DESTRUCTIVE AGENCIES IN ENGINEERING STRUCTURES.

ALL structures, no matter of what material, are subject to physical and chemical agents which tend to destroy them from the very moment of their erection. In steel and iron we have materials in many respects so far superior to the stone or wood of former days that structures, such as bridges, ships, etc., built now-a-days would, using the old material, have been plain impossibilities; still the forces alluded to above are present and do their work.

An iron or steel structure left to itself, without care, and hence more sensitive to the action of these forces, will be, in an incredibly short time, destroyed or rendered dangerous or useless. With proper care, however, they may on the other hand, last for generations. The duty of the engineer and architect is, therefore, not only to secure strength and form, but also to so arrange, combine and protect the material, that the effects of the forces referred to hereafter will be counteracted, checked, or neutralized.

The more common causes of decay and destruction are vibration, corrosion and galvanic action. The first of these does not fall within the limit of this article, but may occasionally be referred to. Galvanic action may set in from different causes. For instance badly arranged materials of different kinds, various degrees of hardness; as a consequence of corrosion setting up a galvanic couple; presence of a conducting fluid between different metals, and as a result of riveting, hammering, etc.

Corrosion will follow as a result of exposure of the material to the different influences of the atmosphere, or to that of water, either fresh or salt; or to the presence of certain gases, or carbon, or to the difference in the chemical constitution of the metal, lack of homogeneity, the presence of combined air and carbonic acid in water, partial or total exposure, from variations in temperature, non-uniformity in the cooling of steel, the material being exposed to conditions of wet and dry alternately, the presence of free oxygen in water, galvanic action and from various other causes.

The vibrations referred to, although they are common to all structures, do not become dangerous so long as the structures are properly designed; and inasmuch as there is no practical danger before the rigidity of the work is threatened, and as such a danger cannot very well arise if the scantlings are duly proportioned and properly connected, these questions naturally belong to the construction and not to the protection of the structure. If the stresses are sufficient in intensity to produce distortion in the material beyond the elastic limit, then the danger commences, as in such a case the crystalline arrangement in the metal will be affected, that is, an alteration will take place in the crystalline axis."

Corrosion and galvanic action are so intimately connected that it may be wise to consider these two forces as tending toward the same results.

The corrosion of steel and iron is different in air, in water, and when in contact with foreign bodies, and the acceleration of the corrosion is also different in each case under different circumstances. Different metals suffer different losses under the same conditions. The loss in weight per month per square foot of surface in pounds in salt water is:—for steel, 0.0216; iron, 0.0203; zinc, 0.0069; copper, 0.0061. The corrosion will increase if the metal is in contact with certain foreign substances, as, for example, iron in contact with brass and submerged in salt water will lose 3.42, with copper 4.95, with lead 5.50, and with tin 8.60; the corrosion of iron by itself being taken as 1.000. Metals containing this or similar substances will of course tend to accelerate the corrosion of iron relatively. Some alloys are however, more powerful than their components.

It is said that fresh water corrodes wrought iron more rapidly than cast, but the reverse seems to be the case in salt water. The corrosion increases somewhat with the carbon, and steel should, therefore, under precisely the same circumstances, suffer a trifle more than iron. Salt water will transform cast iron into a plumbaginous substance in a very short time if not effectively protected, and cast iron pipes laid under ground near the sea where the earth is salt have been found to be destroyed in an extremely short period. White or light grey castings stand this destruction much better than do dark castings. Iron, as well as wood, seems to suffer most if the metal is alternately exposed to water and air, the cause of this, as far as the metal is concerned, is undoubtedly due to the fact, that in such a case there will be a greater percentage of carbonic acid mixed with air present, and also because the material is partly acted upon by the water and partly by the wind, both accelerating the circulation. As a preventative against corrosion of iron laid in salt water or even in the air, pure coal tar is very commonly used; the metal is heated and then coated with the tar. Pure asphalt and common Swedish tar are also employed. The corrosion of iron in common water is mostly due to the presence of dissolved air and carbonic acid, the acid forming spots on the metal which presently become more oxidized by the effect of the air and decomposed water; the proto-carbonate acting as a medium, the whole surface will soon be covered, and as the metal is electro-positive to its own oxide a voltaic couple is set up between the first formed sesquioxide and the, as yet, unaffected surface, spreading the disease with a force inversely as the square of the distance from the first affected spot.—*American Engineer.*

Mr. H. N. Willoughby, of Carleton Place, has secured the contract for the new Town Hall at Arnprior, Ont., of which A. W. Bell, of Almonte, was the architect. When finished this will be one of the handsomest public buildings in the Ottawa Valley.

It has been ruled that if a builder's work is improperly executed, and the employer can show there has been no beneficial service, he can deduct or bring a cross action. Liability depends entirely on the evidence that can be brought to show that the orders of the architects were not obeyed.

An English woman who has noticed the inconvenience to which men attending the theatres are in the habit of putting themselves and other people by going out between acts, makes the suggestion that theatre seats should be so constructed that they could be sunk through a trap in the floor into a saloon below.

MURAL DECORATION AT THE CAPITOL.

AN interesting account of the decorations on the walls of the Senate has recently been published in the Washington *Star*. It pointed out that down in the basement of the Senate the walls are the most elaborately decorated of any in the Capitol. The restaurant, the barber shop, the stationary room and the less desirable committee rooms are on that floor. The walls in other parts of the building are frescoed more sparingly and in larger design. But these are deep-toned and present a panorama of fine paintings. The figures are nearly all small, and they cover almost like mosaic work the walls and arched ceilings. Over some of the doorways there are large figures, and here and there are panels representing small busts of distinguished statesmen, as Washington, Franklin, Webster, Marshall and Clay. But the greater part of the painting represents birds of varied plumage, and here and there a native animal. Then there are other birds not familiar to these parts. Passing through the corridors one is surrounded by an ornithological carnival. A fine scroll forms a sort of frame-work of relief. Interspersed throughout the design are bunches and sprays of native plants and flowers, and here and there a snake common to this clime coils his way up among the scroll-work. Chipmunks, squirrels, common field mice, flying-squirrels, beavers, mole, weasel and other animals appear in natural attitudes. Clusters of grapes, cherries, plums, peaches pears and other native fruits, with here and there an ear of Indian corn, complete the design.

The work was begun about ten years before the war. Brumidi and a number of other famous frescoe artists were engaged upon the work. When the war broke out the heavy appropriations had to be stopped, and the work intended for the whole capitol, as outlined by the work on the walls of the Senate basement, virtually abandoned. Since the war no one has had the courage to propose an appropriation to carry out the original design.

At present there is being nothing done with the belt of historic frieze work in the rotunda. Costagini, the artist, has been in Philadelphia for some time, and it will be several weeks before he resumes his work in Washington. It is proposed now to erase one of the panels that has been completed and substitute for it another subject. The objectionable panel represents the death of Tecumseh.—*Building.*

FLOWERS ON PANELS.

FLOWERS will always be prominent as subjects of decoration, conventionalized or otherwise. They suitably fill both regular and irregular spaces, separately or in groups, ordinarily with leaves and stems. They also admit of high or low toned colors, of flat or shaded treatment. All the technical skill the painter possesses may be turned to account in their portrayal. Of late they have been extensively used for the adornment of door panels, all the more attractive when each panel presents different groups of flowers.

Much of the success of decorative flower painting depends on their artistic grouping, which includes the avoidance of overcrowding or confusing one flower with another. Every flower should be defined with sufficient exactness to enable the spectator to tell at a glance what it is. It is always a safe plan to group the light colored flowers on one side and the dark ones on the other. The effect of roundness may thus be got with color even in a flat treatment.

Pricking and pouncing and then painting in the flowers, ornaments, etc., is the method a highly skilled painter would adopt, because it would afford him the opportunity as he went on of exercising his fancy by putting in here and there a flower, bud or leaf just as he pleased, not being restricted to working within the lines of the original design. To a skilled flower painter this is one of the great charms of the work. But for flat treatment and outlining afterwards a stencil is the most widely useful.

Flowers are of course susceptible of a variety of treatment. They may be worked at times with advantage in gold, with a black outline, on a golden brown or citron ground in conjunction with other low-toned colors, or an azure or sky blue ground made from white, ultramarine and blue, with a little white, added. The flowers may also be painted and shaded in their natural colors without outlining, the corner ornaments or vases being in subdued pinks, greens, grays and yellows. The method in which there is the least danger of failure is the flat treatment with outline, excellent grounds being a dull cream or yellow or Indian red with ultramarine added to give it a rich bloom. In naming these grounds we assume that care will be taken that the colors selected to be placed on them will be harmonious. The finishing of the flowers in flat tints does not preclude the putting in of the different colors of their several parts. Good effects too may often be attained by painting even brilliant flowers in low toned hues, using only two or three shades of the same color or even only using one color for the general surface and outlining and putting in the detail with another color. The stencil pattern need only be outlined when stencilled in one color. Well selected neutral colors with a black outline on a dark ground always look rich and good. Where vases and ornaments are introduced these will look well gilded and outlined in black; in such case the clustered flowers will be improved if touched up with gold. As most ordinary doors have two top and two bottom panels of different sizes, some difficulty is apt to be encountered in so arranging the designs for all that they will approximate in general form.

The majority of the stencil brushes should be small. Small pieces of papers may be used to prevent one color encroaching on another, the paper being held with one hand. Two larger sized stencil brushes for blending or gradating two colors one with another will be required: a clean piece of deal board should be on hand to dab the stencil brush on after it is charged with color, which takes off the superfluous color that might otherwise when working produce ragged edges. To ensure sharp good work it is always safest to use an almost dry brush, and spend the time in carefully dabbing or rubbing the color on, instead of working with a brush full of color.

The painting of flowers and leaves in two shades of the same color, the shadowed side comparatively dark as compared with the light, will produce an appearance of roundness without departing from the flat treatment.

We would suggest as an excellent selection for the panels of a door the flowers emblematic of Spring, Summer and Autumn, Winter being represented, in place of flowers, by the ivy, the misletoe with its berries, the holly, ruddy hips and haws, grasses and ferns. Vases, if any, should be introduced only on the lower panels. On any additional small panels at top fanciful subjects might be introduced.—*Painters' Magazine.*

The use of white lead in the composition of floor paints is to be avoided, as it softens the wood. Ocher, raw umber and sienna are not injurious. The best finish for a floor which is to be much used is oil and wax, or a composition into which each of these ingredients enter.

The following is regarded as a good receipt for a floor varnish: Place 10 pounds of linseed oil in a pan, heat it to 300°, stirring it meanwhile. Mix with it, little by little, two pounds of pure white borate of manganese, finely powdered. Now head 100 pounds of linseed oil in a boiler until it is ready to boil over, pour in the former compound and boil together for twenty minutes. Then filter the mixture through cotton cloth, and apply one or two coats as desired, and a final coat of shellac if an extra polish is wanted.

The London *Oil and Colorman's Journal* furnishes the following method of preparing a valuable varnish known as milk of wax: Melt in a porcelain capsule a certain quantity of white wax, and add to it while in fusion an equal quantity of spirits of wine, of sp. gr. 0 830; stir the mixture and pour it upon a large porphyry slab. The granular mass is to be converted into a paste by the muller, with the addition from time to time of a little alcohol, and as soon as it appears to be smooth and homogeneous water is to be introduced in small quantities successively, to the amount of four times the weight of the wax. The emulsion is to be then passed through canvass in order to separate such particles as may be imperfectly incorporated. The milk of wax thus prepared may be spread with a smooth brush upon the surface of the painting, allowed to dry and then fused by passing a hot iron (salamander) over its surface. When cold, it is to be rubbed with a linen cloth to bring out the lustre. It is to the unchangeable quality of an encaustic of this nature that the ancient paintings on the walls of Herculaneum and Pompeii owe their freshness at the present day.

We have heard rumors to the effect that ex-Mayor Howland and several other Toronto gentlemen are considering the scheme of incorporating a joint stock company with large capital with the object of tendering for the construction of large buildings in Canada.