purine. Acids turn it to a blue-black, but do not strip it. With basic colors it plays the part of a mordant. The number of colors prepared with diamido-stilbene-disulphonic acid is still more considerable than that of the Congo group. Leonhardt & Co. have thus brought out so-called Hessian yellow, violet, and purple. These colors are injured by the smallest quantity of a salt of copper, and have to be dyed in wood or tin pans. The (Berlin?) Aniline Co. has patented colors derived from stilbene and playing the double part of dyes and mordants. Brooke, Simpson & Spiller have produced primuline yellow, which dyes cotton at once in a boiling bath, and which may be converted on the fiber by special treatment into "ingrain red" and "ingrain orange." The Berlin Aniline Co. announce that all the "Congo" colors and the derivatives of stilbene fix themselves upon wool at a boil. The process is very slow, but the shades are absolutely fast to the most severe fulling. Casella & Co. also send out two fulling reds, which are not very beautiful. The Baden Aniline Co. produce rhodamine, a color belonging to a novel group. By its basic character and its dichroism it borders on the safranines, but it is distinguished from them by the color of its solution in monohydrated sulphuric acid, which is brown, and not blue or green. J. Walder prepares a novel anthracene color by the action of anthraquinonedisulphonic acid upon sodium nitrite. The Baden Co. sell an alizarin black which resists light better than the logwood blacks. J. R. Geigy produces two new vegetable colors, xanthaurine and anthracine. These extracts, with mordants of acetate of chrome, alumina, or salt of tin, yield all the shades from pale yellow to old gold. Zulz affirms that Indian yellow is probably a product of animal excretion.—*Moniteur Scientifique, Quesneville; Chem. News.*

[PROCEEDINGS ENGINEERS' CLUB OF PHILADELPHIA.]

MILLIMETRES AND EQUIVALENTS IN INCHES.

Geo. R. HENDERSON, November 20th, 1888.

Milli- metres.	INCHES.			Milli- metres.	INCHES.		
	Decimal Equivalents.	Fractional Equivalents	Fractional Equivalents		Decimal Equivalents.	Fractional Equivalents	Fractional Equivalents
1	.03937	$\frac{1}{25}$	$\frac{1}{25}$	51	2.00787	$2\frac{1}{16}$	$2\frac{1}{16}$
2	.07874	$\frac{1}{12}$	$\frac{1}{12}$	52	2.04724	$2\frac{1}{8}$	$2\frac{1}{8}$
3	.11811	$\frac{1}{8}$	$\frac{1}{8}$	53	2.08661	$2\frac{1}{4}$	$2\frac{1}{4}$
4	.15748	$\frac{1}{6}$	$\frac{1}{6}$	54	2.12598	$2\frac{1}{2}$	$2\frac{1}{2}$
5	.19685	$\frac{5}{16}$	$\frac{5}{16}$	55	2.16535	$2\frac{3}{8}$	$2\frac{3}{8}$
6	.23622	$\frac{1}{4}$	$\frac{1}{4}$	56	2.20472	$2\frac{1}{2}$	$2\frac{1}{2}$
7	.27559	$\frac{3}{8}$	$\frac{3}{8}$	57	2.24409	$2\frac{1}{4}$	$2\frac{1}{4}$
8	.31496	$\frac{1}{3}$	$\frac{1}{3}$	58	2.28346	$2\frac{1}{4}$	$2\frac{1}{4}$
9	.35433	$\frac{2}{5}$	$\frac{2}{5}$	59	2.32283	$2\frac{1}{4}$	$2\frac{1}{4}$
10	.39370	$\frac{1}{2}$	$\frac{1}{2}$	60	2.36220	$2\frac{1}{2}$	$2\frac{1}{2}$
11	.43307	$\frac{7}{16}$	$\frac{7}{16}$	61	2.40157	$2\frac{1}{2}$	$2\frac{1}{2}$
12	.47244	$\frac{3}{5}$	$\frac{3}{5}$	62	2.44094	$2\frac{1}{2}$	$2\frac{1}{2}$
13	.51181	$\frac{4}{5}$	$\frac{4}{5}$	63	2.48031	$2\frac{1}{2}$	$2\frac{1}{2}$
14	.55118	$1\frac{1}{16}$	$1\frac{1}{16}$	64	2.51968	$2\frac{1}{2}$	$2\frac{1}{2}$
15	.59055	$1\frac{1}{8}$	$1\frac{1}{8}$	65	2.55905	$2\frac{1}{2}$	$2\frac{1}{2}$
16	.62992	$1\frac{1}{4}$	$1\frac{1}{4}$	66	2.59842	$2\frac{1}{2}$	$2\frac{1}{2}$
17	.66929	$1\frac{3}{8}$	$1\frac{3}{8}$	67	2.63779	$2\frac{1}{2}$	$2\frac{1}{2}$
18	.70866	$1\frac{1}{2}$	$1\frac{1}{2}$	68	2.67716	$2\frac{1}{2}$	$2\frac{1}{2}$
19	.74803	$1\frac{5}{8}$	$1\frac{5}{8}$	69	2.71653	$2\frac{1}{2}$	$2\frac{1}{2}$
20	.78740	$1\frac{3}{4}$	$1\frac{3}{4}$	70	2.75590	$2\frac{1}{2}$	$2\frac{1}{2}$
21	.82677	$1\frac{7}{8}$	$1\frac{7}{8}$	71	2.79527	$2\frac{1}{2}$	$2\frac{1}{2}$
22	.86614	$1\frac{1}{2}$	$1\frac{1}{2}$	72	2.83464	$2\frac{1}{2}$	$2\frac{1}{2}$
23	.90551	$1\frac{5}{8}$	$1\frac{5}{8}$	73	2.87401	$2\frac{1}{2}$	$2\frac{1}{2}$
24	.94488	$1\frac{3}{4}$	$1\frac{3}{4}$	74	2.91338	$2\frac{1}{2}$	$2\frac{1}{2}$
25	.98425	$1\frac{1}{2}$	$1\frac{1}{2}$	75	2.95275	$2\frac{1}{2}$	$2\frac{1}{2}$
26	1.02362	$1\frac{1}{4}$	$1\frac{1}{4}$	76	2.99212	$2\frac{1}{2}$	$2\frac{1}{2}$
27	1.06299	$1\frac{3}{8}$	$1\frac{3}{8}$	77	3.03149	$2\frac{1}{2}$	$2\frac{1}{2}$
28	1.10236	$1\frac{1}{2}$	$1\frac{1}{2}$	78	3.07086	$2\frac{1}{2}$	$2\frac{1}{2}$
29	1.14173	$1\frac{5}{8}$	$1\frac{5}{8}$	79	3.11023	$2\frac{1}{2}$	$2\frac{1}{2}$
30	1.18110	$1\frac{3}{4}$	$1\frac{3}{4}$	80	3.14960	$2\frac{1}{2}$	$2\frac{1}{2}$
31	1.22047	$1\frac{7}{8}$	$1\frac{7}{8}$	81	3.18897	$2\frac{1}{2}$	$2\frac{1}{2}$
32	1.25984	$1\frac{1}{2}$	$1\frac{1}{2}$	82	3.22834	$2\frac{1}{2}$	$2\frac{1}{2}$
33	1.29921	$1\frac{5}{8}$	$1\frac{5}{8}$	83	3.26771	$2\frac{1}{2}$	$2\frac{1}{2}$
34	1.33858	$1\frac{3}{4}$	$1\frac{3}{4}$	84	3.30708	$2\frac{1}{2}$	$2\frac{1}{2}$
35	1.37795	$1\frac{7}{8}$	$1\frac{7}{8}$	85	3.34645	$2\frac{1}{2}$	$2\frac{1}{2}$
36	1.41732	$1\frac{1}{2}$	$1\frac{1}{2}$	86	3.38582	$2\frac{1}{2}$	$2\frac{1}{2}$
37	1.45669	$1\frac{5}{8}$	$1\frac{5}{8}$	87	3.42519	$2\frac{1}{2}$	$2\frac{1}{2}$
38	1.49606	$1\frac{3}{4}$	$1\frac{3}{4}$	88	3.46456	$2\frac{1}{2}$	$2\frac{1}{2}$
39	1.53543	$1\frac{7}{8}$	$1\frac{7}{8}$	89	3.50393	$2\frac{1}{2}$	$2\frac{1}{2}$
40	1.57480	$1\frac{1}{2}$	$1\frac{1}{2}$	90	3.54330	$2\frac{1}{2}$	$2\frac{1}{2}$
41	1.61417	$1\frac{5}{8}$	$1\frac{5}{8}$	91	3.58267	$2\frac{1}{2}$	$2\frac{1}{2}$
42	1.65354	$1\frac{3}{4}$	$1\frac{3}{4}$	92	3.62204	$2\frac{1}{2}$	$2\frac{1}{2}$
43	1.69291	$1\frac{7}{8}$	$1\frac{7}{8}$	93	3.66141	$2\frac{1}{2}$	$2\frac{1}{2}$
44	1.73228	$1\frac{1}{2}$	$1\frac{1}{2}$	94	3.70078	$2\frac{1}{2}$	$2\frac{1}{2}$
45	1.77165	$1\frac{5}{8}$	$1\frac{5}{8}$	95	3.74015	$2\frac{1}{2}$	$2\frac{1}{2}$
46	1.81102	$1\frac{3}{4}$	$1\frac{3}{4}$	96	3.77952	$2\frac{1}{2}$	$2\frac{1}{2}$
47	1.85039	$1\frac{7}{8}$	$1\frac{7}{8}$	97	3.81889	$2\frac{1}{2}$	$2\frac{1}{2}$
48	1.88976	$1\frac{1}{2}$	$1\frac{1}{2}$	98	3.85826	$2\frac{1}{2}$	$2\frac{1}{2}$
49	1.92913	$1\frac{5}{8}$	$1\frac{5}{8}$	99	3.89763	$2\frac{1}{2}$	$2\frac{1}{2}$
50	1.96850	$1\frac{3}{4}$	$1\frac{3}{4}$	100	3.93700	$2\frac{1}{2}$	$2\frac{1}{2}$

OLEOMARGARINE IN GREAT BRITAIN.*

THE quantity of margarine imported into Great Britain, principally from Holland, during the last three years is as follows:

In 1885.....	847,263 cwt.
1886.....	856,573 "
1887.....	1,273,095 "

It was formerly imported from the United States, but legislative regulations have there interfered with its manufacture and sale, and its manufacture has subsequently been diverted mainly to Holland. The history of the manufacture of this butter substitute is somewhat remarkable and sensational. It has been long contemplated by chemists that the fat of the cow might in some way or other be made to act as a substitute for the fat found in the milk of the same animal. While the composition of animal fats was not known, speculation in theories of substitution was common enough, and in 1869 M. Hippolyte Mège, of Paris, was induced, by the pressing necessity for a regular butter substitute supply during the German invasion, to turn his attention to the subject. In that year he took out a patent which had for its object the making of neutral products new by their nature. His invention was said to be based on the deductions of modern science, which proves—

1. That odoriferous coloring matters, volatile and becoming rancid, do not pre-exist in the natural fats called suets.

2. That they are developed by the action of the organized tissues under the influence of fermentation, heat, or chemical agents.

3. That the fats of milk called butter are only fatty bodies from fat modified first by its cellular tissue, second by the organized tissues of the udder.

In applying these so-called facts industrially he formulated his process thus:

1. From suet is obtained a virgin fat, with odor or smell of fat, and like most fatty bodies.

2. A variety of true butter taken at its source, formed as in ordinary lactation, and superior to butter from milk by the length of its preservation.

In other words, he meant to say that his process consisted of the two distinct operations of obtaining from beef fat, at a low temperature, a pure, sweet oil without smell or taste, and of churning with this sweet oil milk or cream for the manufacture of artificial butter. From this beginning has sprung the large margarine manufacture, and of which substance we are very large consumers.

Formerly this oil, or "oleo" as it is now called, was a by-product in the production of stearin for stearin candles, but now the oleo is in greater demand than the stearin for the manufacture of artificial butter. A new outlet is found for the stearin in the manufacture of "refined" American lard, which is composed of lard, stearin, and cotton seed or earthen oil, and sent in large quantities into this country. The oleo is thus manufactured: The thick and thin fat of bullocks is obtained in a perfectly fresh state from the slaughter houses of Paris, London, and other large cities. The fat is selected with very great care, and allowed to cool thoroughly till hardened. It is then chopped into very small pieces to rupture the cellular tissue, and put into mills with toothed rollers to tear the tissues still more, to allow of the free flow of the oleo. The torn fat is then put into steam-jacketed boilers, and gently heated to a temperature not exceeding 122° Fahr. for about an hour and a half, but no water is allowed to enter the boiler. The fat that will run off at the end of the operation is drawn off by a siphon, and the residue left in the boilers is then mixed with mutton and other fats, and the product sold for soap making.

The proportion of melted fat fit for oleo is about 63 per cent., for soap and candles 20 per cent., and 17 per cent. is lost in waste material. So rapidly is the work performed, that frequently the fat of animals killed in the morning is in the evening made into oleo.

The siphoned oleo above mentioned is allowed to remain in the tank two hours, to admit of the sinking of the refuse. The purified fat is permitted to cool slowly, and when hardened it is cut into pieces of about 2 lb. weight each, and each piece is wrapped in a strong cloth, and submitted to hydraulic pressure to separate the olein from the more solid stearin. The proportion of olein is about 66 per cent., of stearin 33 per cent.; loss 1 per cent.

The oleo is allowed to cool in a darkened room, having a temperature of about 58°, and in six or eight hours the oleo is ready for the margarine factory. The margarine is made in different ways, but the most approved quality is thus manufactured: A certain quantity of milk is put in the churn, then oleo at a temperature of 103°, earthen oil, and butter in lumps in the proportion of from five to fifty per cent. Annatto extract is added for coloring. The churning takes place at 86° Fahr., and lasts about an hour. When the churning is completed, the contents of the churn pass through a sluice of wood into a vat, and the contents of the sluice are, in passing down, artificially cooled by ice cold water. This operation granulates the liquid margarine, and between 40° and 50° Fahr. the margarine hardens and aggregates. It is then worked, salted, and prepared for market. This industry is a very large one, and it is computed that 40,000 tons of oleo, olein, or oleomargarine, are imported into Holland annually.

The rapid demand which has sprung up for this production has naturally caused agriculturists in every country to be opposed to its manufacture and sale. If always sold under its own name, there is no ground for complaint; but it has been proved that in some countries, notably in France, about twelve months ago, certain brands of butter were made up with different proportions of margarine, and this adulterated butter found its way into London and other large towns. The French government has now stopped the adulteration, but in almost all countries where butter is a staple article of trade restrictions are put upon the sale, and sometimes on the manufacture, of margarine. In the United States all manufacturers have to be licensed, and a duty is put upon it. The effect of the legislation has been that the export trade in it has practically died out, and other countries, not so handicapped, have monopolized the business.

In Germany, the mixture of butter with margarine is absolutely prohibited. In Holland, Belgium, Denmark, Scandinavia and Russia, special enactments are in force, different in each country, it is true, but yet very restrictive in all. The Danish laws against general trade misrepresentations are very severe, and, up to 1884, were punishable by imprisonment from five days to two years, with a diet of bread and water. In 1885, margarine was exempted from this law, and specially dealt with. Fines can be imposed under the present law, varying from £11 to £110, coupled with the confiscation of the offending article.

In the United Kingdom a margarine act came into operation on the first day of this year, but up to the present time the imports of margarine for the year have been larger than during a like period in any previous year.

The act gives a legal definition of butter and margarine, and offenses are punishable by penalties not exceeding £20 for a first, £50 for a second, and £100 for a third or subsequent offense. Inspectors have power to visit factories, which must be registered, to obtain samples from shops and factories without purchase, and to do other things considered necessary for controlling the legal sale of margarine.

Much of the margarine imported into the country is carefully made, nicely packed, and much cheaper than bad butter. The article so made is of very good value, and it is not likely that the changed name will greatly prejudice its consumption so long as the quality is maintained. There are low qualities which seem scarcely suitable for the use of man, but, on the other hand, there is butter placed on the market possessing the most objectionable smell and flavor, and the trade assure me that margarine, even of poor quality, can be sold more readily than such butter, because its flavor does not rapidly deteriorate. Instances have been known in different parts of the country of farmers buying this article to adulterate their own butter, the mixture being sold as genuine fresh butter. It readily lends itself for such an admixture, but such a trade is particularly immoral, and, when discovered, does more harm to the home dairy farmer than can be well imagined.

What has been said respecting our butter supply may be thus summarized:

1. Butter and butter substitutes are imported equivalent to the produce of not less than 1,400,000 cows, or

36 per cent. of the milch cows of the United Kingdom.

2. Our butter trade has diminished through want of uniformity in quality, and not being able to continue a regular supply in winter as well as in summer.

3. That individual effort cannot bring back our trade, but it must be done through some form of co-operative combination, as in France.

4. That skill must be brought to bear on the feeding of cattle, the treatment of the milk and butter, and scrupulous care exercised to make up the butter for market in the most convenient and attractive manner.

5. That the skill required should be imparted at the expense of the government through dairy schools and similar means, and that every effort should be made to carry out such methods of instruction as will in the cheapest and best way take the education to the farmer at his farm, as is done in Denmark, and not compel the farmer to leave home to be educated.—*Sour. Society of Arts.*

ON THE INFLUENCE OF SULPHUR UPON EGGERTZ'S CARBON COLOR TEST.

By T. W. HOGG.

IT is now pretty well known that Prof. Eggertz's simple process for the colorimetric determination of carbon in steel is open to many sources of error.

In the first place the color intensity of a solution of steel in nitric acid of 1.2 sp. gr. does not depend entirely upon the quantity of carbon which may be present, but also so much upon its condition that in some special cases the results become quite misleading. Again, the coloring matter which gives to the solution its peculiar tint is so extremely sensitive to external influences that serious errors occasionally arise from the neglect of certain necessary precautions. The other elements usually present in steel are generally supposed to be without any influence upon the color test, and, so far as I have been able to find, the only experiments bearing upon this point have been conducted by Prof. Eggertz himself, and an account of them may be found in the *Chemical News*, vol. xlv., p. 173.

Among the substances examined is the element sulphur, and in order to ascertain the influence of it, 0.001 grm., in the form of magnesium sulphate, was added to 0.1 grm. of iron dissolved in 2.5 c. c. of nitric acid and 2.5 c. c. water—"the sulphur was found to be without any influence."

It is quite evident, therefore, that the above conclusion rests entirely upon the assumption that the sulphur, which of course is present in the steel as a sulphide of iron, is oxidized to SO₂, and will be present in the solution as a sulphate.

From the fact that the quantity of sulphur usually present in steel is very small, and that it is exposed for a considerable time to the action of hot nitric acid, it may be very reasonable to make such an assumption, but that it is not quite the case any one can soon satisfy himself by experimenting upon any special steel containing a considerable quantity of this element. The sulphur is really liberated as such, and remains suspended in the fluid, thereby communicating to it a certain turbidity or milkiness, particularly striking in the case of low carbon or "mild" steels. This peculiarity enables one to select from a miscellaneous lot of samples all that are likely to be abnormal in the proportion of sulphur.

Pure Swedish steels which contain mere traces of sulphur dissolve in nitric acid of 1.2 sp. gr., and after the usual twenty minutes heating in boiling water are always found to be perfectly clear and brilliant; common steels, in which the sulphur may reach, say, 0.05 per cent., give a solution so decidedly different in clearness that they can be readily distinguished from each other. More noticeable still does the influence of the sulphur become when it is present to the extent of 0.1 to 0.2 per cent., and in a "steel" with 0.50 per cent. it is quite impossible to make any satisfactory adjustment of the tints.

In the experiment tried by Prof. Eggertz, and referred to above, the sulphur added as magnesium sulphate is equal to one per cent.; if a "steel" actually containing this quantity had been used, instead of finding it to be without any influence, it would have been found quite impossible to compare it with any ordinary standard.

A very simple experiment showing how the color estimation is influenced by the presence of suspended matter in the liquid, may be tried by taking a highly diluted solution of ammonium sulphide to which an excess of nitric acid has been added; this solution will be quite milky, owing to separated sulphur. If now a sample of pure Swedish steel be dissolved in the usual way and divided into two equal portions, and to one of them a drop of the above solution is added, an immediate increase in the color intensity will be observed when the tubes are examined from above as they are held over a mirror.

Not only is the color intensity altered, but the brilliant amber-colored solution will be found to have acquired a distinctly browner hue, and this suggests that, apart from the difference of color quality, due to slight variations in the condition of the carbon, sulphur possesses an important influence in this respect.

Another interesting experiment is to take the solution of a common steel containing 0.05 to 0.1 per cent. of sulphur and divide it into two equal portions and filter one of them; if they are now carefully compared with each other, the result of the observation will be somewhat astonishing to those who may be under the impression that their estimations are reliable to within one or two hundredths per cent.; the two solutions will be different both in quality and intensity. I would here point out that when an attempt is made to adjust the tints of two colored solutions differing slightly in clearness or quality, if only a small portion of the liquid be looked through, as is done when looking across the tubes, the observer is often easily satisfied with his comparison; but if, after having apparently adjusted the tints of the liquids in this manner, he will look through a much greater depth of the fluid, his self-satisfaction will often disappear; the fact is that two colored solutions, differing even slightly in quality, can never be exactly equalized.

This subject is one of great importance on account of its bearing upon the question of the proper selection of standards, and in conclusion it may be of interest to note that if a common steel is compared with a stand-

* Abstract from a lecture by P. L. Simmonds.