OTTO GAS ENGINES AT THE PHILADELPHIA ELECTRICAL EXHIBITION.

The application of the "Otto" engines to electrical purposes has grown very much during the last year, and at the exhibition three different sizes of engines are shown in connection with incandescent plants—one 4 horse power engine running 25 Edison lights and one 7 horse power engine running 40 Bernstein lights. Both these engines are of the usual type, so well known for its simplicity; and while with it impulse takes place only once for two revolutions when fully loaded, or even for many more revolutions when partially loaded, they are run under the control of a sensitive governor and under the influence of the momentum of well proportioned fly wheels in a manner to produce all that is required with respect to regularity to drive incandescent machinery

A twin engine of the Otto type is also exhibited, indicating 15 horse power and producing under full load an impulse at every revolution; but as the exhibitors, Messrs. Schleicher, Schumm & Co., propose to show the practicability of their single cylinder engines, and most simple construction for incandescent lighting especially, the twin engine, whose less simple construction seems naturally to secure a higher degree of regularity, was not considered worth while to be brought to a test, and is not connected to any electric machine

The power for electrical lighting being used at certain times in the evening only, an engine which is started without lengthy preparations, needing no boiler, and whose running expense is limited to the time of use only, seems not only very suitable, but renders incandescent plants practical in residences and halls not connected with the wires of an electrical station.

It is also important that in such cases the motor used possesses the greatest simplicity in parts, making it possible that domestics ordinarily employed about a household can assume its management.

In this respect, the application of a single cylinder gas engine is preferable to more complicated variations in construction. Besides the purpose of electric lighting, the Otto engine is much used for other electrical work. The small sizes are driving the commutators in our leading telephone offices. The Philadelphia Local Telegraph Company create, with a 10 horse power Otto and Edison dynamo, the necessary current for about 400 instruments, for brokers' and other offices in Philadelphia and New York.

Otto engines are also used for metal plating by electricity, electrotyping, for photography with electric light; and the electrical railway worked along Brighton Beach in England, about one mile in length, has its current produced by an 8 horse power Otto. The fact that this electric railway is a paying enterprise is certainly in part due to the use of such an economical prime mover.

Exporting Steel Rails.

According to the *Railway Review*, for the first time in the history of our rail mills they have made a large sale of steel rails abroad. The Lackawanna Iron and Coal Company has contracts to deliver 10,000 tons of steel rails at Brockville, Canada, for the Canadian Pacific at a figure varying not far from $28 50 per ton. It is not so very long ago that we were importing steel rails to a not inconsiderable extent, and our ability to now turn about and compete successfully with the mills from which we have so recently bought indicates the existence of possibilities in an export trade in steel rails that should not be lost sight of.

NEW GRIP SYSTEM FOR ELECTRIC RAILROADS.

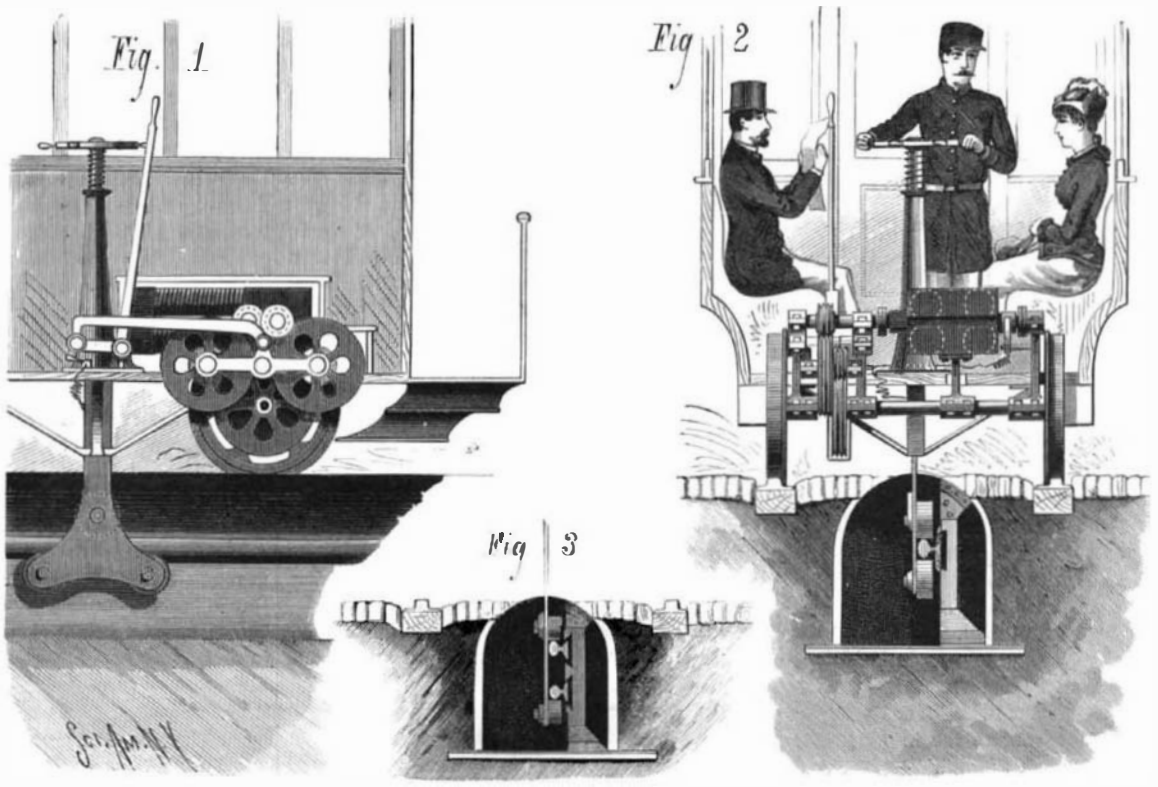
In the earlier electric railroads the general plan was to use the rails as conductors, and while, theoretically, this was the best and cheapest way, in practice it was found to possess many disadvantages—perfect insulation was difficult, and good contact between the rails and wheels was not always to be obtained because of mud, ice, etc. In addition, there was danger that animals might come in contact with the rails. No matter how powerful the current used, the tractive force was limited to the weight of the car, and, of course, any attempt to carry extra weight to overcome a grade would result in additional expenditure of power on a level.

In the system of Mr. John C. Henderson, Civil Engineer of this city, in case of danger one movement of a lever instantly throws the whole tractive force in the opposite direction with the full power that is being used at the time, irrespective of the motor car. The car can be reversed and run back, as when overrunning a switch, and in case of a large conflagration in the city the road can be kept in operation by simply introducing two or three crossovers in the length of the line. The conduit can be constructed of iron, concrete, or timber, according to the locality, and having no movable cable running through it the extra space can be used by electric light and other wires.

This system is very simple in construction, as will be seen from the engravings. A fixed bar or bars are supported according to requirements in a conduit beneath the track, in the same manner as in the cable system, and are insulated by chairs or shoes at the supports. The grip takes hold by rollers under the bar; the grip shaft passes up through the bottom of the car, and upon its upper end screws a hand wheel. By turning this wheel in a direction to raise the grip, all the tractive power required can be obtained. The grip also conveys the current to the motor, and back from and to the bars, as the case may be or the locality require, since in some instances it may be advantageous to use only one bar, the return being obtained through both rails and the iron conduit.

By means of a lever the electric motor can be shifted so that a pulley upon the armature shaft having a V-shaped face will be in contact with similar pulleys driving the axle; by this means the direction in which the car is moving can be changed without interfering with the current.

Further particulars regarding this system may be obtained of J. C. Henderson, 2 Liberty Street, New York city.



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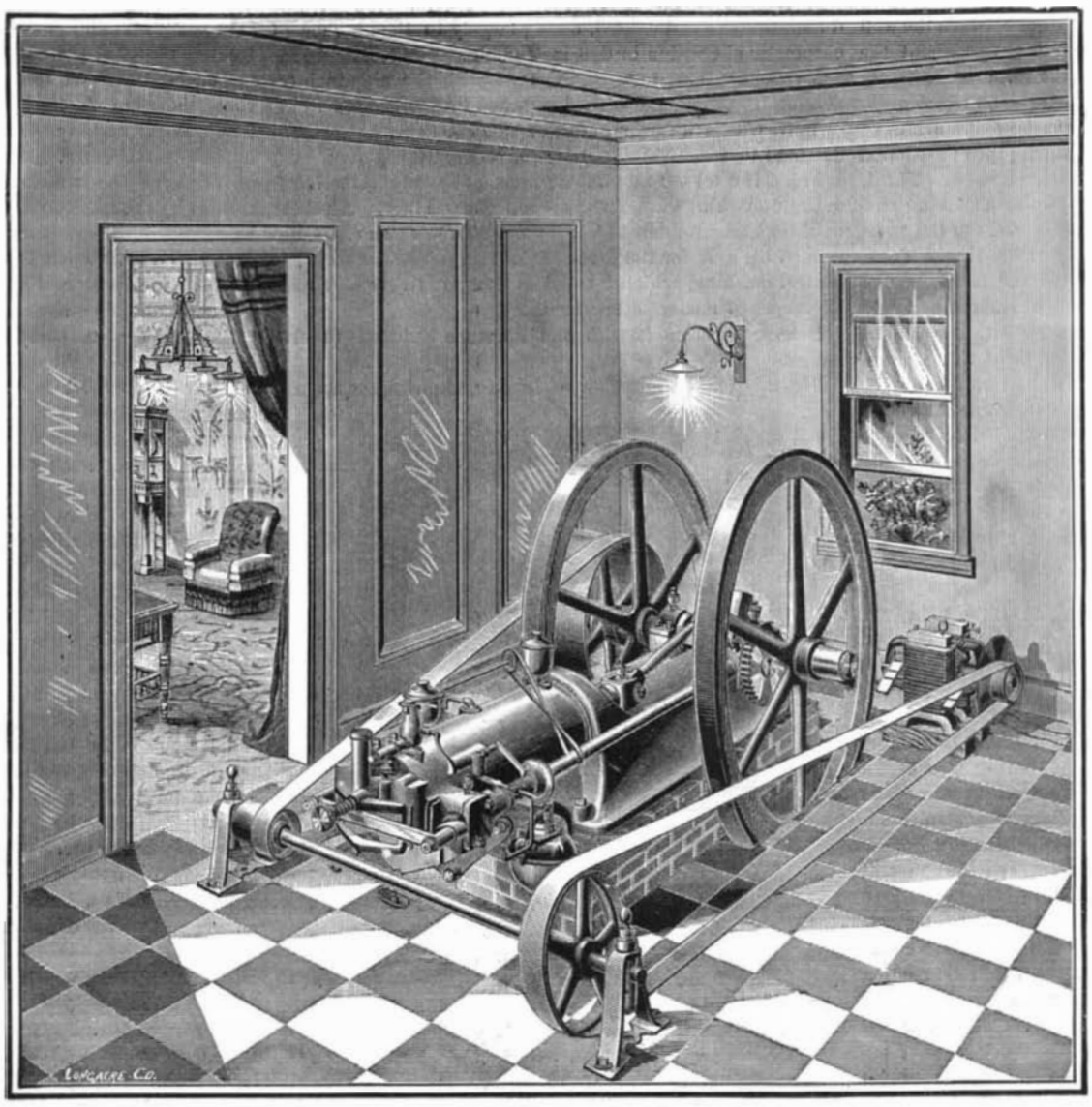

THE OTTO GAS ENGINE AT THE PHILADELPHIA ELECTRICAL EXHIBITION.

Chilled Roll Casting.

Messrs. Taylor & Farley, the well known roll makers of the Summit Foundry, West Bromwich, England, have just completed a very large pair of chilled rolls for Messrs. Bolckow, Vaughan & Co.'s new plate mill at the Eston Steel Works, Middlesborough. The rolls referred to are 30½ inches diameter, finished size, and have been cast with a hole through the center, this hole being about 7 inches diameter in the middle part of the roll, and tapered down to a smaller size at the neck and wabbler ends, in accordance with the design of Mr. Franklin Hilton, the steel company's engineer. These rolls have been so cast hollow with the object of counteracting the unequal expansion and contraction which is so frequently the cause of the breakage of chilled rolls, having regard to the well known difficulties inseparable from the casting of chilled rolls, more especially rolls of large diameter—difficulties which are increased by coring out. On being turned, these rolls presented a splendid working surface with a perfectly regular chill three-quarters of an inch deep, and are absolutely free from blow-holes or other defect; indeed, they will stand microscopic inspection. Experienced manufacturers of iron and steel who have inspected these rolls have pronounced them to be a magnificent pair. The large and powerful plate mill above mentioned was successfully started on the 16th of October, in the presence of Mr. Bolckow, Mr. Windsor Richards, and a number of other gentlemen of eminence in the steel and iron trade.

Cholera Boxed Up.

It is said that two doctors of Marseilles fancy that they have succeeded in discovering the morbid agent of Asiatic cholera, which, according to their statement, is a "mucor" entirely distinct from the "comma" of Dr. Koch. Considerable amusement was created at the Academy when the perpetual secretary, Professor Beclard, exhibited the sealed box which contained preparations and specimens of the offending "microbe." Amid a general burst of laughter, the president was requested "to keep the box sealed." Thus does the spirit of comedy invade the ground of tragedy even in the most serious of human affairs.

Varnish for Patterns.

A varnish has been patented in Germany for foundry patterns and machinery which, it is claimed, dries as soon as put on, gives the patterns a smooth surface, thus insuring an easy slip out of the mould, and which prevents the pattern from warping, shrinking, or swelling, and is quite impervious to moisture. This varnish is prepared in the following manner: Thirty pounds of shellac, 10 pounds of Manila copal, and 10 pounds of Zanzibar copal are placed in a vessel, which is heated externally by steam, and stirred during four to six hours, after which 150 parts of the finest potato spirit are added, and the whole heated during four hours to 87° C. This liquid is dyed by the addition of orange color, and can then be used for painting the patterns. When used for painting and glazing machinery, it consists of 35 pounds of shellac, 5 pounds of Manila copal, and 150 pounds of spirits.

The Probert Process.

We glean from the *Mining and Scientific Press*, of San Francisco, the following details of this new process for separating gold and silver from arsenide and sulphites of iron and copper by the use of litharge or lead when in a state of fusion in a certain manner which Mr. Edward Probert, of Eureka, Nevada, has patented, including a method of stirring or agitation of the molten matter by the steam developed in the action of that mass upon certain substances in the following way:

Iron pots, of a conical shape, about thirty inches deep, thirty inches wide at top, and rounded off at the bottom spherically to about twelve inches in diameter, each capable of holding fifteen cwt. (more or less) of the substance to be treated, are coated with a lining of refractory material, composed, preferably, of decomposed or pulverized lava, pumice, or other volcanic rock, but when this is not obtainable, of silicious sand, with a certain admixture of finely pulverized limestone or calcareous marl, to which has been added a sufficiency of clayed water or milk of lime to work the whole into a paste. After laying on this internal coat of refractory material (intended primarily to protect the pot from corrosive action) to the thickness of about three-quarters of an inch, a further portion of a specially prepared composition, consisting of coarsely crushed limestone, dolomite, siderite, or other suitable carbonate, mixed with a sufficient quantity of ordinary composition with which pot is lined to give it consistency, is laid on the bottom of the pot to the thickness of one inch, more or less.

The pots thus prepared are placed in a suitable oven or chamber, or a small fire is placed inside each pot, to dry coating, which, however, is not to be baked so as to expel the last portion of moisture, but only so far as to remove excess of water. When required for use, pots thus lined and partially dried are placed in succession under spout of smelting furnace containing substance to be treated in a state of fusion, which is then tapped into them, while at the same time, or immediately afterward, a charge of lead or litharge, preferably granulated, is fed into each pot from a hopper conveniently placed above.

First effect of molten substance tapped from furnace into pots, is to convert small amount of moisture contained in protective lining of pots into steam, which, rising upward from bottom and the sides, causes a brisk ebullition of molten material. This treatment is insufficient in itself to effect the thorough stirring and blending of the contents of the pot necessary to assure a successful result; but no sooner is this first ebullition, due to the escaping steam, over, than the limestone, dolomite, or other carbonate fixed in the bottom of the pot, as well as the calcareous matter in the whole lining, begins, under the intense heat of the molten charge, to undergo calcination, and streams of carbon dioxide are sent off, which, rising upward through the molten matter, produce the effect of a small geyser. This keeps the charge in a state of ebullition and agitation for a period of time proportionate to the quantity of mineral carbonate or other source of carbon dioxide originally used in preparing the pot, and thus effecting such complete blending and intimate admixture of the ingredients as cannot be attained in any other way.

Duration of ebullition, and consequently stirring process, may be regulated to any required number of minutes, from five upward, or as long as the molten material continues hot enough to exercise a calcining effect on the limestone, etc.; and inasmuch as the carbon dioxide produced comes off in a steady stream without sudden bursts, as from the vapor of water, there is never any danger to the workmen from explosions. After ebullition is over, the pot with its contents is set aside to cool, when the lead settles to the bottom, carrying down with it the precious metals, and, when solidified, the mass of alloy can be detached from the waste matter and treated by cupellation in the usual way for the separation of the silver and gold. It will thus be seen that the stirring is effected partly by steam, which, however, can never be made to do the whole work, being too violent in its action, and causing trouble when too much moisture has been left in the composition, but chiefly by the carbon dioxide ("carbonic acid," so called) developed during the calcination of the limestone or other carbonate employed as the source of gas or vapor.

Railroad Subsidies in Mexico.

A contemporary says that the Mexican press do not look kindly upon the granting by government of subsidies to railroads, and one of them says, what the press might with one accord say here, that "all railway lines which are worth building ought to be able to command private capital to carry them into execution. If they cannot do this, they should not be built at all. It is the height of folly to cover the country with a net-work of 'wild cat' railways which traffic prospects for a half century to come will not justify. Several of these lines might be mentioned, which through their subsidies are in reality built by the government and made a present to the owners."

CHOLERA MORBUS.

The ingenious artistic combination represented in our engraving, is the original drawing of the Italian artist Gallieni; seen at a little distance, it represents a fleshless skull

CHOLERA MORBUS.

with its black eye sockets and grinning teeth; a nearer view of it shows two beautiful children who are playing with their infant toys and caressing the faithful dog, and whose heads occupy the central part of a window.

Gallieni has given to his composition the fearful title of cholera morbus, and he explains it in brief words as follows: Fear increased by the imagination is the best friend of the guest of the Ganges.—*Ilustracion Espanola.*

Luminous Paint.

Luminous paint continues to make slow but steady progress in its application to innumerable useful purposes. Among its most recent applications may be mentioned tapes for field use at night by the Royal Engineers' department. Starting from a given point toward the front, the men leave a trail of luminous tape on their track, and on reaching a given point they mark the contour of the earthworks to be executed by the same means, paying out the tape as they return toward the camp. The working party then follow the outward trail, execute the work, and return to camp without having discovered a single ray of light to the enemy. The German War Office authorities have experimented with the paint for purposes of night attack, and Lieutenant Deppe, of the Belgian School of Gunnery, is investigating its merits in the same direction. Our own government, says the *Building and Engineering Times* (London), are also using painted framed glasses, or Aladdin's lamps, as they are called, for internal boiler inspections. General Lord Wolseley also took with him a luminous compass for the Nile expedition. It has also been applied in some large establishments to the fire buckets, which are thus easily found in the dark. A South-Eastern Railway third-class carriage has the interior lined with the paint on the back of glass.

Fishing in Jalisco, Mexico.

Consul Lambert, of San Blas, gives the following account of the methods employed in fishing in Jalisco. The fibrous roots of a small shrub called *varbasco*, which grows wild in the neighborhood, are procured, and after being well broken up, they are placed in the bottom of the canoes. At high tide the fishermen proceed to the mouths of the *esteros* (small creeks), and erect a wooden fence. They then partly fill their canoes with water, which produces an intensely white liquid from contact with the root. Arriving at the source of the *estero*, or in some shallow places beyond which the fish are not likely to go, the preparation is thrown into the water, which also turns perfectly white. The effect of this is that the fish are blinded, and in a very short time they are found floating on the surface of the water at the fence erected at the mouth of the *estero*. The larger ones are then gathered into the boat, and taken to market.

Another method which is more fatal in its effects, though it is performed less frequently, is the employment of the milk of the *ava* tree. This tree yields, when tapped, a white liquid very much resembling the juice of the India rubber tree. It is used in the same manner as the *varbasco*, and not only blinds, but kills the fish instantly. Fish killed in this manner have to be used immediately. In neither case is there any visible sign of the manner in which the fish have been killed. There is a law in existence against the use of poisons in procuring fish for market, but it is practically inoperative and void, for the reason that there is no defined method for determining the death of fish by these liquids, and the natives who take them in this manner are careful that each fish shows a spear hole in the back before landing it; and in the absence of any method of detection, the spear hole is *prima facie* evidence that they are not poisoned. Consul Lambert says that, as far as he has been able to ascertain, no bad effects from eating fish killed in this way appear to be known.

A Powerful Gun.

M. Dupuy de Lome recently called the attention of the French Academy of Sciences to a new piece of ordnance of superior power which has been constructed by the Societe des Forges et Chantiers de la Mediterranee for the Spanish Government. It is a naval gun of 16 centimeters caliber, having a *bouche a feu* made according to the designs of General Honoria of the Royal Spanish Naval Artillery, and on the principles which the Societe des Forges et Chantiers have laid down to prevent unbreeching. The caliber of the piece is 161 millimeters; the diameter of the powder chamber, 200 millimeters; the length is 5,890 millimeters; the weight, 6,200 kilogrammes; and the weight of the projectile is 60 kilogrammes; the charge of powder is 32·5 kilogrammes; the velocity of the projectile at the muzzle, 632 meters per second; the maximum pressure with the powder used, 2,250 atmospheres; and the maximum thrust along the axis measured at the widest part, 706,000 kilogrammes. The kinetic energy of projectile at the muzzle is 1,222 tonneaux meters, and the ratio of the kinetic energy of the projectile to the weight of the cannon is 197, whereas with the 16 centimeter piece of the French Marine this ratio is only 168, that of the six inch British No. 3 is 168, while the Krupp 15 centimeter gun gives 153 for the same ratio. The recoil lasts for 0·21 of a second, as measured by Sebert's velocimeter, and is limited to 70 centimeters.

A Water Pipe Shock.

A singular occurrence, which is stated to have recently taken place at Ithaca, N. Y., illustrates the dangers attendant upon the universal introduction of electricity. As a lady was turning on the water from the faucet over the sink in her kitchen, using her right hand, her left hand being in contact with the iron lining of the sink, she was suddenly prostrated by a severe shock. Her impression was that she had been stricken with paralysis or apoplexy, but a physician who was summoned found that the inside of the thumb of the left hand had been blistered in several places. This led him to believe that she had received a strong electric shock from some source. A few minutes subsequently the lady's daughter, in drawing water from the same faucet, was similarly affected, though not so severely. The family then became convinced that the trouble existed in the water pipe and sink. The manager of the Telephone Exchange, after a brief examination of the premises, found the secret of the trouble. The residence was connected with the Ithaca Hotel by a "dead" private telegraph wire. This wire had been crossed with the electric light wire. The "dead" wire was connected with the metallic roof on the dwelling house, which in turn was connected by a tin water conductor with the water pipe leading to the sink. When the dynamo machine of the electric light company was in operation, the current passed over the "dead" wire to the tin roof, and thence to the water pipe. It needed only the completion of the circuit by some person drawing water.