It is claimed by its backers that a graduated alloy is formed so that the protective coating cannot be completely broken through except by breaking the sheet itself.

Cold Galvanizing.—Another process which is being used more and more as it is improved is that of wet galvanizing or electroplating. In this case the article to be coated is suspended as a cathode in a suitable bath and is subject to easy control. It provides a coating of high purity and uniform thickness in general, but recesses and corners cause some trouble. It is liable to be more or less porous and may contain acid which will eventually cause failure. In both of these processes, hot or cold, the coating does not become intimately connected with the base metal through deep alloying.

Sherardizing.—The latest process of this type is sherardizing, and it is undoubtedly the most perfect as a protection. The object to be sherardized is placed in an iron drum which is filled with a mixture of finely powdered zinc and zinc oxide, in varying proportions, and is heated in a reducing or inert atmosphere for a period of time, the length of which depends on the thickness of coating desired. The coating so obtained consists of four protective layers. Next to the pure iron is an alloy "C," rich in iron, upon which is another definite alloy "B," containing more zinc. Then there is a layer containing a number of more or less unknown alloys, and finally a layer of pure zinc. This makes a coating which is not easily broken down and which is continuous. The principal objections to its use are the high temperature to which the piece must be subjected and the increase in size which may be caused.

The theory which has been advanced to explain this process is interesting in that it may be considered as a distillation process. The zinc dust which is obtained from the zinc smelters is said to be in a state of unstable equilibrium, so that in contact with the hot iron it undergoes a change tending to restore it to the normal condition. During this change some of it alloys with the iron, thereby lowering the vapor pressure for zinc in that region. A slow distillation then begins from the zinc nearest the object to the object itself. As the alloy becomes richer in zinc the difference in vapor pressure becomes less and less and then finally becomes zero. This is found to be the case in practice. The deposition becomes slower as the time is extended.

Calorizing.—This recently developed process makes use of aluminum as the protective metal and is of particular advantage in preventing oxidation at high temperatures. The protective action is due to the oxide formed by the action of heat on the protecting metal, rather than to any electrolytic relations between the aluminum and the base.

It has been found very useful in the case of iron utensils subject to direct contact with flames at temperatures up to 1,000 deg. C. and also in the case of boiler tubes, for the life is increased many times by this treatment and the saving in the cost of replacements is much greater than the additional initial cost of calorizing.

Schoop Process.—One of the most recent processes, and one of the most promising, is the Schoop process. This is applicable to the deposition of metals or alloys on any sort of an object. The apparatus consists of a pistol into which the coating metal is fed as a wire. It passes through a straightening and centering device into the nozzle, where it is fed through a burner whose temperature may be regulated from 700 deg. to 2,000 deg. F. The molten metal is carried a short distance by the gas current and is suddenly caught by a powerful blast of compressed air which shoots it out of the nozzle with a velocity of 3,000 feet per second, directly on the object to be coated, which is held a short distance away. The coating is homogeneous, continuous, and of any desired depth, and is also exceedingly intimate.

The following explanation of the theory is given by the inventor:

"The theory is that the gaseous medium used is much larger in volume at any moment than the drop it has pulverized and is carrying, and the gas is expanding so rapidly that its temperature is far lower than that of the spray. A rapid exchange of heat, therefore, takes place between them, which consolidates the molten particles and gives them a temperature far below the melting point. If the particles arrived in a liquid state at the base with the observed velocity of 3,000 feet per second, they would simply splash on the surface and largely rebound. As a matter of fact they impact and inter-penetrate freely, and the later bombarding particles unite with the earlier ones to form homogeneous compact bodies. In accounting for the observed action of the Schoop spray at the receiving base, it is supposed that the cooled particles of the metal, just before impinging with great velocity on a hard surface, are in an abnormal physical condition. Due to the heat of collision they pass directly into a vapor which condenses and solidifies on the relatively cold receiving body, penetrating by osmotic pressure the superficial pores of the base when an affinity for the latter exists, and otherwise driven in by the pressure behind it. In either case it condenses and solidifies after penetration, and is effectively dovetailed into the base. The hammering and bombardment of the solidified first coat by the minute succeeding particles is practically a process of cold working. The entrained particles liquidify and solidify so rapidly that the metal has not time to return to its natural crystallized state."

In conclusion Mr. Allison states that there are many other processes in use which could not be mentioned in a brief review of this type. Those processes outlined were chosen as representative of the various different means used to obtain the desired protection because of their prominence, or of some new feature which they contain.

GAS FROM REFUSE WOOD.

Leaves, loppings, roots, chips and sawdust, and any kind of combustible refuse will make gas for working gas engines and supplying retorts and furnaces. According to the Timber Trades Journal, 2½ to 3 pounds of such refuse will develop 1 b. h. p., which means that a ton will supply 100 b. h. p. a day. As no skilled attention is needed for such wood-waste gas-producing plants, the working costs are low. Sawdust and wood-waste show good financial results when used for distillation purposes, and it also pays to use sawdust for the manufacture of oxalic acid, which at the present time commands a high price. It is found that the distillation of one ton of waste wood (common soft woods) yields 15 gallons of boiled tar, 4 gallons of wood oils, 6 cwt. of charcoal, 5 gallons of wood naphtha, and 1¼ cwt. of lime. With wood-waste at 10s. a ton it is calculated the working expenses of a complete distillatioin plant to deal with 100 tons a week would be about 23s. a ton, and a quantity so small as 25 tons can be treated weekly on a commercial basis.

The firm of Keuffel and Esser Company of Hoboken, N.J., has been awarded three grand prizes at the Panama Pacific International Exposition at San Francisco. One was for drawing materials and slide rules; another for surveying instruments, and a third for telescopic sights and periscopes.