first used the reflector, so that the subjects should not appear to be reversed. He built the first locomotive with wooden wheels, but with the same double crank now used. He originated the process of photo-lithography. To guard against abuses of this process, he invented the system of printing in colors on bank notes and patented it, but never received any benefit, all the banks having used it without pay. He perfected the system of making collodion for the photographers, and aided Mr. Harrison in the mode of grinding lenses for camera tubes."

Perhaps his greatest invention was that of the plumbago crucible, as used to-day, and thereby he revolutionized the metallurgical industry of the world and laid the foundation of his large fortune. In 1827 he was established in the manufacture of crucibles and shortly thereafter moved to its present location in Jersey City. The Joseph Dixon Crucible Company was incorporated in 1868, and has grown steadily year by year to its present magnitude. One by one new uses have been found for graphite, and in this field the Dixon Company has always been the pioneer. Stove polish, pencils, paint, lubricants and half a hundred specialties has this marvellous mineral graphite yielded, and each succeeding year has brought forth new uses and new Dixon products.

To-day, the Dixon factories turn out almost three hundred pencils for every working minute, and seven hundred different pencils are regularly made. They own their mines and are also importers so that the exact quality of graphite is provided for the peculiar needs of each application of it. It is very necessary in the manufacture of graphite products that the form and size and chemical analysis of the mineral be exactly adapted to the work in hand. Graphite for lubrication purposes must be of the flake formation as the amorphous is always associated in nature with earthy impurities from which it cannot be separated. Even the Flake Graphite from the Dixon mines has to be carefully milled to wholly free it from the silicates with which it occurs and the processes call for great skill and experience and much elaborate equipment. It is almost impossible to detect impure from pure graphite by the appearance or feeling and the only safe way to avoid the mishaps that will surely follow the application of a gritty lubricating graphite, is to refuse anything but a responsible manufacturer's original packages. The history of the graphite industry can almost be written in the records of the Joseph Dixon Crucible Company, and "Graphite" has come to mean "Dixon" the world over. The company issues a good deal of useful literature on the uses of graphite, alone or in combination with other substances as a crucible mixture, stove polish, protective paint, lubricant, pencil "lead" or electrical specialty, and will no doubt respond to enquiries on these subjects from interested readers.

STREET CAR WHEELS AND TYRES.

R. H. Simpson discusses in The Light Railway and Tramway Journal, of London, the merits of steel tyred and chilled iron wheels. He says:

In view of the present tendency towards equipping cars with steel-tyred wheels, it may be interesting to take up a few points with regard to them. Careful consideration should be given to the question of diameter before specifying the size with which the truck is to be fitted. In America the standard wheel diameter is 33 in., and the type of wheel used is invariably the chilled one. In this country the diameter up to the present time has generally been 30 in., and also that of the chilled iron type. Amongst others, there are two reasons for the adoption of this diameter: one, a relict of the days of horse traction, and the other, that with this diameter the height from the ground to the steps is reduced to a reasonable figure. It is generally known that with 30 in. wheels and with most manufacturers' motors there is not more than from 2¾ to 3 in. difference between the underside of the motor or gear case and the top of the rail head, and it is also invariably found in practice that this dimension does not obtain in the centre of the track between the rails, as the paving, whether of stone setts or wood blocks, is crowned at least ½ in. Besides this, the paving rises after a short time, and it is difficult to prevent it from doing so; therefore, with new wheels 30 in. in diameter, there will be less clearance than is stated above. It is not possible to wear down a chilled wheel 30 in. in diameter to less than 28¼ or 28½ in. on account of getting below the depth of the chill, which is only from ⅝ to ⅞ in. deep; also the clearance between the motor and the ground becomes too small—some 2 in. or so. In changing from cast-iron wheels to steel-tyred, the diameter should be increased for this reason: the steel tyre, which is usually 2½ in. deep, allows a greater depth to be worn down, say to 1½ or 1¾ in. on the radius, instead of ¾ to ⅞ in. in the case of the chilled wheel, and if a 30 in. steel-tyred wheel is employed, the motor will be down on the track before the full life of the tyre can be obtained. This result will be seen to be extremely uneconomical. For this reason the writer advocates the use of a wheel of not less than 31¾ in. in diameter when steel-tyred, which size is in use on several existing tramways. It will, therefore, be seen that it is useless going to the expense of a steel tyre with a depth of 2½ in., which is the minimum, if it cannot be worn down to its working limit on account of the smallness in diameter bringing the motor down on the road. The objection that a larger diameter wheel raises the height of the steps can be easily remedied if these two points are considered together when designing the car underframe, and, as a matter of fact, there are cars running already with wheels 31¾, 32, and even 33 in. in diameter, in which this trouble has been eliminated.

STEEL-TYRED VS. IRON CHILLED WHEELS.

This subject requires thought and experience before an opinion can be expressed; each type has its merits, but the conditions of working should be considered before deciding upon the type of wheel to be installed. The writer has not been able to ascertain that both types of wheel have been run over the same line under equal conditions, and would be glad to be informed if such had been the case. By equal conditions is meant a new track carefully laid and thought out, with the same section of rail throughout, the gauge constant, wheel base of truck arranged to suit the minimum curves, and whether single or double track cars in either case; as regards the wheels themselves, the section of tread designed to suit the rail on which it has to run, especially in respect to the thickness of the flange; and lastly, the correct wheel gauge to which the wheels should be pressed on. The writer is of opinion that, with all points taken into consideration, the difference it costs between the two types of wheels would not amount to a great deal. It is very well known that on those lines where trouble has been experienced with chilled wheels, due to the flanges chipping, it has not been so much the fault of the wheels themselves as the condition of the track over which they have had to run; also, that some engineers insist on their own design of tread instead of leaving this detail to the wheel manufacturer. While on this point of section of tread, I think it is now quite time that a standard section should be agreed upon, taking into consideration that in the near future cars owned by various corporations and private companies will be running over one another's lines. It is argued that steel wheels have stronger centres than chilled ones; this may be so, but there have been few failures in this respect with the chilled wheel. The steel-tyred wheel appeals more to the mechanical engineer, especially to the steam or railway man, who has been used to these wheels on his steam locomotives, but whichever wheel is adopted much depends on the quality and price of the wheel purchased, the amount of attention it receives, the gradients over which it has to run, the condition of the permanent way, the radii of the curves, whether electric braking is used extensively or not, and to the skill (or lack of it) on the part of the motormen, all of which vary considerably. On a road which is properly managed, both as to upkeep of rolling stock and education of its drivers, it will be found that not only wheels, but other renewable parts, last some 50 per cent. longer, and even more, than on those lines which are left practically to run themselves till something gives out. The writer has noticed that with steel-tyred wheels the flange has sometimes worn hollow at the throat, but this has usually happened on bogie trucks, which have had insufficient lubrication on their side bearings, causing them to work stiffly, the truck consequently not adjusting itself to the track after having passed round curves.