Optical Appearance of Cut Lines in Glass.

The use of high powers in delicate investigations renders it necessary that the microscopist should study the character of appearances which arise from optical laws, and which can only be rightly interpreted by referring them to forms and structures to which they bear no real or exact resemblance. A short time since, the writer called attention to the deceptive nature of the appearances presented by the fine cracks in silica films; and further observations show that if the finest or narrowest of such marks are select ed for examination, the chances of obtaining perfect illusion are increased by the amount of magnification and the perfection of the objectives employed. Delicate interference bands, pseudo-beading, etc., look more real with well corrected object glasses than with bad; and careful illumination will often add to the structural aspect of mere optical effects. The edges of silica cracks differ from edges of minute furrows cut in glass, being smooth instead of jagged. The latter as well as the former are well worth study. Preparatory to examining such furrows as are cut with diamonds in glass for micro meters or diffraction gratings, it is well to notice the edges of thin glass cut for slide covers. If half a dozen or more thin glass squares are held close together, and viewed, edges upward, as transparent objects, a variety of curious optical effects will be seen, arising from interfering reflections and refractions. The examination should begin with an inch or two thirds, after which half inch, and quarter or one fifth will be advantageously employed. It is easy to focus parts of the glasses' edges, so as to show their true form; but portions a little in or out of focus will show beads, appearances like columns of Egyptian architecture, etc. Most of these optical appearances are sufficiently hazy or confused to give warning of their true nature; but generally some will be found so sharp and clear that, if viewed separately, they may easily mislead a practised observer. In making these experiments, it is best to have handy a box containing at least several dozens of the thin glasses, as some sets will prove much more interesting than others. They should be viewed with their edges parallel to the plane of the objective, and also at various angles. The corners of the squares should also be looked at.

Lines cut in glass for micrometers or diffraction gratings are usually filled up with finely divided black lead, and the same material has been employed in the writings and patterns made with the Peter's machine. This substance of course modifies the appearances. To see them in the simpler form, recourse was had to Mr. Ackland (Horne and Thornthwaite), who ruled several sets of fine lines, each on glass slides, at varying distances 1—2000'', 1—3000'', and 1—4000'', and mounted them with Canada balsam, so that they could be safely used with immersion lenses. One set was not covered or mounted in any way.

Those who have examined very minute writing done by the late Mr. Farrants with the Peter's machine will be aware that even when a very fine diamond point is used, the incision partakes more of the character of a scratch than of a clean cut. It seems impossible to cut glass with a smooth, clear edge, such as certain metals readily give with a sharp tool. A line cut in glass is thus a furrow, more or less rough at the bottom and sides, and when viewed correctly under the microscope, has the appearance of a narrow depression less transparent than the adjacent spaces. It is difficult to get a really correct view. Even under favorable circumstances of illumination and correction, the edges of a cut are apt to appear as two raised lines.

Many instructive optical appearances, which might bewilder the observer if the character of the object were not known, may be easily produced, as the following notes will show. The observations are made with Powell and Lealand's immersion one eighth and Ross's four tenths, condenser aperture 109°. Using central stop, A, and varying inclinations of mirror. Paraffin lamp. (1*a*) Cuts as rounded bands; interspaces flattish furrows. The bands illuminated on right side, shaded on left. Tint of lightest part of furrows bluish. (2*a*) Flattish bands and rounded furrows, the former slightly shaded on left; tint of shading bluish. (3*a*) Oblique rounded furrows with narrow blue ridges; broadish bands with narrower elevated bands up their centers, light on right side, shaded deeply down the furrowed side on left.

Same condenser 109°, two radial slots forming obtuse angle. Angle of mirror varying. (1*b*) Broad, flat spaces, narrow, shaded, and elevated ridges. (2*b*) Ridges four times as wide as No. 1, with rounded tops. (3*b*) Narrowish grooves, something like actual object. (4*b*) False ridges, puzzling to count and hollow.

Same condenser 109°, two rectangular radial slots. Angle of mirror varied. (1*c*) Half round hollows, with rod-like ridges in the middle; rounded interspace elevations somewhat lower than ridges and between them. (2*c*) Narrower ridges; nearly flat spaces. (3*c*) Appearance of additional ridges, strongly shaded on left. (4*c*) Narrow ridges, shaded on right; flattish spaces, and low ridges, with narrower shelving shade spaces down to ridges, etc., etc.

Same condenser, 109°; one radial slot which was rotated to various angles. Angle of mirror varied. (1*d*) Each cut made into a flattish space, with two narrow raised edges, shaded on left. (2*d*) Cuts made into flattish, ribbon-like elevations, with raised edges. (3*d*) Interspaces raised, with rounded edges; cuts made to look flattish, and at lower level. (4*d*) Appearance of additional and imperfect ridges. (5*d*) Series of imbricated and shaded bands.

In the lines cut by Mr. Ackland no attempt was made to produce the narrowest possible furrows. The width of furrows found practically convenient for micrometers was only slightly deviated from, as some cuts were a little deeper than others, and thus caused the wedge-shaped diamond point to open the furrows a little wider. The interspaces of the narrowest were much wider than the cuts. It is obvious that a cut wide enough to be distinctly seen, under given magnification, will present to view two linear edges, and thus be reckoned as two lines, if its true character be not considered.

Cuts very close together may, if the cohesion of the glass and the perfection of the cutting tool permit, be wider than their interspaces.

It will be seen that in the preceding statements only one instance is mentioned of appearances agreeing tolerably well with the real facts. It must not be inferred from this that it is not easy to exhibit moderately fine cuts correctly, or very nearly so. The object of this paper was to select a number of appearances all looking as if they might correspond with the facts, and all differing more or less from them.

Those who study the most vexatious diatoms or Nobert's test lines must, it appears to the writer, not only take into account what they do se , but what they ought to see, provided the object has a certain definite structure, and certain powers of producing optical images under given conditions.

ON A NEW CONNECTION FOR THE INDUCTION COIL.

By Prof. Edwin J. Houston, in the Journal of the Franklin Institute.

The following experiments were made at the Central High School of Philadelphia, with a view of increasing the quantity of the spark of the induction coil wi hout greatly diminishing its length. The instrument used was made by Ritchie, of Boston, and will throw the spark six inches in free air.

One of the poles or ends of the secondary wire was connected with the earth by a copper wire, attached to a gas pipe. The other pole was connected with a wire, which rested on a large lecture table holding the coil. On turning the break piece, the electricity, instead of being lost by passing along the wires to the earth, jumped from the pole connected with the table to that connected with the earth. The thickness of the spark was greatly increased, its length diminished, and its color changed to a silvery white, as when a Leyden jar is placed in the path of the discharge.

While the electricity is flowing between the points, long sparks may be drawn from any part of the table, or from any metallic article within eight or nine feet of the coil. On one occasion, the gas was ligh ed by a spark drawn from the finger of a person standing on the floor. The gas pipe being in almost perfect connection with the earth, the spark must have been given to it from the body of the person.

On another occasion, one wire was attached to the gas pipe, as before, and the other to a stove, whose pipe connects with that of another stove in an adjoining room. The thickness of the spark was greatly increased. Sparks were drawn from the distant stove, and even from a small steam engine, which latter was fully thirty feet from the coil. In all the experiments it was found necessary to insulate the handle of the break piece, as a slight shock was experienced at every break. The poles being kept at a distance from each other less than the insulating power of the coil, six inches, no danger of injuring the instrument was apprehended. In one instance sparks were drawn, in a room underneath the adjoining room, from a wire which connected with the table on which the coil rested.

These facts showing great loss of the electricity, but indicating the need for a large conductor, probably to allow the rapid discharge of the secondary wire, a large insulated conductor was extemporized, by placing some old tin stills and percolators on large glass jars. On connecting one of the poles with this conductor, and the other with the gas pipe, the quantity of the spark was increased, though there was reason to believe that, with a larger conductor, better results would have been obtained. The conductor was then divided into two, of about equal size, which were connected with the poles. The quantity of the spark was increased, with, however, great diminution in the length. By successively diminishing the size of one of the conductors, and increasing that of the other, the length of the spark was increased, without any sensible diminution in its quantity, until, when one of the conductors was less than one square foot in surface, a fine quantity spark of abont five inches was obtained.

It will be noticed that this connection is somewhat similar to that used in the common cylinder or plate machine, in which one of the conductors, generally the negative, is connected with the earth, and the quantity of the electricity thereby increased.

In all the experiments in which one pole was in partial connection with the earth, as when it rested on the table, the loss of electricity must have been very great, for several gas and water pipes were in connection with the table. If, then, the table merely serves as an imperfectly insulated conductor, which allows the rapid induction of electricity in the secondary wire by its rapid discharge, and thereby, notwithstanding the loss, gives so great an increase in the quantity of the spark, it would seem that if, instead of the table, an insulated conductor of very large surface were used, a much greater increase in quantity would be obtained.

It would seem from the above experiments, that the maximum increase will be obtained when one of the poles is connected with an insulated conductor, say several hundred square feet in surface, and the other with the earth.

Cultivation of Rice.

In preparing the land for rice, the ground is cleared, embanked and ditched in a thorough manner, and is often laid out into independent fields, so that a certain number of hands can complete any one operation connected with the culture of the rice, in a single day. The ditches are often five feet wide, and as many deep, and the main one is sometimes large enough to be used as a canal in boating the rice in large flats, from the fields to the place of stacking. The land is plowed or dug over with the hoe early in the winter, and is kept under water during the warm changes in the weather. In March, the ground is left to dry, and made ready for the seeds. Trenches for the same are run at right angles with the drains from thirteen to fifteen inches apart, with a four inch trenching hoe. From April till the middle of May, the seed is scattered in these trenches at the rate of about two and a half bushels to the acre. The seed is sown lightly covered with the soil, and the plan has been to let in the water upon the land for several days after the seed is put in, or until it sprouts. Latterly it is considered better to stir the seed in clayey water the day before sowing, as the clay adheres to the seed so that it remains in the trenches when the water is let on, if not covered by the soil. After the water stands from four to six days on the sprouts, it is let off, and when the plants are about five weeks old, the first hoeing takes place. The plants are again hoed in ten days, and then the "long water" is put on for two weeks, at first deep for four days, afterwards gradually diminishing the depth of water. After two more hoeings, the joint appears in the plant, and the "joint water" is let on to remain a few days before the grain is ready to be cut with the sickle.

Rice grows much like wheat, with stalks from four to six feet high. It is closer jointed than wheat, with leaves resembling those of the leek, and the seed is inclosed in a rough, yellow looking husk. The average yield on the low land is about forty bushels to the acre, a bushel weighing usually forty-five pounds.

South Carolina is the most successful rice growing State in the Union, and her rice commands the highest prices in market. It is said that the seed was first introduced into the State accidentally, from a Madagascar vessel that put into Charleston in 1694

It was formerly customary for the planters to have their slaves separate the rice from the outside husk by pounding in small hand mortars. Each male hand had his task allotted him, of pounding three pecks before breakfast, and the same amount after the day's work was over in the field. It is now done by machinery at the rice mill. The mill is provided with long upright wooden pestles, which pound the rice a certain number of strokes in long wooden mortars. After undergoing this process the rice is cleaned and then passed over wire sieves, so arranged that the small and broken grain falls through the fine meshes in the sieve, the large and perfect grain through the larger ones. In this way the various grades of rice are assorted for market.

WOVEN WIRE MATTRESSES.

In almost every newspaper one takes up, the eye meets a very artistic engraving of a mattress, fabricated in wire, and, accompanying it, an advertisement of the Woven Wire Mattress Company, Geo. C. Perkins, Secretary, Hartford, Conn.

In the SCIENTIFIC AMERICAN about a year and a half ago, when the manufacture of these mattresses was in its infancy, and before some of the improvements since added were made, we published an engraving of the article, which elicited considerable inquiry from managers of hospitals and other public institutions, in various parts of the United States, and from some of the warmer countries in Middle and South America.

From the time of the fall exhibition of the American Institute of 1869, when the energetic secretary of the company first exhibited them, the wire mattress has been gaining favor with the public, until it is now on sale in nearly all cities and large towns in the United States.

The company, we learn, is turning out several hundred beds a week, and the demand for hospitals, steamships and private use is constantly increasing.

The mattresses are durable, cool for warm weather, comfortable to lie upon, and insects avoid them.

A MANUFACTURER of Easthampton has offered an endowment of $500,000 to Amherst College, on condition of the name being changed to "Williston University"

A RAILROAD of 30 inch gage, 11 miles in length, is to be constructed in Green county, Tenn. It will cost $20,000 only

PATENT OFFICE DECISION.

Henry Moule and James Bannehr—Appeal from Examiner-in-Chief. March 31, 1871.—In the matter of the application of Henry Moule and James Bannehr, for letters patent for Improvements in Earth Closets.—Applicants have invented, and in their specification have described, a particular form of mechanism adapted to the earth closet, and which, if new, will entitle them to a patent. The claims set up are in the following language:

1. The application of dry and powdered earth, in closets and commodes, to the excrementitious matters deposited therein.

2. In combination with an excrement chamber and a hopper, or other receptacle, for deodorizing material, a charger or distributer, located between them, and adapted to discharge portions of the contents of the deodorent receptacle into the excrement chamber in the manner set forth.

3. In combination with a commode or closet, in which there is a means provided for deodorizing the excrement, a means for mixing the discharged mass, substantially as set forth.

In conformity with the current practice of the Office, as grounded upon the decision in *ex parte* Charles Rubens & Co. (Commissioner's Decisions, 1869 107), the concluding words of the second and third claims should be ignored in considering the novelty of what is therein claimed; and in fact applicants' attorney has based his whole argument upon the supposition that these words are mere surplusage, and are not to be regarded as in anywise limiting the scope of the claims. It will thus be seen that applicants do not confine themselves to the mechanism described, and of which they are doubtless original, and perhaps the first inventors, but are seeking to secure claims in their nature calculated to lay under contribution every existing form of the useful invention to which their mechanical improvement relates.

The English patent granted to these same parties upon the invention now offered for an American patent bears date May 28, 1860.

All the references, then, which are cited by the examiner of a later date than the date of the English patent are manifestly insufficient, since they neither disprove the novelty of the invention nor establish a public use in the United States for more than two years prior to the pending application. At the time when they were given, May 21, 1870, they were pertinent, as tending to establish the fact of common and public use in the United States prior to the application; but the legislation of 1870 so far changed the law in this regard that public use in the United States for a less time than two years prior to an application upon an invention previously patented in a foreign country, cannot constitute a bar to the grant of a patent here; and by the second proviso of section 111, of the act of July 8, 1870, the applicants are entitled to the benefit of this more liberal legislation. Going back, however, to the English patent of Legras, No. 12,869, of 1849, there are found, minutely described, various forms of commodes, port-