shadwell’s personalities were returned with interest. A month later he contributed to Nahum Tate’s continuation of *Absalom and Achitophel* satirical portraits of Elkanah Settle as Doeg and of Shadwell as Og. In 1687 Shadwell attempted to answer these attacks in a version of the tenth satire of Juvenal. At the Whig triumph in 1688 he superseded his enemy as poet laureate and historiographer royal. He died at Chelsea on the 19th of November 1692.

His son, Charles Shadwell, was the author of *The Fair Quaker of Deal* and other plays, collected and published in 1720.

A complete edition of Shadwell’s works was published by his son Sir John Shadwell in 1720. His other dramatic works are—*The Royal Shepherdess* (1669), an adaptation of John Fountain’s *Rewards of Virtue·, The Humorist* (1671); *The Miser* (1672), adapted from Molière; *Psyche* (1675); *The Libertine* (1676); *The Virtuoso* (1676); *The history of Timon of Athens the Man-hater* (1678),—on this Shakespearian adaptation see O. Beber, *Shadwell's Bearbeitung des... Timon of Athens* (Rostock, 1897); *A True Widow* (1679); *The Woman Captain* (1680), revived in 1744 as *The Prodigal·, The Lancashire Witches and Teague O'Di'velly, the Irish Priest* (1682); *Bury Fair* (1689); *The Amorous Bigot, with the second part of Teague O'Divelly* (1690); *The Scowerers* (1691); and *The Volunteers, or*

*Stockjobbers,* published posthumously (1693).

SHĀFI'Ī [Mahommed ibn Idrīs ash-Shāfi'ī] (767-820), the founder of the Shāfi'ite school of canon law, was born in a.h. 150 (a.d. 767) of a Koreishite (Quraishite) family at Gaza or Ascalon, and was brought up by his mother in poor circumstances at Mecca. There, and especially in intercourse with the desert tribe of Hudhail, he gained a knowledge of classical Arabic and old Arabian poetry for which he was afterwards famous. About 170 he went to Medina and studied canon law *(fiqh)* under Malik ibn Anas. After the death of Malik in 179 legend takes him to Yemen, where he is involved in an 'Alid conspiracy, carried prisoner to Bagdad, but pardoned by Hārūn al-Rashîd. He was certainly pursuing his studies, and he seems to have come to Bagdad in some such way as this and then to have studied under Hanifite teachers. He had not yet formulated his own system. After a journey to Egypt, however, we find him in Bagdad again, as a teacher, between 195 and 198. There he had great success and turned the tide against the Ḥanifite school. His method was to restore the sources of canon law which Abū Ḥanīfa, had destroyed by inclining too much to speculative deduction. Instead, he laid equal emphasis upon the four—Koran, tradition, analogy, and agreement. See further, under Mahommedan Law. In 198 he went to Egypt in the train of a new governor, and this time was received as the leading orthodox authority in law of his time. There he developed and somewhat changed the details of his system, and died in 204 (a.d. 820). He was buried to the south-east of what is now Cairo, and a great dome (erected *c.* a.d. 1240) is conspicuous over his tomb.

See F. Wüstenfeld, *Schāfi'iten,* 31 ff.; M. J. de Goeje in *ZDMG.* xlvii. 106 ff.; C. Brockelmann, *Geschichte,* i. 178 ff.; M.G. de Slane’s transl. of Ibn Khallikan, ii. 569 ff., *Fihrist,* 209, Nawawi’s *Biogr.* Dict. 56 ff. (D.B. Ma.)