zine, there was several hundred pounds of dynamite in the shanty at the time of the explosion, or twelve boxes of dynamite, each box holding about seventy-five sticks. The boxes were on a shelf which stood about four feet above the floor of the shanty, while underneath the shelf there was scattered a lot of paper wrappings from the cartridges. The shanty appears to have been lighted by a candle, which was stuck between nails driven into the wall. The man in charge of the shanty supposes that the setting off of a blast must have shaken the candle down onto the floor, where it set fire to the paper. Whether this was so or not, he states that he had been gone but a few minutes from the shanty when he heard a cry of fire, and running to the door saw the paper cartridge wrappings on fire and the shelf burning. Although a bucket of water was thrown upon it, it failed to put out the fire. The man had not run far from the place before the detonation occurred. His theory is that the heat of the fire had warmed the dynamite, and that the burning of the shelf caused the whole mass to fall to the floor, the jar and heat together causing it to detonate. On the other hand, it is stated by the President of the Rapid Transit Commission that there were thirty pounds of combustible in the magazine on the night before the explosion, that 440 pounds were delivered next morning, and that four-fifths of this amount had been used, leaving only about 100 pounds on hand at the time of the explosion.

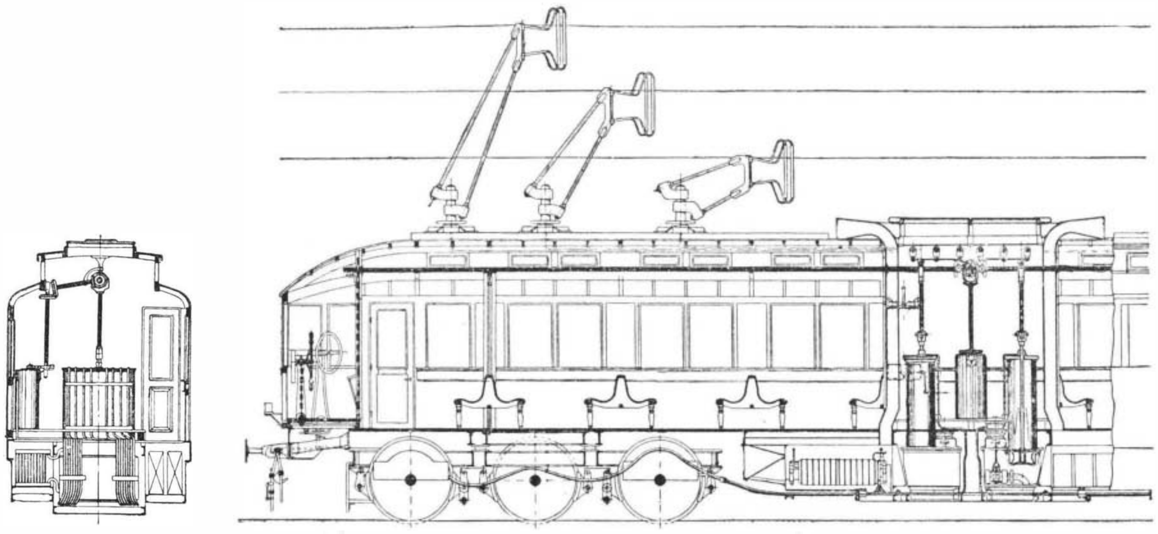
Although the results were disastrous, they were not nearly as fatal as one might have expected from the ordinarily crowded condition of the streets at this hour. In all five persons lost their lives, three of them in the Murray Hill Hotel, and two or three hundred persons, the exact number of whom will never be known, were more or less injured. No great damage was done to the Rapid Transit Subway, the loss being confined to the destruction of a derrick and hoisting engine and some platforms and timbering of the tunnel shaft. The most serious destruction was that wrought on the adjoining buildings, and particularly the Murray Hill Hotel. On this building the force of the blast was sufficient to shatter not only every window, but practically every window-frame from street line to cornice. A mass of mud, earth, and splintered timbers was hurled into the nearest rooms, and the glass wreckage and blast of the explosion overturned furniture, wrecked the chandeliers and brought down large portions of the ceiling. The condition of the interior of the hotel may be judged from the photographs which are herewith presented. One of the fatalities occurred in a bedroom immediately opposite the scene of the explosion, the occupant being buried beneath a mass of rubbish, while another person was killed at the cigar stand. On the opposite side of Park Avenue the windows of the Manhattan Eye and Ear Infirmary were completely shattered, the same effects being produced on the Grand Union Hotel.

A curious effect, noticed immediately after the explosion, was a heavy piece of planking which had been driven through the cornice of the tower of the Murray Hill Hotel and hung in this position over 100 feet above the sidewalk. Another incident that attracted much attention was the instantaneous wreck of the two large clocks in the towers which flank the southerly façade of the Grand Central Depot. The clock faces were blown from their setting back into the clockroom. It is a matter for congratulation that, although the explosion occurred within a few feet of the tracks of the Metropolitan Street Railway, no lives were lost nor passengers seriously injured. It so happened that, although this is one of the most busy points on the system, there was no car in the immediate vicinity at the moment of the disaster.

HIGH-SPEED GERMAN RAILWAY AT ZOSSEN.

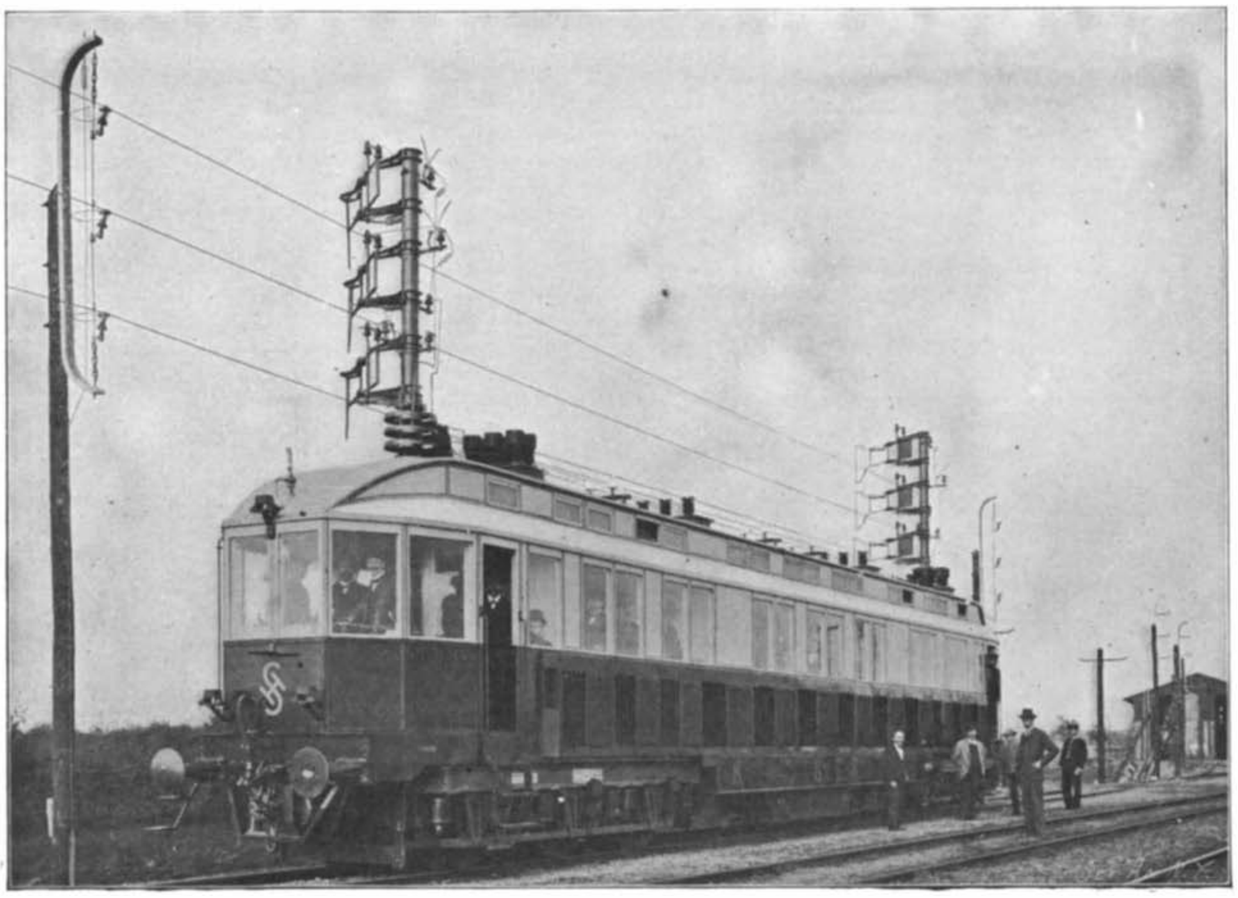
BY FRANK C. PERKINS.

The high-speed polyphase railway experiment is creating great interest in Germany as well as in this country. A speed exceeding 100 miles per hour has been attained of late, and it is claimed much higher speeds are possible.



LONGITUDINAL AND CROSS-SECTIONAL VIEWS OF CAR BUILT BY ALLGEMEINE ELEKTRICITAETSGESELLSCHAFT.

The line installation, as well as the electrical equipment of one of the cars, was furnished by Siemens & Halske. This line is operated between Marienfelde and Zossen. The current is supplied from the power station of the Allgemeine Elektricitäts Gesellschaft at Oberschönweide. The accompanying illustrations and description have reference to the car equipment of the Siemens & Halske Company, of Berlin. The cars were supplied by Van der Zypen & Charlier, of Cologne, Germany. The road is about 14 miles in length, with grades up to 3 per cent. The current supplied has a frequency of 45 to 50 periods per second and a potential of 10,000 volts. The car as seen in operation may be noted in the accompanying photographic and diagrammatic views showing detail of construction and the arrangement of passenger and apparatus rooms. Cross seats are provided for 60 passengers in a center room and two end rooms, the former being nearly 8 meters and the latter about 4 meters long. The total length of the car is 22 meters, with platform at each end nearly 2 meters in length, from which the operator controls the car. Automatic Westinghouse brakes are used, two 10-inch cylinders being used for each truck, and the brake rods being so arranged that they may be applied by hand from either platform of the car.



SIEMENS-HALSKE HIGH-SPEED POLYPHASE CAR.

Compressed air is used not only for the operation of the brakes, but also to control the electrical apparatus from either platform of the car. Two sets of electrical apparatus are used, each consisting of two rheostat controllers, two motors, two motor switches, a large step-down transformer, together with an air pump with its own transformer and the necessary current collectors in three parts for conveying the current from the overhead wires to the transformers and motors. Two motors are supplied to each truck directly mounted on the axles, each of which has wheels 1,250 millimeters in diameter (about 4 feet). Each motor has a normal capacity of 250 horse power to 500 horse power. The four motors, when heavily loaded, have a capacity of 3,000 horse power, or 750 horse power each. The primary pressure is varied from 1,850 volts to 1,150 volts from starting to full speed, the currrent of primary being respectively 280 amperes and 120 amperes. The voltages of the secondaries of motor are 1,000 volts and 540 volts, while the current is 550 and 210 amperes.

The metallic resistances are placed behind the open shutters seen on the side of the car in the accompanying illustration. The cold air rushing through the openings keeps the temperature of these resistance coils down, as a large amount of heat is generated in regulating the speed of the motors by cutting these resistance coils in and out of the secondary circuit of the motors. Cold air is also supplied by pipes extending above the roof of the car, as shown in the diagram.

The high tension transformers operate at from 30 to 150 amperes, the potential of the primary being 10,000 volts, while the secondary voltage is varied according to whether the secondary winding has delta or star connections. The high tension winding is always connected as a star winding and carried through safety fuses to the distributing wires and thence to collector trolley.

The accompanying views show the car and high tension line to good advantage.

The line is divided into parts each 1 kilometer in length, a feeder connecting the center of each section. The poles are nearly 8 feet from the track, the three conductors being mounted vertically one above the other, the lowest about 20 feet from the ground. The poles are somewhat more than 100 feet apart, are of wood construction and have mounted upon them bow-shaped arms, the conductors not being rigidly fastened, but supported upon insulators of hard rubber mounted upon a vertical chain and wire system, as seen in the figure. The conductors are hard-drawn copper of 100 square millimeters in cross-section and have a conductivity of 97 per cent pure copper.

Each trolley wire at its supporting insulator is connected to a loop of copper wire about one-third of an inch in diameter which is designed to become grounded in case the trolley wire breaks; by being pulled into contact with a vertically-suspended wire of the same cross-section, having a coil spring near its upper support, its lower end being directly connected to the track. Copper rail-bonds are used, and ground plates are placed at each section of the track. The four feeders on the high tension line consist of three high voltage conductors and a neutral wire mounted on porcelain insulators. Part of the conductors consist of insulated cables and part of bare wires, the latter having 50 square millimeters cross-section and the former having 70 square millimeters cross-section.

The current is collected from the trolley wires at the side of the track by three bow-shaped collectors specially designed for this installation. These are mounted on a mast consisting of two telescoped tubes about 8 inches in diameter. A mast is mounted at each end of the car, passing down through the roof, and may be revolved by the motorman by means of a handle through a set of gears. The collectors are of steel tubing and may be easily detached.

The trolley wire insulators were tested under rainy conditions to 20,000 volts and the electrical equipment of the car, including all circuits in apparatus, were tested to 15,000 volts, while the large and small transformers were tested for an hour under a potential of 20,000 volts.

The high tension switches have a double break on the three branches and are of the tube type. The switches are placed in sheet-iron boxes next to the small transformers. To the cover of each box the six insulators are fastened. The switch is closed by the raising of the plate operated by the air-cylinder piston. The compressed air which is used for the operation of the electric switches as well as for the air brakes is obtained from two electrically driven air pumps placed under the car.

The duplex pump operates at 190 revolutions per minute, the two cylinders compressing 400 liters of air to a pressure of 8 atmospheres. Each motor is operated from a small step-down transformer supplying 110-volt current to the motor terminals. Each platform is supplied with the necessary cocks for controlling the air in the rubber tubes and iron pipes beneath the floor of the car, connected with the starting cylinder. Within sight of the motorman are the various air-pressure gages, ammeters and voltmeters.

The large transformers noted in the accompanying diagrams are placed beneath the car, the cores being provided with air pipes for cooling. The windings are heavily insulated with mica, the leads passing through porcelain insulators at the ends; heavy steel plates holding the coils together by several heavy bolts. The leads from the transformers are connected to four high-tension fuses of the mica tube type. The secondary current from the step-down transformers is supplied to the motors after passing three sets of safety fuses and switches. The motor switches have double breaks of 140 millimeters in each phase, six tubes with contacts being placed in a circle, the switch being operated by means of compressed air by an air cylinder in the center of the circle.

Two transformer switches are required, one connecting the secondary for delta and the other for the star winding. In starting the car each of the four motors supplies 750 horse power, or about three times the full speed current (250 horse power), about 20 horse power being cut out at each step. There are 29 steps, 25 of which are used for gradually increasing the speed and 4 for cutting in the motor. The controller cuts in the four motors one at a time by means of two air cylinders, working in opposite directions. The air cylinders are of different diameters and so arranged that the controller may be stopped at any particular contact.

There are three large and three small resistance boxes—one for each phase. The larger boxes each have 25 coils and the small ones 4 coils. The air is supplied from the outside of the car through the numerous openings, keeping the resistances at a proper temperature.

The motor has six poles and is directly connected to the car axle, which has a speed of 900 revolutions per minute, the diameter of the car wheels being a trifle over 4 feet. The rotor of the motor is mounted directly on the axle, and is about 2 feet 6 inches in diameter. The rotor carries the primary pressure of from 1,150 to 1,850 volts, the current being conducted through three collector rings, upon each of which eight carbon brushes press, giving the necessary contact. The slots of the rotor are well insulated with mica, and wooden wedges are used to hold the bar winding in place together with the usual wire bands.

The stator winding is of the ordinary alternating kind, 72 slots being used in the secondary and 96 slots being used in the primary, the motor having a 6-pole winding. The total weight of the car fully equipped is 88 tons, being very close to that previously calculated.

The Current Supplement.

The current SUPPLEMENT, No. 1,362, is begun by an article on Mexico, accompanied by a number of illustrations. "The Bursting of Small Cast-Iron Flywheels" describes some very ingenious experiments which were tried. "The Venom of Serpents and Anti-Venomous Serum" is accompanied by a number of illustrations. "Recent Science" is by Prince Kropotkin.

On January 1 the new Japanese patent law went into effect. Under this an inventor who has applied for a patent in a foreign country will obtain priority as from the same date in the United Kingdom, if, within twelve months, he files an application there. He, however, loses the advantage that may be gained by first applying for provisional protection only, as he must at once file his complete specification.

Patent Department

Profit in Patented Inventions.

A writer in The New York Sun considers a good patent as valuable as a gold mine in its way. Patents and gold mines resemble each other very much in one respect; there are no infallible signs by which one may recognize the bonanzas. No matter what the prospectus may say, the mine must be worked before its value may be known. No matter what the theories of the inventor may be, the world's market, and not himself, must determine the value of his invention.

Some very large fortunes have been made out of apparently trivial inventions. There is much luck in the first place. But skill in handling the patent counts for even more than luck. The little rubber stopper with the wire attached to it, which is used now on every beer bottle, is a good example of fine business management in the handling of an apparently trifling invention.

Often the inventor fails to realize the value of his device. Everyone is familiar with the hook eyelet now commonly used on boots and shoes. The man who invented it could dispose of it only by selling the complete title to his patent to a shoe company. Even the shoe company did not fully appreciate the value of the invention which they had acquired; for the hook and eyelet was regarded as an eccentricity and would require expensive machinery in its manufacture. It is said that the inventor realized $600 for his hook and eyelet; the profits to the manufacturers were some hundreds of thousands per year.

Some inventions, says the writer, drag along for years without getting to a paying stage, and then suddenly make fortunes for their owners when the patent is almost run out. The typewriter is an example of this thing. The men who believed in it had many reasons for giving up all hope of its ultimate success. The man who had the general agency for the whole South in 1877 sold only four machines in a year, three of them in one town, Huntsville, Ala. It was not until the most valuable part of the patents had expired that any one made any money on the typewriter. Bell offered to sell a half interest in his telephone to his next-door neighbor for $1,000, and the neighbor laughed at the absurdity of paying such a price for an interest in a freak scientific toy.

Speaking of Bell's telephone, it is not generally known that he came very near losing all his English patent rights, and would have done so, but for a most remarkable piece of luck. At the time of the telephone's invention Lord Kelvin was in this country, and he took back with him to Scotland one of the crude instruments which Bell had made, intending to exhibit it to his college classes as an American curiosity. At that time the transmitter had a spiral spring on the upper side, and while the model was knocking about among the scientist's baggage in its journey across the ocean this spring somehow got bent upward. When Lord Kelvin came to give the promised exhibition the thing would not work, because the spring was bent up too much. It is almost impossible to believe, but it is nevertheless a fact, that it never occurred to the giant intellect of this great scientist to press that spring down again, and he had to apologize to his audience for the failure of the much advertised experiment. A publication before application for a patent is a bar in England, and when the great trial to settle the validity of the Bell patents came up over there, it was sought to prove this previous publication, and this lecture was a case in point, but it was conclusively proved that there had been no publication in this lecture, because the model would not work. Had Lord Kelvin pressed down that little spring and shown those Scotch laddies how the telephone worked it would have cost the Bell company many millions of dollars and made telephones very cheap in England.

Most successful inventors are men who have been brought up in connection with the business to which their inventions are to be applied, or have at least made themselves familiar with the laws governing the processes which they seek to improve. There are cases in which inventors have discovered new laws or new applications of old ones, especially in chemical processes. The Bessemer converter is a familiar example. The cyanide process of washing gold and the manufacture of acetylene gas are others. Some inventors have had courage enough to dispute the established facts of science, as in the case of some recent experiments in fog signaling, in which the inventor used the principle denied by such eminent authorities as Tyndall and Prof. Henry.

It is well known that there is very little money in surface washing or placer mining for gold, and that all the big profits are made out of long and patient development of deep mines. The same is true of patents. There is very little profit in inventions which can be realized upon almost immediately. They are mere surface washings. All the big things have taken time and patience to bring to perfection, and any inventor who finds himself making quick profits may be sure they will be short-lived, although he may have a good thing while it lasts, like the pigs-in-clover puzzle. Confidence, tenacity of purpose, and capital are the requisites for building up big fortunes on the foundation of a patent; the thing itself must have intrinsic merit to begin with or it must fail before long.

The simplest inventions are the best money-makers, because to perfect complicated machines costs time and money. A great many have ended with the original conception, the inventor having no ability to handle detail so as to carry out the original idea in a practical way. The Bessemer process of converting steel is extremely simple, blowing hot air through the molten metal. Just sit down and get out the drawings for a machine which will carry out this idea, especially the arrangements for controlling the supply of air that is admitted to the converter, and see how soon you will find that the first idea is a small part of the invention as a whole. The use of compressed air as a motive power was understood and appreciated thirty years ago, but no one could invent a governor which would control it, although hundreds of patents were taken out which professed to do so. The power of the steam from a kettle was evident to Watt long before he could devise a means of utilizing it. The combination of the piston and the slide valve, which looks so simple to us now, was not worked out in a day.

It is a common practice to speak contemptuously of inventors on account of their exaggerated notions of the value of their ideas. When the invention is obviously a delusion this is quite natural, but it must not be forgotten that without this infatuation for the creatures of their brains inventors would be much more easily discouraged than they are, and many of the most valuable inventions might be lost. The tenacity with which some of them cling to their ideas until they finally force their adoption upon the world almost amounts to inspiration. It seems born in some men to fight harder for the children of their brains than for their families, and it seems a pity that their reward is not often greater than it is.

Novel Uses of Electricity.

An electrical steam boiler is the subject of an invention patented by Charles E. Griffing, Hamilton, Ohio. The boiler shell is wound with copper wire which is suitably covered with an insulator. The water-heads are secured at each end of the boiler and are connected by pipes running the full length of the boiler and provided with a series of minute perforations directed to the interior face of the boiler-shell. Additional water-heads at each end of the boiler are secured immediately within the previously mentioned water-heads, and are connected by perforated pipes. These additional water-heads are divided into three separate compartments. A series of alternately arranged heating pipes is introduced between the water-heads to connect the water-pipes or tubes. These heating pipes are provided with electrical conductors, suitably insulated from each other and from the pipe in which they are inserted. The conductors in the several heating pipes are connected in series and arranged to be disconnected separately for purposes of repair. The insulation employed, although a non-conductor of electricity, is an ample conductor of heat. The first-named water-heads are connected with the source of supply, whereby the desired amount of steam can be generated.

Mr. Elihu Thomson, who is well known for his numerous inventions, has devised an apparatus for uniting the edges of metal sheets, which apparatus is applicable to the joining of separate sheets or plates of metal, or to the joining of two opposite edges of a single strip or sheet formed or shaped so that its two edges will approximate. The invention is particularly useful for the protection of pipes by forming or rolling up a strip or skelp into a cylindrical form, and in making a joint between the longitudinal approximated edges. The invention is carried out by approximating the edges to be joined, preferably upturning them so that they are in contact or nearly in contact. A strip of metal or wire, which is adapted to be joined by welding to the pieces to be united, is laid along the line of the joint. An electric current is passed transversely through the wire or strip into the joint and through the edges against which the wire is laid, the volume being sufficient to bring the wire and edges to the welding temperature. Pressure is then applied to cause the edges of the wire or strip to weld or unite in order to form one piece, thus completing the joint. In forming a pipe, a strip or piece of sheet metal is rolled up into the form of a hollow cylinder with the edges meeting to produce a seam. Into this seam or joint is laid a wire or thin