A CHROMATIC ILLUSION.

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A quality of the nervous element of the eye, that of inverting all images painted on the retina, was the cause of the inversion illusion described in the May 25 issue of the SCIENTIFIC AMERICAN; the cause of the illusion described here is, on the contrary, a serious though ever-present defect of the normal eye.

With a single stroke of your penknife make a slit nearly one inch long in the middle of a large piece of dark-shaded pasteboard. Over half the length of the slit lay a piece of blue glass, and keep it in place with some gummed paper stuck on the edges of the glass, so as to let light pass freely from the slit through the glass. Over the other half of the slit fix in a similar manner a piece of red glass. This being done, the card, seen on the opposite side, will look as shown on the following figure, *B* and *R* being the blue and red halves of the slit.

Take another piece of the same pasteboard, and near a corner make two pinholes one-eighth of an inch apart. The apparatus is now complete and ready for use.

Place yourself near a source of light, lamp or window. Bring the card bearing the two pinholes in contact with one eye, the two holes lying on a horizontal line, and, through them, look at the vertical blue and red slit, *B R*, on the other card, this being placed at a distance of about one foot from the eye and right in the middle of the field of vision.

The following figure shows the appearance of the card thus observed. Two luminous red slits and only one blue are perceived.

The card bearing the slit may be inverted. The result is the same; the red goes up, the blue goes down, the red slit is duplicated, the blue is not. As everything but the color is symmetrical, right and left, up and down, on both cards, any observer will promptly reach the conclusion that the cause of the illusion lies, not in the position, size, or shape of the slits or pinholes, but in the difference in color of the slits.

The inference is right. Owing to its defective achromatism, the eye does not bring red and blue rays to one and the same focus, and the little apparatus shows that this aberration is far from being an insignificant factor of the imperfection of normal sight. The following two figures show the path of the luminous pencils emitted by the blue and red slits and admitted by the two pinholes. (Distance from slit to eye has been shortened to spare space, and the refraction phenomena in the several humors has been simplified.) The blue rays emitted by the slit *B* are brought to a focus, *b*, on the retina, but the red rays are less bent than the blue; and although the distance of both blue and red slits from the eye is the same, the red pencils emitted by the slit *R*, and admitted by the two pinholes, strike the retina in *r r*, before meeting, and give thereby the impression of a double red slit.

If the card bearing the slit is placed at much less than one foot from the eye, two blue slits, much closer together than the red ones, will be perceived. The blue pencils, in that case, also meet behind the retina, although not so far behind it as the red pencils under the same circumstances. The card with the slit must be large, to prevent side light from partially closing the pupil, thus increasing notably the achromatism of the eye. For a similar reason, if the two pinholes are much less than one-eighth of an inch apart, the experiment is much less remarkable; the central instead of the marginal parts of the crystalline lens are made to work, and increased achromatism is the result.

No Fire Peril in Pennsylvania Terminal.

Contracts have been closed for the construction of floors, interior partitions, and roof of the Pennsylvania's new Manhattan Passenger Terminal. Protection of the 400,000 passengers who will pass in and out of this station daily has absorbed the attention of the company's engineers a long time, and to avoid the possibility of fire they have selected a material, every block of which is tested by being heated red hot before being used, to be sure that it is unburnable. Porous terra cotta was the only building material which was found able to withstand such a test, and the railroad's engineers have decided to use it in the form of hollow blocks as a covering for the gigantic steel frame of the building, and for the partitions and roof, as well as for lining the outside walls.

If all the blocks used in this work should be built

into a wall ten feet high, it would stretch from the station to Newark, N. J., a distance of twelve miles.

The "Mauretania" Beats the Record.

In spite of a fresh gale and a high following sea during her last passage, the "Mauretania" beat the best eastward time of her sister ship, the "Lusitania," by 21 min., completing the run from Sandy Hook to Daunt's lightship in 4 days, 22 hours, and 29 minutes. The average speed was 23.69 knots, and the best day's runs were 556 knots and 554 knots respectively.

The Lady of Senbtes.

During the excavations made under the direction of the Metropolitan Museum of Art in Egypt, a mummy now known as the "Lady of Senbtes" was discovered.

Fig. 1.—The Slit as It Is.

Fig. 2.—The Slit as It Appears to Be.

It is believed that it is the oldest mummy that has been discovered so far. When the tomb was opened, Dr. Elliot-Smith, professor of anatomy at the Cairo School of Medicine, was called in, and made an interesting report. He found that the lady was of the twelfth dynasty, about 4,000 years ago. She was fifty years old at the time of her death and was slender, with a small, almost infantile face. Her eyes were large and round, and her nose well proportioned, being neither aquiline nor flat. Her teeth were remarkably well preserved. The mummy was that of a person of very high caste, as was shown by the ornaments buried with it. On the breast was a dagger in a gold-capped sheath of wood, and in the hair was a weave of gold

Fig. 3.—Path of the Luminous Blue Pencils.

Fig. 4.—Path of the Luminous Red Pencils.

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filigree work profusely decorated with gold rosettes. Perhaps the most interesting find in this connection was the discovery of the ceremonial whip of Senbtes, which was lying beside the mummy in the coffin. This whip, the only perfect one in existence, was swung ceremonially by those high in authority.

Arbitration proceedings between the Ottoman government and the Ottoman Railway Company have been commenced before Señor Maret, the ex-premier of Spain, who has been nominated umpire by the Kaiser, the former arbitrator. The chief matters in dispute, says Reuter, relate to the harbor works at Salonika, the port of Dedeagatch, and questions of customs and maritime transports. The sum involved amounts to about \$16,000,000.

NEW AND INGENIOUS FRENCH TOYS.

Many ingenious devices, some of them of practical utility, were to be seen at the seventh annual toy show at the Tuileries, Paris.

Diabolo, the ancient game that has again become popular, was represented by numerous models, ranging in price from two cents to more than two dollars, according to size or material, the latter including wood, metal, celluloid, cork, rubber, and cloth.

Diabolo has inspired several similar toys; among which is the "climbing shell." The apparatus consists of a deeply grooved flat spool or disk, a cord, and a fork with two bent tines. A metal pin projects from each side of the disk to hold it on the fork. One end of the cord is attached to the disk, the other held in the hand with the fork, and the cord is wound up in the groove. The pins are rested on the fork, when the latter is tilted to let the disk roll off. As it falls it rapidly unwinds, and as it reaches the end of the cord keeps on spinning, and so rewinds itself up the cord. Just as the disk is at the lowest point a quick upward pull is given to the cord. This pull must be just sufficient to replace the energy lost by the disk, and so enable it to climb as high as the point it fell from. The trick consists in giving the right amount of jerk at the right moment, and to present the fork in such a way that the disk is caught at the top of its flight.

Similar in principle to the foregoing is the Rail Ball. A rubber ball is placed on two parallel curved rails, one extremity of which is held in the hand, and the ball is caused to roll up the rails and lodge securely in the ring which terminates them, by means of a dexterous movement of the wrist. The rails and the ring are made of one piece of iron wire.

The Joust is another game of skill. A little tub filled with water or flour swings from a cross-beam supported by two posts. One end of a railway is inserted between the heavy bases of the posts and the other end is supported on blocks at any desired height. In a carriage stands a puppet armed with a lance. It is required to adjust the direction and the inclination of the railway so that, when the carriage rolls down the grade, the lance shall enter a hole in a vertical plate attached to the bottom of the tub. Otherwise the lance will strike the plate and overturn the tub, spilling its contents on the lancer. The difficulty is increased by giving an oscillating motion to the lance. Similar jousts, entailing the same risk of being drenched with water or covered with flour, are practised by human lancers at French country fairs.

The Weathercock Race is a modification of the popular French game of "Petits cheveux." The innovation consists in causing the circle of horses and riders to revolve, alternately in opposite direction, as it glides down a pole. This result is accomplished by means of two spiral grooves, corresponding to right and left handed screws of long pitch, which are cut on the inside of the sleeve or hub of the circle of riders, and which encounter and engage with pegs on the post as the circle descends. The horse which stops nearest a marked goal is the winner.

Another game of chance is Toboggan Marbles or Toboggan Billiards. An inclined board is crossed obliquely by a number of wires. A small interval is left between the lower end of each wire and the upper side of the next one, so that a small ball, placed on the upper wire, will roll down along all the wires in succession, following a zigzag course, to the bottom of the board, and there fall into a numbered compartment. An interesting feature is the automatic and successive release of the twelve balls, which is accomplished as follows: A rod, mounted so that it can turn freely on its axis,

runs along one inclined side of the board. The ends of this rod are bent in such a manner that, during the descent of the first ball, the second and succeeding balls are stopped by the upper bent end, but when the moving ball reaches the bottom of its course it lifts the lower bent end of the rod, thus releasing the second ball by turning the rod, which immediately falls back into its original position and holds the third and succeeding balls. Along the other inclined side of the board an endless band is stretched over two rollers. By turning a crank attached to the upper roller a sort of spoon carried by the band is made to pick up the balls from the receptacle at the base and carry them, one by one, to the top wire, for another descent.

The Balloon Accident is a lottery in which the winner is determined by the fall of the aeronaut. A card