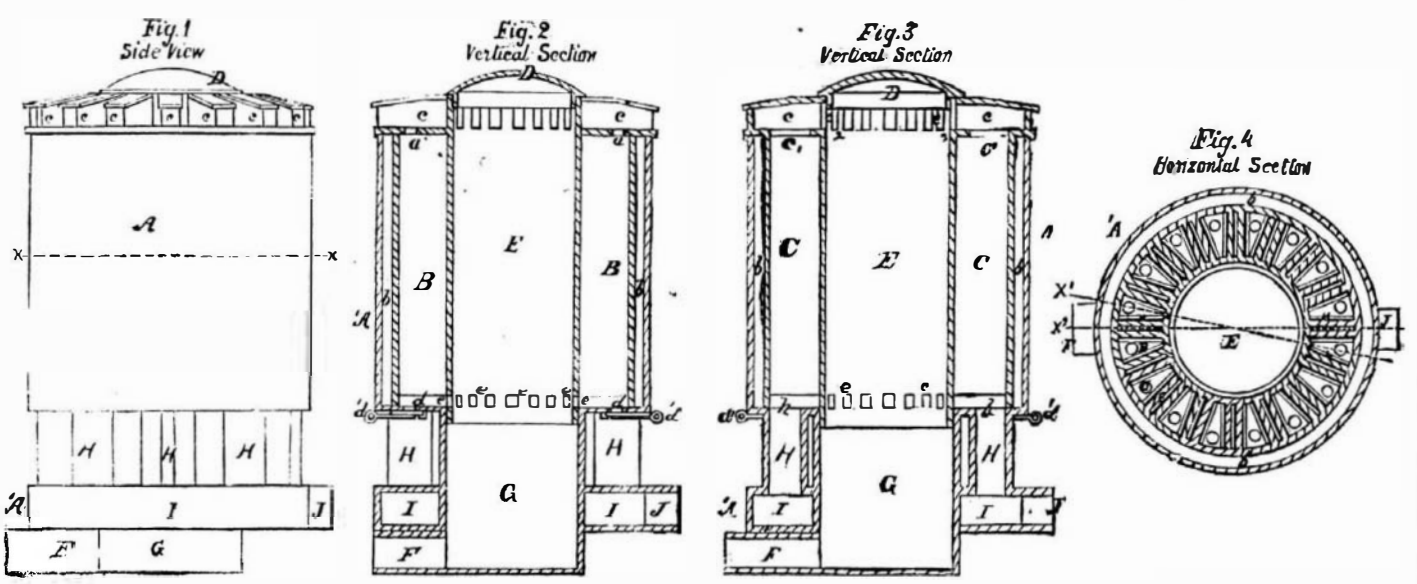
THE WILSON PROCESS FOR MAKING WROUGHT IRON DIRECT FROM THE ORE.

BY EDWARD M GRANT, C.E.

The repeated attempts to manufacture wrought iron direct from the ore are so well known that it is useless to recount the history of past inventions, and, therefore, I will proceed directly to a description of the process which I have investigated.

This furnace was invented and patented by Mr. Joel Wilson, of Dover, N. J., who has spent his whole life in the iron business, in England and America, and has been working on this process for nearly twenty years. His last patent was taken out in July, 1872; and his furnace has been in operation a portion of the time during the last twelve months. The stoppages have been caused by changes made at various times in the puddling furnaces, to adapt them to this process; several hundred tuns of iron have been made by this method during that time and sold in the New York market.

I first heard of this invention in August, 1872, and in December I came north for the purpose of making a thorough investigation of its merits. I brought several tuns of hematite ore from Alabama, for the purpose of testing the working of our native ores by this process. I became so much interested in the matter that I remained in the vicinity of the works until September, 1873, when they were closed in consequence of the panic. During this time I weighed nearly all the ore and coal used in the furnace, and kept complete records of the yield in muck bar from each retort, as well as the amount of coal used in puddling, time of heats, etc. I also preserved samples of muck bar from the various charges of ores, to test the uniformity in quality of the iron produced.



WROUGHT IRON DIRECT FROM THE ORE.—THE WILSON IRON FURNACE.

The accompanying diagrams will assist an explanation of the apparatus. The ore is crushed to the size of small shot, and mixed with the proper percentage of powdered coal, and then charged in the retorts, B, through the apertures, *a a*. These retorts are built of fire brick or tile, and dovetailed together in such a manner as to hold them firmly in position. They contain from 1,300 to 2,000 lbs. of ore, according to the comparative weight and bulk of the mineral. The heat employed is produced from the gases escaping from two or more puddling furnaces, which are conducted from said furnaces through the flues, F, into a collecting chamber, *i*, whence the gases ascend to the level of the base of the retorts at *d d*. Here part of the heat passes under the retorts through the small flues, *h h*, into the annular space, *b b*, thence up to the top of the furnace, where they are conducted through the conduits, *c c c*, into the intermediate flues, C′ C′ C′, and thence downward. The major part of the gases rises up through the central chamber, E, to the cap, D, thence through the conduits, *c c c*, and down through the flues, C C, uniting therein with the portion of the gases that went up the annular space, *b b*, thence down through the stand flues, H H, into the circular collecting flue, I I, which conducts the escape heat to the stack.

In this way the gases pass entirely around the retorts, heating them from the outside, while the ore is completely protected from the action of the puddling furnace gases.

After the ore in the retorts has been reduced by the action of the carbon mixed with it, and thereby freed from its oxygen, the metallic iron, in the shape of red hot particles (which flow freely, like fine gravel), is taken out at the bottom of the retorts through the apertures, *d d* (covered by the slides, *d′ d′*), and received into an airtight vessel, of my own design (thus protecting the ore from oxidation from the atmosphere), and is there transferred to a hopper, opening into the puddling furnace, whence it is charged upon the hearth beneath, without losing the heat absorbed in the reducing furnace.

This reducing furnace contains sixteen of these retorts, twelve feet high, arranged in a circle about the central chamber, E; the tiles forming the retorts are two inches thick and twelve inches in hight; all parts of the furnace exposed to the action of the products of combustion are constructed of fire brick or cast iron lined with fire clay. The central chamber, E, is seven feet in diameter, and this size of the passage prevents any cutting away of the brickwork by the flame, and also produces an even distribution of the gases through the intermediate flue system, C C C. The heat which escapes from the flue, J, looking to the stack, is sufficient to raise steam for blast and rolling machinery. One of these reducing furnaces will supply three puddling furnaces with reduced ore, so as to keep them in constant operation, and the escape gases from two of these furnaces will furnish all the heat required to deoxidize the ore.

The construction of the puddling furnaces is based upon the same general principle as that adopted in ordinary bar mills; they are lengthened out, however, so as to form three bottoms, about the ordinary size; the first, next to the flue, is inclined, and upon this hearth the ore is charged; it is thoroughly heated up here, and is then moved forward upon the second hearth, by a tool designed for the purpose, where it is heated sufficiently to melt the slag produced by the fusion of the impurities of the ore; from there it is moved to the third bottom and balled up. The operation is continuous, as a second charge is placed upon the first bottom as soon as the first one is moved to the second hearth. The puddling involves less muscular exertion than that required for working pig iron, and only requires one laborer in addition to the usual puddler and helper employed in the ordinary furnace; and the yield from the puddling furnace is fully equal to the production of similar furnaces in using pig metal.

The operations of hammering or squeezing, rolling, etc., are, of course, the same as in the ordinary working of pig iron blooms. A tun of finished iron can be made with two tuns of coal, including that used for reducing purposes. The cost of these reducing furnaces is a small item, and they can be erected in any rolling mill, and the puddling furnaces modified as described, and thus render the mill owners independent of the blast furnaces.

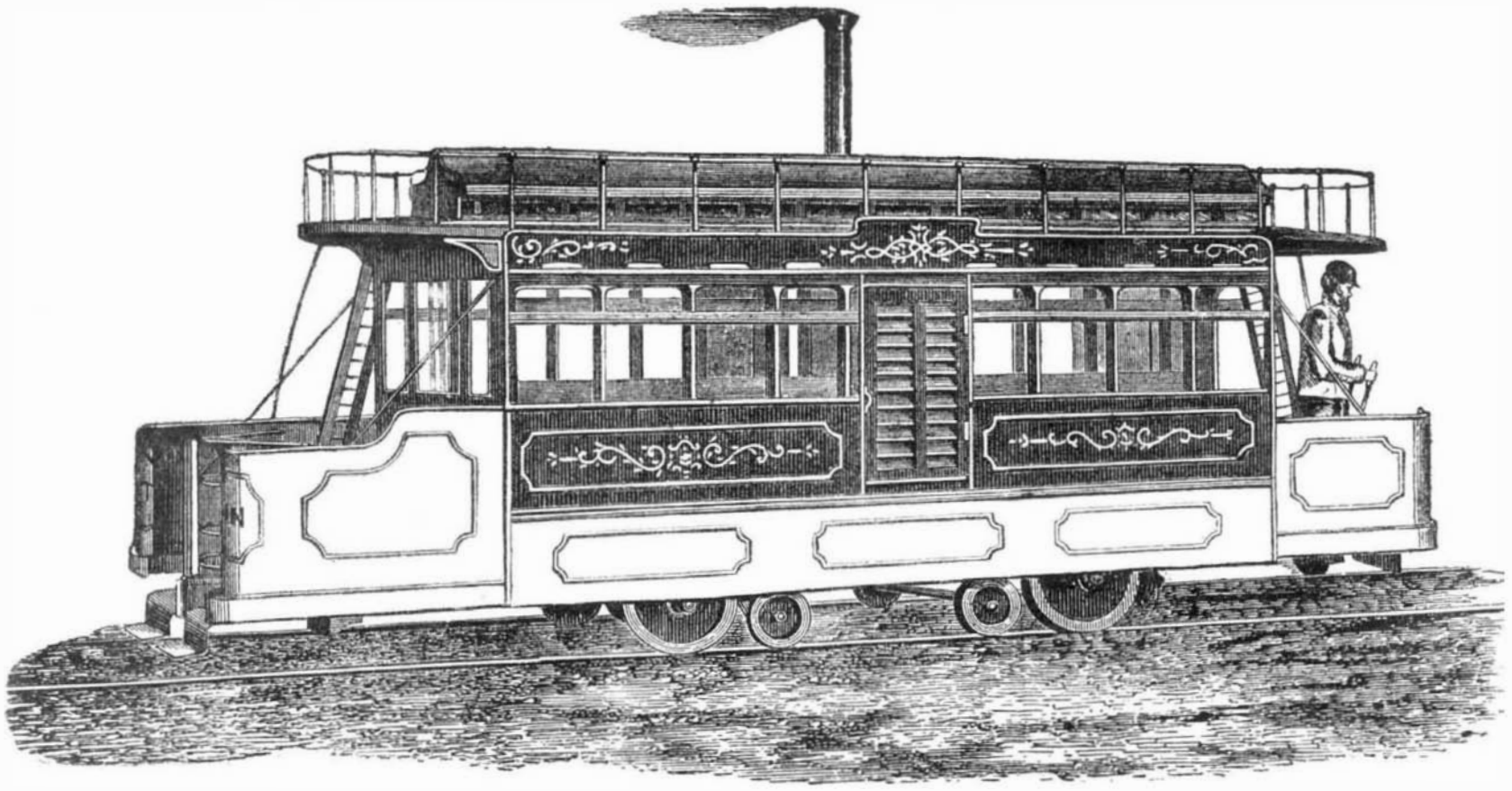
The yield in muck bar from the ore is about the same in amount as that obtained at the blast furnace in the shape of pig iron. The Alabama ore assayed 54 per cent, and I obtained 47 per cent muck bar. Seven tuns of ore sent me from Georgia assayed about 50 per cent (being surface ore) and yielded 45 per cent. Spanish ore from Bilboa, assaying 48½ per cent, yielded 45 per cent, and many ores from New Jersey and adjacent States yielded to within two to five per cent of the assay. Magnetic and hematite ores were worked with equal facility, and they were mixed together in various proportions, fully demonstrating that mixtures of ores could be worked so as to produce any kind or quality of iron desired. The muck bar showed a uniform fracture both in color and texture, and there is no question about this process producing a quality of iron equal, if not superior, to any produced from the same ores by the old process. The degree of heat employed in the reducing furnace is not sufficient to produce any visible effect upon the bricks, and, therefore, they will endure a long period of service. The furnace is surrounded by a casing of tank iron, with a fire brick lining between the iron and the annular space, *b b*.

Ores containing an excess of impurities may be fluxed in the puddling furnace with perfect facility.

During my investigations, every facility was afforded me by the proprietors of the works; and for a good portion of the time, the operations were practically under my own direction, the inventor following my suggestions so that I might have every point tested in my own way, and to any extent deemed necessary. My conclusions were so favorable that we should have had our works in the South, upon this plan, well under way by this time, but for the unexpected stringency in the financial world, which has, of course, postponed all new enterprises.—*Engineering and Mining Journal.*

A NEW STEAM OMNIBUS AND STREET CAR.

Our engraving illustrates a new style of steam passenger cars, for street railways, the invention of Mr. Grantham, of London, where the improvement was lately tried. Two small boilers are used, one on each side, fired from the ex-



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