can be reburned with the next charge. The sound ones are to be ground coarse or fine, according to requirement, and the ground stuff is ready for use.

The material thus prepared I call "pyroconcentrates of fluxed clay." Its distinguishing characteristics, as compared with merely calcined clay substance, are as follows: The pyroconcentrates of fluxed clay consist, practically, of aggregates of aluminum silicate molecules that are bound together by vitrified remnants, mostly in the form of very thin films of the liquefied slag. When a comminuted mass of such concentrates is intensely heated, these vitrified particles resoften to some extent and then act as a mechanical bond without reacting, chemically, on the aluminum silicate. Granting that a lining which contains such remnants of the liquated slag may be attacked by a bath of liquid melted monosilicate slag, it stands to reason that the ensuing corrosion cannot be very energetic, considering that the silicate constitution of the slag bath does not differ much from that of the slag remnants of the lining. Pure clay substance, on the other hand, contains nothing that could bind it under heat, and if a clay does frit together in calcining, this chemical action is evidence that the calcined mass contains sufficient soluble matter to become readily decomposed by a corrosive slag bath. The pyroconcentrates can be applied in the usual manner after mixing with tar, etc., for lining the inside of melting vessels and furnaces, as a top dressing for linings made of other material, and for the manufacture of tuyeres, crucibles, and other refractory products. Its proper application as a hearth lining allows, as already explained, of holding and manipulating a thin fluid slag, which is so corrosive that it readily destroys the acid, as well as the basic and so-called "neutral" linings that have been thus far devised. This feature may also give rise to an important improvement in the manufacture of steel, inasmuch as a decarbonized steel bath can be purified from remnants of sulphur and phosphorus by bringing it into intimate contact with thin fluid desulphurized blast furnace slag. That such slag readily absorbs ferrous sulphide bodily—*i. e.*, holding it in intermolecular combination—and that it readily combines, chemically, with phosphoric oxide and phosphates is well known; but, in order to desulphurize the slag and in order to utilize the desulphurized slag for the indicated purpose, the suitable hearth lining material had first to be devised.

The mechanical portion of the herein described method of treating clay allows obviously of many modifications that are determined in actual practice—as, for instance, the most suitable shape and sizes of the pieces that are to constitute the charges and the manner of forming them, the most suitable devices for furthering the overflow of the slag from the fining charge and the arrangement of the hearth, which will be most advantageous for facilitating the separation of the slag from the fining charge—such modifications depending chiefly upon the capacity and construction of the furnace plant that is to be used and on the volume of the charges that are to be treated.

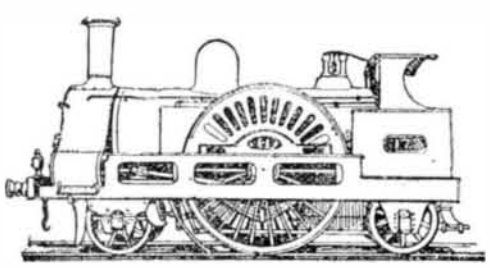
CLAIMS.

1. The herein described process of treating clay for the lining of metallurgical furnaces, etc., which consists in intermixing suitable clay with a flux which, if admixed in suitable proportions, combines with the fluxible accidental constituents of the clay to a thin fluid percolating slag when the mix is heated to about white heat; in preparing the mixes of clay and flux by forming and drying for the heating operation; in subjecting the prepared charges on the hearth of a suitable heating furnace first to a fritting heat and then to a melting heat; in furthering the outflow and removal of the slag from the melting and molten charges by suitable manipulation; in drawing and chilling the finished charges, and in preparing them for use by crushing, assorting, and grinding.

2. As a new article of manufacture, pyro-concentrates of fluxed clay, consisting of particles of dehydrated aluminum silicate holding remnants of a liquated flux in mechanical combination, substantially as described.

A FAMOUS LOCOMOTIVE.

IT is remarkable that one of the fastest, if not the fastest, engine now running was built forty-five years ago. She was designed when the great competition between the now vanished broad gauge and the narrow gauge was at its height. The Great Western on the broad gauge had beaten all records by upon several occasions obtaining a maximum speed of seventy-eight miles an hour, and it was necessary to beat her on the narrow gauge. The result was the building by Mr. F. Trevithick, superintendent of the northern division of the London and Northwestern Railway, of the Cornwall. Her driving wheel was made six inches larger than that of the Great Western, which



THE CORNWALL.

Built 45 years ago with the largest driving wheel in the world.

was 8 ft. in diameter. Mr. Trevithick, in order to obtain a large driving wheel and a low center of gravity, adopted the peculiar plan of placing the boiler under the driving axle. The driving wheel of 8 ft. 6 in. was the largest size which had then, or has since, been tried upon the ordinary 4 ft. 8½ in. gauge, the cylinders being 17½ in. diameter and 24 in. stroke. The engine appears to have fully answered the expectation of her designer, for upon the trial trip a speed of fully seventy-nine miles an hour was attained under favorable circumstances, thus beating the Great Western by one mile an hour. She was shown at the exhibition of 1851, but the position of her boiler was not approved, and in 1863 a new boiler was put in her above the axle. We give a sketch taken from Mr. Stretton's "Locomotive Engine and its Development," and it is interesting to know that the engine is still working the forty-five minute expresses between Manchester and Liverpool, one of the fastest services in the kingdom, and it is stated that still, after her forty-five years' service, with a load equal to her power, she is capable of running at the highest possible speed yet attained.—*Daily Graphic.*

STEAM FIRE ENGINE FOR BOMBAY.

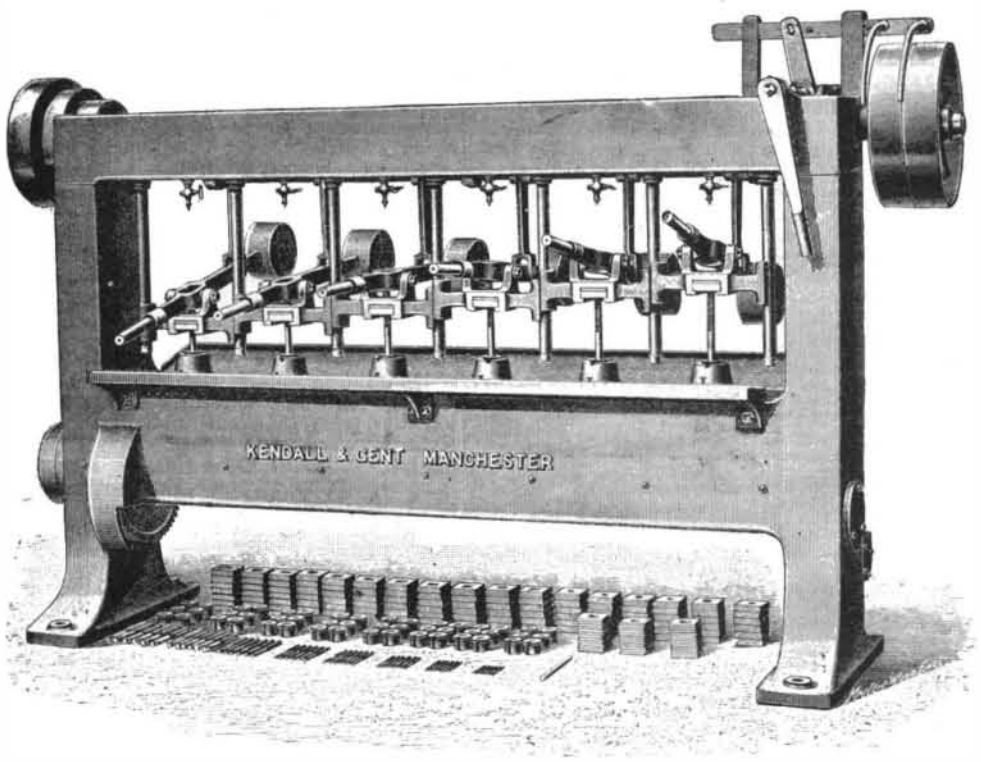
THE fire engine illustrated is one of a series of five recently made by Messrs. Merryweather & Sons for the Bombay municipality. In general design, says the *Engineer*, it is similar to those constructed by them for the Metropolitan Fire Brigade, but of greater capacity. In order to reduce unnecessary weight the usual gun metal distance piece between the pump and cylinder is replaced by three turned steel stays, the two upper ones carrying the crank shaft bearings. The bent crosshead, a specialty of the makers, is used, so that while the whole machinery is short and compact, a long connecting rod is admissible, which insures much freer running than could be obtained by a slotted crosshead or other arrangement usually used to shorten up the engine. A twenty foot length of suction, not shown, is carried on the engine, always attached to the pump, and the delivery outlets are fitted for improved instantaneous couplings.

A light fly wheel of large diameter is provided, in order that the engine may be worked at slow speed if required. The outside of the pump is triangular, and the two side covers are made removable in one piece with their respective valves. The pump is also fitted with a by-pass in case it is required to work from a limited water supply or through long lines of hose. A large hose box, forming seats for firemen, is fitted on the front of the engine, and the whole of the machinery is accessible from the back, so that the stoker can attend to the fire and the engine without moving from his post in the rear.

Our illustration shows the various points alluded to, and the whole forms a light, powerful machine, and is capable of delivering water under high pressure, 360 gallons per minute.

IMPROVED NUT TAPPING MACHINE.

WE illustrate herewith an improved type of vertical nut tapping machine, possessing several novel features and constructed by Kendall & Gent, of Manchester.



IMPROVED NUT TAPPING MACHINE.

In vertical nut tapping machines, as hitherto made, the taps are driven from above, and after passing through the nuts they fall out of their holders into the trough with the lubricant, cuttings, nuts, etc., which very frequently results in damage to the taps and the very unpleasant necessity of the attendant having to "fish" out the taps from among the oil, cuttings, nuts, etc., in the trough, and reinsert them in the holder for each nut. In the machine illustrated above the operation is entirely reversed, so as to obviate all these defects, and also the great loss of time resulting from them. The taps, as will be seen from the engraving, are driven from below, and the nuts are passed on to them, until the shanks of the six taps, with which the machine is fitted, are full, so that the taps only require lifting out about once every six nuts, to allow them to fall off the shank.

This type of construction allows also of perfect lubrication, as the oil from the lower cistern is pumped by the machine into the upper one, and pipes being fixed over the center of each tap, a constant stream of oil is kept flowing down the grooves of the taps, insuring perfect lubrication.

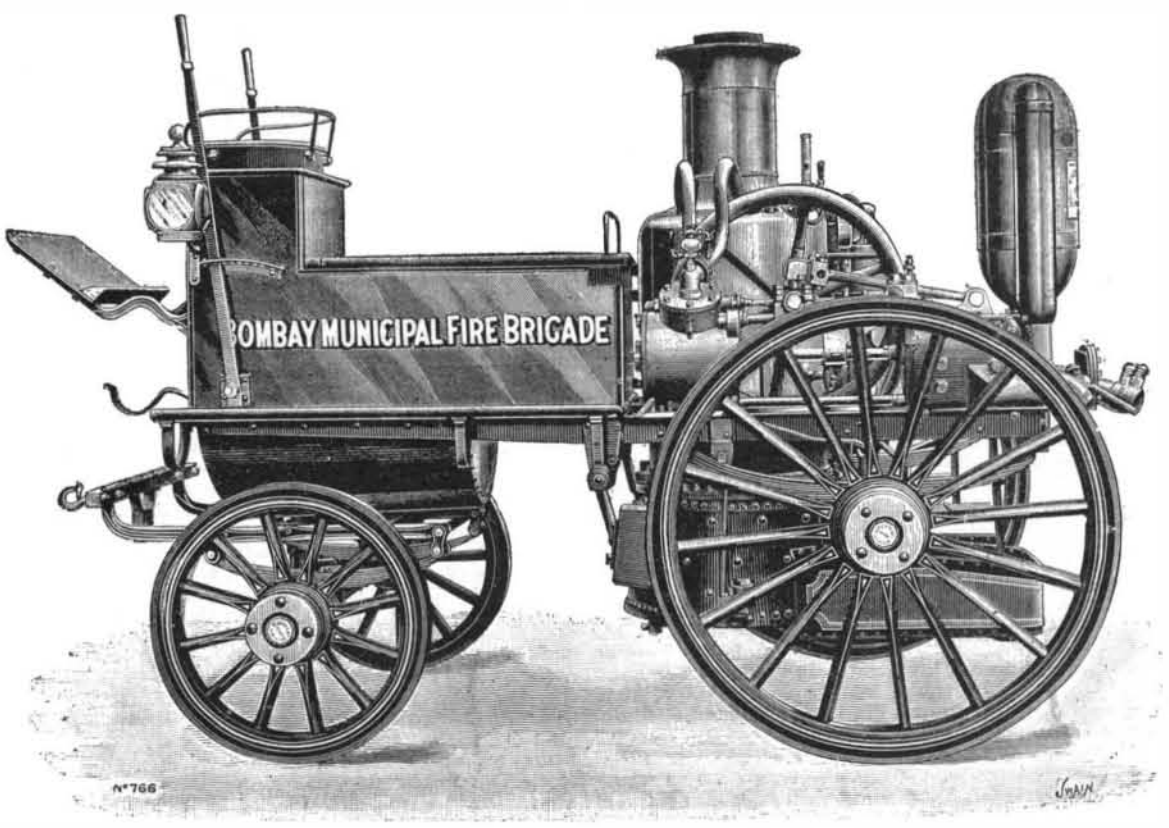
These machines, which are of very substantial construction, form very compact designs, the driving apparatus, stop motions, etc., being entirely self-contained.—*Practical Engineer.*

ON THE TRANSMISSION AND DISTRIBUTION OF POWER IN MODERN SHIPS.*

By NABOR SOLIANI, of the Italian Admiralty.

IN modern ships steam power is used not only as a propelling agent, but also to execute a great variety

* We are indebted to Messrs. Wigham, Richardson & Co., of Newcastle-on-Tyne, for the translation of this paper.



IMPROVED STEAM FIRE ENGINE.

© 1892 SCIENTIFIC AMERICAN, INC