

more difficult to obtain the red in its true value, and sometimes it appears with an orange tint. It is necessary to sensitize the plate more especially for the red and to modify the nature of the film so as to increase the intensity of the reflected beam.

#### NEW APPARATUS FOR CHARGING AND DISCHARGING GAS RETORTS.\*

By EMILE GUARINI.

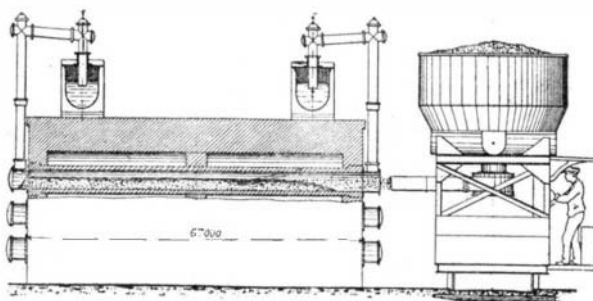
THE fierce war that has for a long time been waging between gas and electricity has had two fortunate results, viz., a diminution in the price of gas and the introduction of improved apparatus for its manufacture. In this respect, the gas industry, one of those most affected by the advent of electricity, has made some great strides, which have been plainly necessitated by the primitive character that the manufacture of coal gas has long possessed. As for electricity, that has always shown itself a little too supercilious toward its competitor. So the efforts made and the results obtained with a view to lowering its net cost are insignificant as compared with what has been effected with gas. And this is not all; electricity has begun to borrow from gas, its competitor, a power which is often cheap and always easily utilized. The central stations in which the dynamos are driven by gas motors are already too numerous to be counted.

If electricity, the victor of the day, has cared so little for gas, it is because, leaving aside heating, for which it is almost everywhere unattainable, it furnishes the most economical means of transmitting motive power to great distances and of dividing it without trouble into small units. As for lighting, the use of incandescent gas burners is usually more economical than that of electricity. It must be remarked, however, that electric lighting by incandescent lamps presents such conveniences of installation and maintenance and such hygienic advantages, and lighting by arc lamps lends itself so well to the institution of great luminous units, that a sort of equilibrium is established between the general advantages of electricity and the economical advantages of gas. It remains, however, to be ascertained to what figures the price of gas will be able to descend. In fact, in our time, in which we are, before all else, practical, or, more exactly, pseudo-practical, since the sacrificing of health to money is not being practical, there is a tendency toward the abandonment of the hygienic and convenient arc lamp for the burner with incandescent mantle, which gives a light that costs, say, a tenth less than that produced by an electric lamp of equal luminous power.

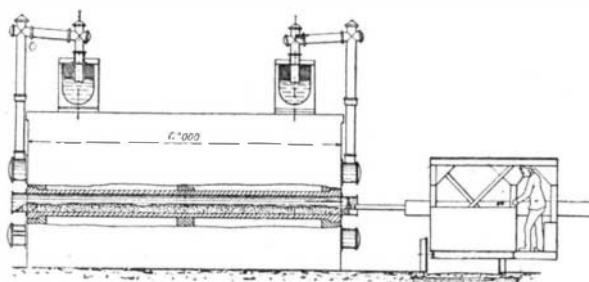
Now with gas the method of charging the retorts may become the source of an important saving. So it is upon this that the efforts of engineers are being

to slide from the heap and place itself in layers that are very uniform provided that the angle of inclination of the retort is equal to the angle of subsidence of the coal. Unfortunately, coal varies, and, with it, the angle of the inclination, while the angle of the retort remains invariable, without taking into consideration the velocity of fall of the coal and other causes that interfere with the regularity of the layers.

All these reasons and many others gradually in-



SECTION OF THE RETORT, WITH COKE DISCHARGER ENTERING.



COKE DISCHARGER OF LA VILLETTE GAS WORKS.

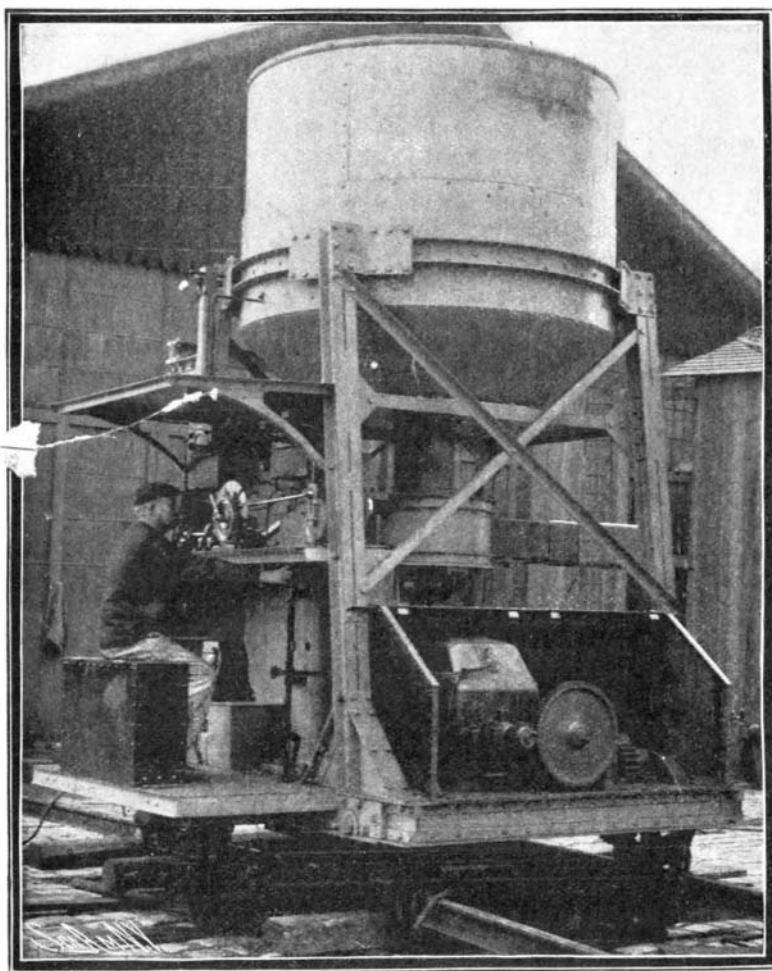
duced the most ardent defenders of the inclined retort to turn their attention to charging and discharging machines, which, up to the present, have operated more or less after the fashion of the charging scoop.

The problem has at length been solved in an entirely different manner by the electric turbine charging and discharging machine of the Parisian Gas Company, and by the De Brouwer charger invented by the superintendent of the Bruges Gas Works. It is electricity to which the inventors have had recourse for the elaboration of these machines, two of the results of which are now certain, viz., a diminution in expenses and a betterment of the condition of the laborers.

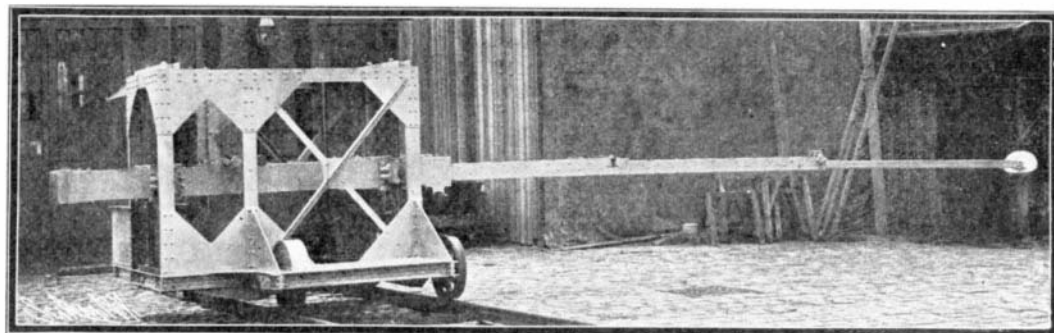
electric motor. The charge is thrown by centrifugal force through a tube into the retort in a continuous stream. The portion of the tube that projects outside of the frame of the machine can be raised. This portion closely approaches the head of the retort, but does not enter it. The turbine can be raised or lowered to the level of the different rows of retorts. The upper part of the apparatus consists of a coal hopper of a capacity of about four tons, which feeds the turbine through a telescopic column that permits the turbine to rise and descend. The passage of the coal into the turbine is regulated by two horizontal endless screws. The electric motor, which is of 4 horse-power, follows the turbine in its ascending and descending motions. Upon one of the sides of the machine there is established another electric motor (12 horse-power), which gives the machine its lateral motion and, by means of gearings, actuates the endless screw. The whole is mounted upon a simple carriage. The current is taken from aerial wires strung along the retort room. The electricity is generated by an installation actuated by a gas motor. The machinist has only to manipulate the interrupters and rheostats in order to put the apparatus in position and start the turbine.

At the beginning of the charging, the turbine makes 400 revolutions, and, at the end, 200. The starting is effected by a simple commutator, and the change of speed by the rheostat. This *modus operandi* does not meet with general approbation, and does not exist in the De Brouwer machine. The space occupied from the front to the back of the machine is seven feet. The weight, everything included, is ten tons.

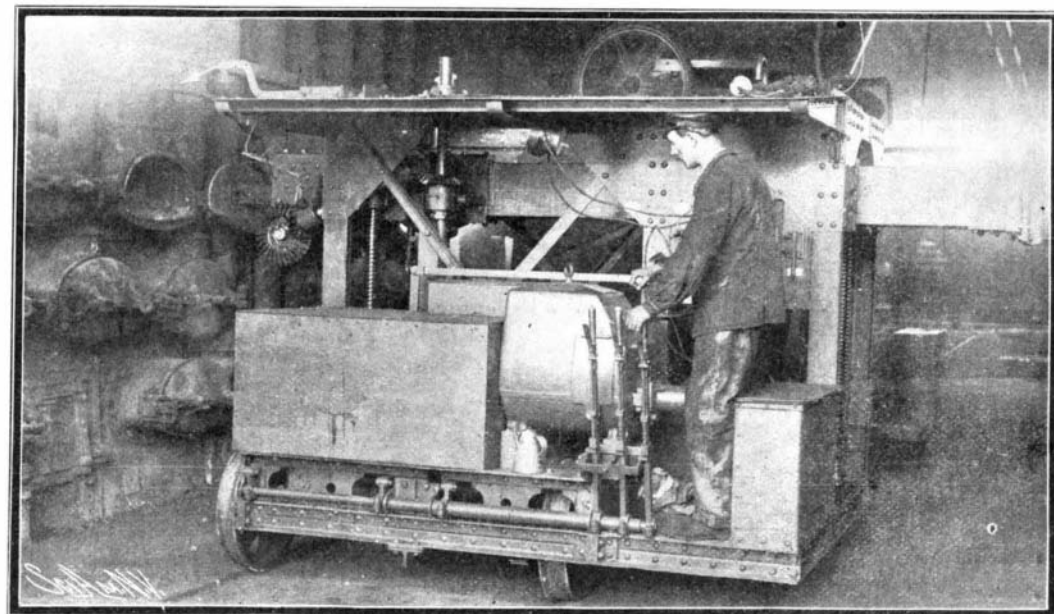
The De Brouwer charger has the advantage of not requiring an expensive installation, of costing little for maintenance, and of being capable of being operated by inexperienced hands. It is as applicable to small as to large works. The machine consists principally of a short belt passing over three idle pulleys with a great velocity. A fourth and larger pulley provided with a channel presses the back of the belt and forces it to follow its periphery for a quarter of a circle. The pulleys are actuated by a 4-horse-power electric motor placed upon the machine. The channel of the large pulley contributes, with the belt, toward forming a conduit. Between the large pulley and the one to the right there is a hopper for emptying the coal. This latter follows, with the belt, the periphery of the large pulley, to an extent of 90 deg. Centrifugal force during its passage into the channel of the pulley presses it against the belt and prevents it from scattering during the rest of the journey. As soon as the belt leaves the contour of the large pulley, the perpendicular direction changes to horizontal. The coal remains upon the belt up to the point at which the latter, in suddenly disappearing from under it, runs over the small pulley. At this moment, the coal



ELECTRIC TURBINE RETORT CHARGER.



TELESCOPIC COKE DISCHARGER DRAWN OUT TO THE FULL EXTENT.



ELECTRICALLY-OPERATED RETORT CHARGER.

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concentrated. Originally, the charging was done by shovel—a long and troublesome process. The use of the charging scoop marked a progress, but it was inadequate. Then machines for charging and emptying made their appearance, but they were too heavy, and not at all economical. Next came the turn of the inclined retort, into which the coal is simply allowed

The machine of the Parisian Gas Works is in operation at La Villette works. As for the De Brouwer machine, that throws the charge into the retorts, but does not convey it to them. At La Villette, the retorts are 20 feet in length. The coke is discharged at the other side, as we shall see further along.

The central part is a turbine of two feet four inches diameter. It contains four blades formed of two riveted sheets of steel. The power is furnished by an

leaves the belt and is thrown with a certain velocity into the retort. The De Brouwer charger is therefore a sort of mechanical sling.

The charging is effected as follows: The compartment of the reservoir corresponding to the retort to be charged and containing about three hundred and thirty pounds of coal is opened by means of a lever. The coal descends into a funnel, falls upon the belt, slides between the latter and the large pulley, and

\* Specially prepared for the SCIENTIFIC AMERICAN SUPPLEMENT.

is then thrown in the form of a layer of uniform thickness into the retort to be discharged. As the coal is projected into the retort horizontally, the layer is of perfect regularity. The first part of the charge is thrown to the bottom of the retort, and, as the layer is formed from front to rear, it reaches the head of the retort at the moment at which the entire charge has passed the charger.

The charging of a 20-foot retort is done in a few seconds. The putting in position for a new operation requires seven seconds. Three retorts can be charged in one minute, and one person suffices for regulating the operation. For the charging of a 10-foot retort, the large pulley makes 200 revolutions a minute. The coal escapes with a velocity of about 2,000 feet a minute.

The vertical and lateral displacement of the machine is obtained by very simple means.

Although based upon an analogous principle, the two chargers differ from each other considerably. If the new machinery continues to do all that it promises, it will combine all the advantages of the inclined retorts without having their drawbacks. Such advantages may be summed up as follows: A very great saving in manual labor, a moderate net cost, adaptability to almost all gas works, a minimum of wear, an enormous capacity for work, and certainty in action. The fault found with La Villette machine is that it necessitates a close proximity of the jointed pipe and the head of the retort. The heavy draught of air caused by the running of the turbine keeps the head of the retort surrounded by a thick veil of flame. It is possible that if the pipe were not so close at the head of the retort this disadvantage would disappear, especially if the upper part of the pipe were abolished. The De Brouwer charger shows that coal can travel very well through centrifugal force without being confined in a closed canal.

Another advantage of the De Brouwer charger that has been noted, especially at the Bruges Gas Works, is the diminution in the accumulation of graphite in the retorts, no removal of this material becoming necessary for a period of six months. This quite unexpected result seems to be due to the fact that a certain quantity of air is carried along with the coal at every operation and burns the graphitic residuum produced during the preceding operation.

The turbine charger of La Villette has its natural complement in the electric coke discharger employed at the same works. This is telescopic and in three parts. To its head is secured a thrust-plate having the form of the section of the retort. In front of the apparatus there is a toothed wheel, of which the teeth are wide enough to give place to the teeth of the bottom of the discharge. The internal section of the latter engages with the teeth of the central section of the wheel; the second part of it with the second and fourth divisions, and the external part with the teeth of the first and fourth divisions of the wheel. The operation of the apparatus, its elevation and its lowering, are effected by means of a 12-horse-power electric motor. The apparatus is provided with three levers, one for the lengthwise displacement, one for the elevation and lowering, and the third for the control. After the apparatus has reached the end of its travel, it returns automatically to where it started.

The raising and lowering of the apparatus to the level of the rows of retorts are effected with great rapidity. The arrangement is compact and occupies

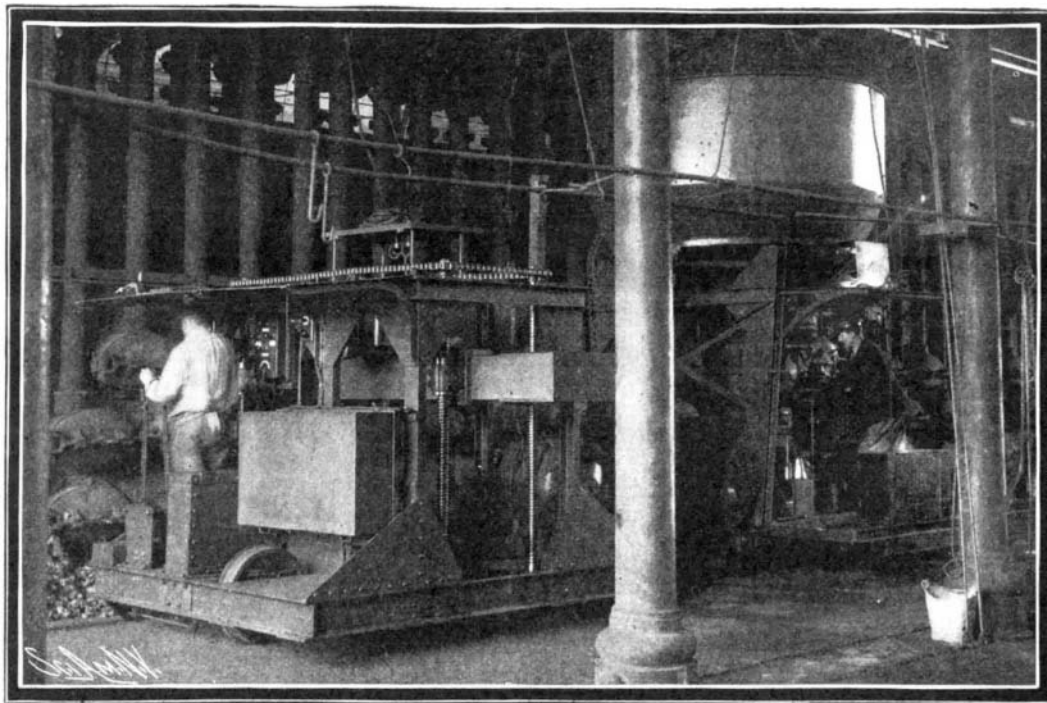
it is not necessary when the retort is charged to leave any space for the expansion of the coal. This circumstance permits of reducing the surface with which the gas is in contact in the retort, and thereby of preventing the alteration of the illuminating power, the formation of naphthalene and the clogging of the upright pipes.

All these machines have given very remarkable results. This is especially the case with the De Brouwer

#### NEW METHOD OF MANUFACTURING OXYGENATED WATER.

HITHERTO oxygenated water has been produced from acid giving a decided acid reaction to litmus paper, and especially chlorhydric, phosphoric, oxalic or fluorhydric acid or mixtures of these acids.

The operation is conducted in acid liquor; the recovery of the acid is produced by means of sulphuric



INTERIOR OF RETORT ROOM AT LA VILLETTE.

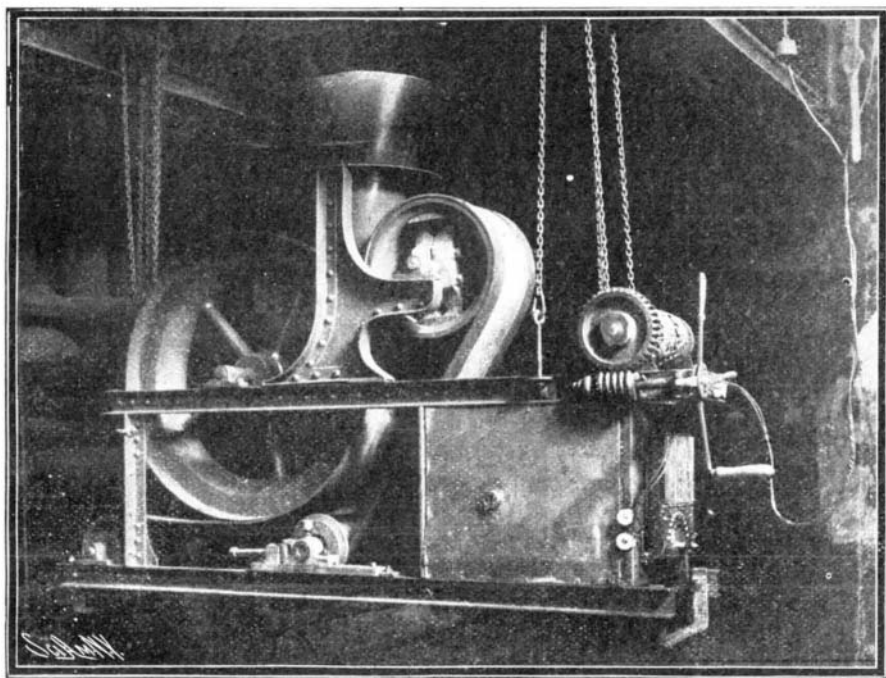
charger, which has been in operation for more than a year at Bruges for furnaces of more than thirteen feet in length, the introduction into which of a charge of 400 pounds of coal requires but 9 seconds. At Bruges it has even been possible to charge four retorts in 54 seconds, the operation of lateral shifting included. By hand, the same operation would have consumed from eight to ten minutes.

With La Villette machines, the results are no less interesting. When the charger is in position, a 20-foot retort in thirty seconds after the manipulation of the starting rheostat receives a complete charge of a thousand pounds of coal. Immediately after the manipulation of the lever, the thrust-plate of the discharger begins its motion and, in ten seconds, reaches the other extremity of the retort, and then returns to its initial position without any noise, hitch, or shock, without any heating and without any injury to the sides of the retort. The coke makes its exit from the retort in large pieces, and is received in trains of small cars of three compartments hauled over rails by a 4-horse-power electric motor. Each car receives 25.5 bushels. In measure as the trains leave the retort room, the coke is extinguished and emptied into a hopper forming part of an elevator that loads it into cars.

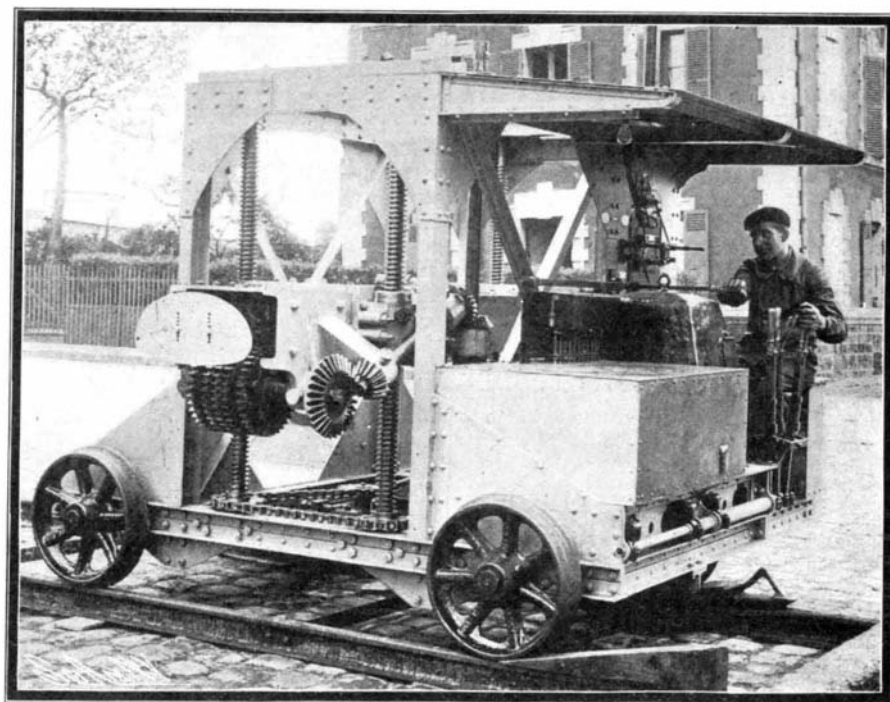
acid; the close of the operation consists in converting the baryta salts into soluble salts of potash, soda or magnesia, freeing them from iron, aluminium and other impurities by means of phosphoric acid, to the neutrality of the liquor and sometimes to its basicity. The clear liquor is acidified by means of chlorhydric, sulphuric or phosphoric acid, and the quantity should be sufficient to prevent the disengagement of oxygen while maintaining in the soluble state the impurities, iron and aluminium, which have not been completely eliminated, and which contain soluble salts, in greater or less quantity, the chloride, oxalate or fluoride of iron and aluminium. The purification of these solutions, in order to produce oxygenated water chemically pure, is long, costly, and difficult. When these industrial waters are put into basic liquor in the presence of matters, to be decolorized or oxidized, the impure matters are gradually precipitated and form centers where the oxygen is disengaged and completely lost.

By the new method of manufacturing oxygenated water, the class of neutral oxides, acid or basic, which, while having a distinctly basic reaction to litmus paper, may under certain circumstances act the part of acids, are utilized.

Such are the oxides of aluminium, of chromium, of manganese, of lead, etc. By operating all the time in



DETAIL VIEW OF THE DE BROUWER RETORT CHARGER.



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but little space. In fact, the apparatus occupies but seven feet from front to rear. Without the telescope, the discharger for 20-foot retorts would necessitate a space of at least thirteen feet more for its operation.

The machinist has nothing to do but manipulate the levers, and is thoroughly protected against flames and heat. As an advantage of this apparatus over other systems of discharging coke may be mentioned the possibility of filling the retort up to the top. In fact,

The results obtained by this system at Paris have been so satisfactory that the company has decided to extend the use of it.

As for the De Brouwer apparatus, that, since its advent, has been put in service in a certain number of works, especially at Bruges, Toulon, and Barcelona. It is applicable likewise to the coaling of ships. It is therefore to be anticipated that the use of it will soon become general.

basic solution, it is easy to see that at each moment of the operation, and in proportion as it advances, all the impurities are precipitated, so that when the volume of water is attained, we have a water, distinctly basic, which is acidified after purification.

Thus from aluminium the aluminate of baryta is produced in basic or neutral solution, regenerated or not by sulphuric acid, until the quantity of dioxide has been employed, which ought to yield the required