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the factory departments were swept up during working hours the average lost time per operative was five minutes on this. This gave a yearly loss on five hundred female operatives of approximately sixty-six thousand working hours at twenty cents per hour, approximately thirteen thousand dollars, eliminating the usual lost time before quitting, and ignoring the fact that the men in the department quit work at the same time the girls did.

"It was not hard to see that providing a separate exit for the women and separate pay-windows on pay-day supplied the needed segregation at the congested hours. Sweeping at night cut out the disturbing expense incident to doing this in the daytime."

HOW PAINT "DRIES"

WHEN a wet towel "dries" the water with which it is saturated evaporates. There is no water in oil paint, nor any other thing that will evaporate, except occasionally when turpentine is used to thin it. The thing that "dries" is the oil; and this it does, not by leaving the paint but by solidifying by combination with the oxygen of the air. This oxidation may take days if the oil is left alone, but it may be hastened so as to take place in a few hours by using certain metallic salts. We are told by F. P. Ingalls, writing in *Chemical and Metallurgical Engineering* (New York), that these salts act as catalyzers, by which is meant substances that promote chemical reaction without themselves taking part in it. Liquids capable of oxidation are few and are all oils. Many oils oxidize, but few solidify in so doing. Linseed-oil, exprest from flaxseed, is the most important and is almost universally used with paint. Writes Mr. Ingalls:

"When linseed-oil is exposed to the air it absorbs oxygen, increases in weight and volume, passes through a stage of highly increased viscosity, and finally becomes a solid, tough, rubbery mass. The rapidity of this oxidation, perhaps indeed even its extent, is dependent upon a number of conditions, chief among which are the temperature and extent of surface exposed, especially the latter. Exposed in layers 0.001 to 0.003 inches in thickness, on glass plates, at a uniform temperature of 75° F., it requires from about six to fifteen days (according to thickness of layer, quality, and kind of oil) for the film to become 'dry to touch,' and in ordinary parlance is then said to be 'dry,' altho it is very well and generally known that the film continues to harden progressively for a very long and definite time thereafter. Obviously, this reaction is very slow.

"If various pigment colors be incorporated with the oil by a process of mechanical grinding, and the mixture so obtained be spread out in thin layers as above, we observe some very remarkable differences in the drying time. Some pigments, as, for instance, umber, will shorten it to less than twenty-four hours, while others will lengthen it into weeks, as in the case of carbon blacks; and certain of the anilin-

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color tannate lakes (made from magenta or methyl violet) may inhibit the oxidation of the oil to such an extent that even after months of exposure there remains only a sticky, gummy film in nowise acceptable as a good paint coating.

"This quickening effect of umber has long been known; just how long is a matter of some doubt, but certainly for two or three hundred years. White-lead, one of the most ancient of pigments, has also long been recognized as an accelerator of this drying process; but, without attempting to follow the historical development, we may come down to the early half of the nineteenth century when good 'boiled oil' and 'oil varnishes' which dry in twenty-four hours or less had become commercial commodities. . . . . .

"Because the best of these were prepared by heating the oil with metallic oxids, notably litharge and red-lead, and because the oil was still further oxidized by the air during the heating process, there became prevalent a theory that the normal drying time was shortened by virtue of the fact that the oil so treated was already well oxidized and only a limited exposure was necessary to complete the process. This theory, altho not now tenable, contained an element of truth, in that coatings with such oils gave harder films than most others made at that time, and was further supported by numerous instances where oil which had merely been heated rather strongly in the air showed greatly increased drying power. Without direct knowledge of how this heating was done, nor under what circumstances, we may now assert quite positively that the increased drying power was due to some other circumstance than were heat and the attendant air oxidation."

It is now known, Mr. Ingalls tells us, that the drying process is dependent on the presence in the oil of certain fatty acids, known collectively in the case of linseed-oil as "linoleic acid." It is the salts formed by these acids with certain metals, notably cobalt, manganese, and lead, that are the real "driers," or stimulants of oxidation. He says:

"Concerning the quantity of these driers required to produce the maximum acceleration, much depends on conditions. Unless the metal is in solution or retained in what may be termed the active field, it has little or no power. Whether the solution is crystalloidal, partly colloidal, or wholly colloidal is open to discussion, but when a precipitate forms it is (at least relatively) inactive, even tho it may retain considerable metal.

"Roughly speaking, it is easy to bring the drying time down to seven or eight hours for linseed-oil, but to go below this time requires extraordinary drier. With lead alone it is difficult to reach this speed with any amount within reason. With manganese three to five parts in ten thousand will suffice. Cobalt requires about the same, perhaps slightly less. . . . .

"In general practise, therefore, it is customary to use lead for character, and jack it up with manganese or cobalt for speed. A good strong-drying oil will generally show on analysis, in parts per 10,000: lead, 50 to 150, and manganese, 5 to 15."