NOTE ON THE CHANGES PRODUCED BY FATTY MATTER
IN THE WROUGHT AND CAST IRON PARTS OF
ENGINES EXPOSED TO THE ACTION OF STEAM.

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I have had, on different occasions, to examine in the laboratory some balls, more or less hard, that were taken, from time to time, from the cylinders of steam engines, and which were generally attributed to the use of acid lubricating oil.

These balls, when crushed and digested in ether, left an insoluble residue of peroxide of iron, whilst the soluble part was composed of oleic acid combined with the oxide of iron and mixed with a non-decomposed oil.

Does the formation of this oleate of iron result from the use of oil more or less rancid, having an acid reaction; or, more probable, is it the product of the decomposition of neutral fatty matter in presence of iron and of steam at a high pressure? This alternative caused me to make the following experiment in the laboratory:—

Steam of near the atmospheric pressure was admitted to a closed vessel filled with wrought iron chippings immersed in oil of colza rendered neutral by a previous treatment with carbonate of soda. A gas pipe, dipping into a gauge filled with water, was placed in connection with the closed vessel. The apparatus being purged of air by the steam, I saw small bubbles of gas, which I recognized as hydrogen, disengage—slowly, it is true, but continuously. The same experiment repeated, with wrought iron chippings perfectly free of grease, gave no disengagement of combustible gas.

According to these experiments, and contrary to some explanations given of the changes produced in the metals by fatty matters, the latter have no need of being acid or rancid, nor of being heated above 212°F., to decompose steam in presence of iron and thus produce oleate of iron, glycerine and hydrogen.

On an examination of the cylinders of the agglomerating engine at

Brassac, after use with an addition of carbonate of soda to the feed-water (which water contained 31·91 grains of sulphate of lime per $1\frac{3}{4}$ pints), the spaces in the piston were found filled with hard matter, formed of grease mixed with oleate of lime and with carbonate of lime, brought in the water, foamed or primed over with the steam. No iron was found; the carbonate of lime had preserved the metal from any change.

The face of the steam-valve of the stationary engine at Valence showed corrosion more or less deep, whilst the valve-stem remained intact. There could be detached from the corroded parts a hard matter which softened at about 392°F., but did not in the least melt. This kind of mastic enclosed particles of iron rubbed off by friction, and had the following composition :

Oil, not changed,	2·60
Peroxide of iron,	91·55
Oleic acid,	5·60
Loss,	0·25
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	100·00

In this engine there had been no foaming or priming over of lime, which might have, as in the preceding case, preserved the iron from change.

In the stationary engine of the workshops at Paris the same fact occurred. The lubricating oil of the inclined valves collected at the lowest part of the valve-chest and perforated the cast iron.

In the locomotives there was observed the same change in the metal at the tappings for the screws which held the springs of the steam-valve.

These observations led me to make the following experiment: An iron bucket containing wrought iron chippings, thoroughly saturated with oil of colza previously neutralized, was left during eight days in a reservoir supplying steam to several steam hammers. At the expiration of this time there were taken from the bucket about $30\frac{1}{2}$ cubic inches of very thick oil, which flowed with difficulty and emitted an odor similar to what is produced by the action of an acid on iron; the iron was strongly corroded, and the oil—colored to a dark brown and entirely soluble in ether—contained 7 per cent. of the oxide of iron. This oleate of iron oxidized rapidly on contact with air and, like all the minimum salts of iron, gave up some peroxide of iron;

when again placed in contact with iron it attacked the iron and was thus brought back to its first state of saturation. In this manner can be explained the large proportion of non-combined peroxide of iron contained in the matter found on the valve-face of the engine at Valence.

These facts appear to me to clearly explain the corrosions of certain boilers receiving fatty matters brought over from the cylinders by the exhaust steam, or used to lubricate the throttle valve of locomotives.

In locomotives the steam is generally taken from the upper part of the boiler by means of an immersed slide throttle valve; the oil used for lubricating the latter becomes saturated with iron, and being thus made heavier than water sinks to the bottom of the boiler where it attacks the iron plates, forming in them those excavations which are only found when feed-water is used of such purity as not to deposit the lime-scale that in most cases preserves the boilers.

The use of mineral oil, thickened if necessary with wax or paraffine, for the lubrication of moving parts placed in the steam, would be without doubt a good means of preventing changes in the material of such organs.

New Clothing Material.—A Berlin inventor has patented a new kind of cloth, which consists principally or entirely of sponge. The sponges are first thoroughly beaten with a heavy hammer, in order to crush all the mineral and vegetable impurities, so that they can be easily washed out. They are then dried and pared, like a potato, with a sharp knife, the parings being sewed together. The fabric which is thus obtained is free from all the danger which sometimes arises from the absorption of poisonous dyes into the system; it absorbs without checking the perspiration, so as to diminish the danger of taking cold; it is a bad conductor and therefore helps to maintain a uniform surface temperature; it can be more readily cleansed than the ordinary woolen garments; its flexibility diminishes the liability of chafing; the ease with which it can be employed in shoes, stockings, drawers, undershirts, hat linings and other articles of clothing seems likely to make it especially useful as a protection against rheumatic and pulmonary attacks.—*Fortschr. der Zeit.* C.