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REFLECTION OF LIGHT BY TEXTILES.

Every visible object possesses the power of reflecting more or less of the light that falls upon it, thus presenting to the eye an infinite variety of light and shade, enabling the brain to determine, not only the outline, but every inequality of the object being examined.

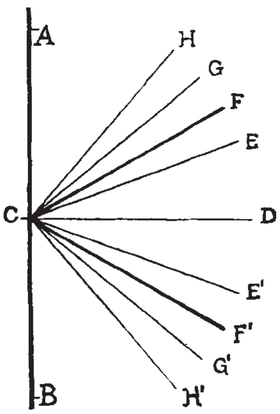

Fig. 1

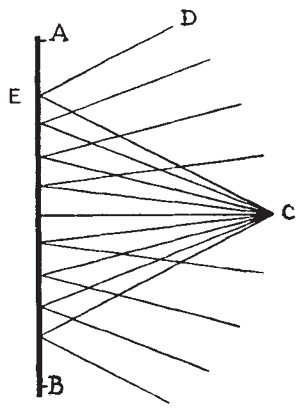

Fig. 2

Reflection has been defined as the change of direction which light experiences when it strikes upon a surface and is thrown back into the same medium from which it approaches.

The path of light through the air is always in a straight line until it comes into contact with a medium of different density. If the intercepting object is transparent, part of the light is reflected or turned back, and part is allowed to pass through at a different angle, and one which varies according to the density of the medium through which it is passing. Opaque objects absorb part of the light, and reflect or turn back the remainder.

The amount of *alteration* in the direction of the light *depends upon the angle* at which it strikes the reflecting surface. The direction in which light approaches any surface is called the line of *incidence,* and the angle enclosed between this line and a second one perpendicular or normal to the surface is the angle of incidence. This angle of incidence is always equal to the angle of *reflection,* and on the opposite side of the normal.

In diagram Fig. 1, the line *A-B* represents a smooth, level reflecting surface; the line *C-D* is normal; *E, F, G* and *H* represent rays of light converging upon the point *C* and reflected by it in the direction *E′, F′, G′*, and *H′* respectively.

The angle *E-C-D* is the angle of *incidence* for the rays E, and *D-C-E′* the angle of *reflection.*

In the same manner, *F* is reflected to *F′*, *G* to *G′*, and *H* to *H′*; while any light approaching *C* in the direction of *E′* will be reflected to *E*. These reflections vary in intensity according to the amount of light falling on the object from different directions, and if the strongest light is falling upon *C* from the line of incidence *F-C*, the object will appear brightest when viewed along the line of reflection *C-F′*. These two lines are marked thicker to represent a more intense light than the remainder.

Surfaces may be flat and smooth, irregular and rough, or they may have a curved outline. Most objects may be classed under one or the other of these divisions, while the general outline of the irregular and rough surfaces may be either flat or curved, and thus, in a modified degree, possess the characteristics of these two reflecting surfaces.

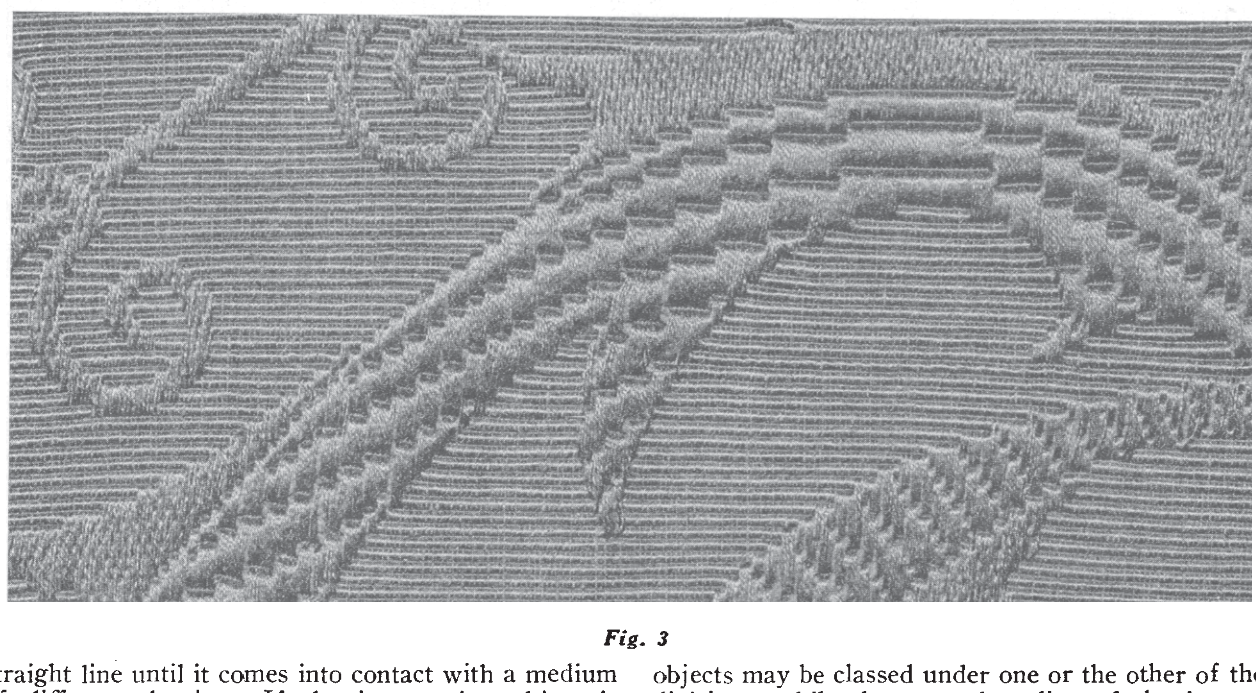

Fig. 3

When the surface is flat and smooth, with the light approaching it in all directions, the apparent brightness of the reflections depend upon the angle from which it is viewed, and is brightest in the direction corresponding to the greatest source of light.

If a flat or level surface appears shady, it is no indication that it is not uniformly illuminated, but that the light falling upon it is from various directions not equally strong.

When the object is perfectly flat, the change will be so gradual as scarcely to be perceptible; but if the surface is creased or waved, the light and shady parts are brought near together and made clearly visible by contrast with each other.

In Fig. 2, letters of reference *A* and *B* indicate a uniformly lighted and perfectly flat surface, and *C* the position of the eye. Each point on the surface of *A-B* is receiving and reflecting light in all directions, as shown at the point *C* in Fig. 1. In Fig. 2, however, all the rays which are not reflected to *C* are omitted, because they do not affect the appearance of the object when viewed from that particular position. Only those rays are seen whose angle of incidence equals the angle of reflection formed by the light passing to the eye from any one point; and as no two positions on the surface of *A-B* form the same angle, the reflected light visible approaches the surface of *A-B* from different angles and varies in intensity according to the strength of the light approaching at that particular angle.

A practical illustration is given in Fig. 3, which is a photograph of a fancy repp (rib or cord) fabric taken with the camera in a similar position to the fabric as point *C* bears to surface *A-B* in Fig. 2. The principal source of illumination was from above and behind the camera, say in the direction of *E-D*.

The floating figure effects of the warp present a flat surface with rounded edges. The upper part of the floats reflects a large portion of light into the lens of the camera and therefore appears bright and luminous, while the lower part appears darker. The transition from one effect to the other is very gradually made and equally affects the cord (rib or repp) and the warp flush portions of the design. The fabric photographed was of a solid old gold color, and illuminated as equally as possible.

An irregular rough surface (even when the inequalities are too small to be perceptible to either sight or touch) scatters or diffuses the light falling upon it in all directions, and therefore does not appear so luminous, nor does it present as great contrasts of light and shade, as a smooth one.

Fig. 4 represents a number of parallel rays falling on to an irregular surface and reflected in all directions by it; some of them are reflected from one part of the surface to another, and thus have their directions changed twice before being finally reflected from it.

When the light falls upon a cylindrical or other curved surface, the constant and gradual change in the reflecting angle scatters the light more and more as it gets farther away from that part which is directly in front of the source of light. This is illustrated in Fig. 5, which represents a number of parallel rays falling upon a cylindrical surface. The ray *A*, falling directly in a line with the centre of the cylinder, is reflected back towards the source of light and appears very intense; while the remaining rays, as they get farther away from the centre, are reflected at a greater angle, spread out farther apart from each other, and thus the light is more and more dispersed, appearing weaker and less luminous.

A light of more or less intensity is falling upon curved objects from all directions at once, and being subjected to various degrees of dispersion; therefore it does not even follow that the apparently brightest part of a curved surface is that which reflects light to the eye from the brightest source of light, because the concentrated rays reflected from a weaker light may appear more luminous and brighter to the eye than rays from a stronger source which strike the surface at a more acute angle, and are therefore more dispersed.

This constant change in the direction of light causes it to be diffused in all directions, so that every object is receiving more or less light from, and reflecting light to, all other objects that immediately surround it. Thus, the light and shade, sometimes even the apparent hue of a surface, is influenced and modi-

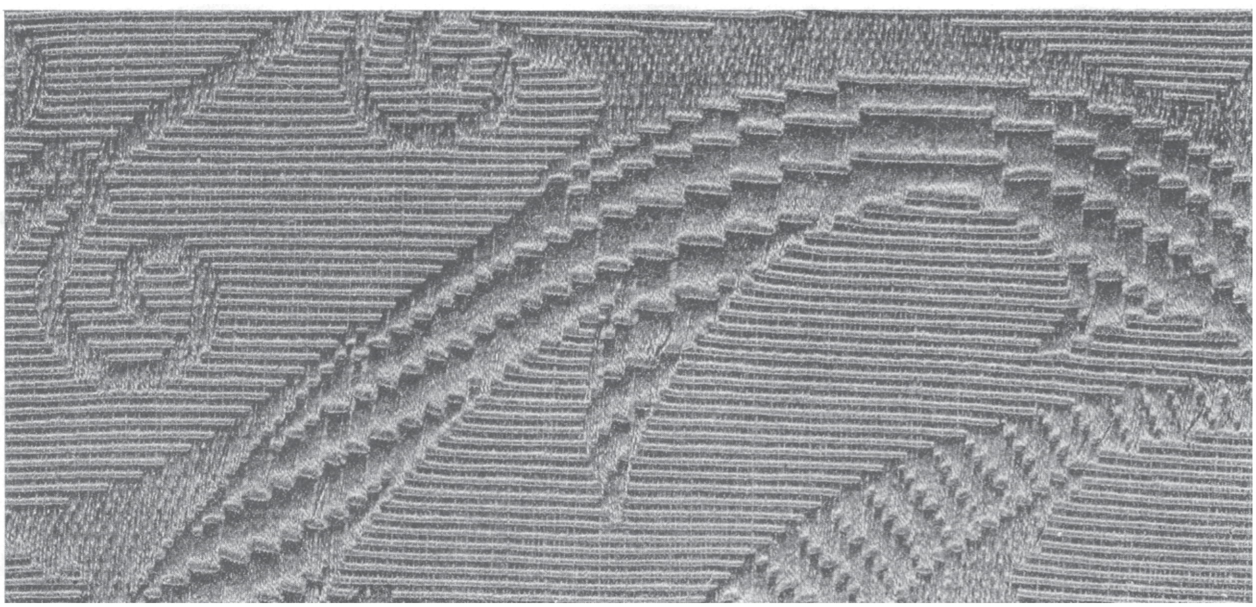

Fig. 6

fied by the reflection from other objects falling upon it.

The difference between unbroken reflection giving a lustrous surface with great contrast in light and shade, and scattered light with subdued contrasts and a non-lustrous surface, is well illustrated by comparing a mirror with a piece of white cardboard when viewed in a strong light. The mirror shows very bright in one direction and very dark in all others; the

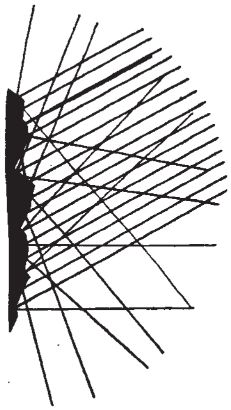

Fig. 4

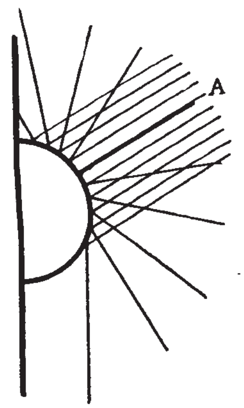

Fig. 5

white cardboard, while varying in intensity, shows white from whatever side it is viewed. Surface reflections, therefore, determine light and shade, and enable the eye to see the shape of an object, and also to perceive whether it is rough or smooth. This play of light and shade on the surface of an object depends upon three principal factors:

First, the total quantity of light reflected, some materials reflecting a larger proportion of the light falling upon them than others.

Second, the nature of the surface (whether smooth or rough) determines if that light shall be concentrated in one direction, giving brightness and lustre, with great contrast of light and shade, or diffused reflections where the contrast is not so marked.

Third, the angle which the surface presents to the light determines the direction in which the light is reflected, and is the principal factor in enabling one to judge the shape of any object. This feature will be seen from Fig. 6 which shows the reproduction of the same fabric sample as shown in Fig. 3 but the angle at which the surface was presented to the light being changed, showing a different appearance of the ground rib weave as well as the floating figure effect, the ground rib showing a two-pick effect, as compared to the single rib effect shown in Fig. 3.

The surface of a fabric is not perfectly level and smooth, but is composed of two sets of threads which are more or less cylindrical in form and placed at right angles to each other; therefore the warp presents a different reflecting angle to the light from what the filling does, while the effect is further modified by the variations in the amount of curvature of the different threads due to differences in the weave and setting.

Again, each thread is composed of a number of fibres with a rounded surface, and the amount of twist and the direction in which the yarns are twisted—by fixing the angle of the individual fibres in relation to that of the thread—alter the character of the reflecting surface. Other modifications of the surface are introduced during the finishing processes, which thus contribute their share to the final appearance of the fabric.

Light, however, is not all reflected by the surface, but part enters into the substance and is reflected from particle to particle until it either becomes absorbed and lost, or escapes back again into space.

The color of an object is its power of making a selection of the rays of light that fall upon it, reflecting some kinds and absorbing others, thus producing that great variety of hue or color that has so large a share in relieving the strain upon the eyes and adding beauty and variety to the visible world. Color is a quality that is independent of form or outline, and is a property of the reflecting substance which is only exercised when suitable rays of light fall upon it.

Light has been defined as that agent or force by the action of which on the organ of sight objects from which it proceeds are rendered visible; color, as that in respect of which bodies have a different appearance to the eye, independently of their form.

Transparent and colorless objects allow the light to pass through them in a straight line without mixing it up or sorting it in any way, and thus, when looking at them, we perceive the light from other objects reflected or transmitted by them in a similar manner to that which would have reached the eye without any change of direction, excepting that any unevenness in thickness or surface tends to blur the images. This blurring of the image is often seen in windows and mirrors when the surfaces of the glass are not perfectly level. Opaque and colored objects have the power of filtering the light that enters their substance, so that it is not only thoroughly mixed up, but some of the colored rays are absorbed and lost, and thus the light that eventually is reflected from the substance is changed, and produces the sensation of color in the eye.

This minute subdivision and mixing of the light by the particles, causes it to be reflected in all directions, so that colored light is always diffused; but the color appears deep and dark in some directions, and varies in brightness as it is mixed by a greater or less quantity of white light that is reflected from the surface. No objects are so black as to absorb all the light that falls upon them, or we should not be able to distinguish variations in form, the play of light and shade on their surface being necessary to clearly indicate the presence of reflected light.

The apparent color of a substance depends not only upon its power of reflecting some rays and absorbing others, but also upon the purity of the source of light, and whether it contains a proper proportion of the various colored rays. An object cannot reflect what does not fall upon it, hence the difficulty of judging colors by gaslight; also the apparent changes in hue or color when an object is placed in proximity to, and receives a large share of light from other colored objects.

Although raw silk dealers are protecting themselves against the proposed increased tariff, there are large orders of goods contracted for before the new bill was proposed which will entail a heavy loss to importers. The latter doubt that any provision will be made to admit free goods previously sold.

Advices from Europe report the Milan market active for European consumption at steadily advancing prices.