THE ELECTRIC WELDING OF RAIL JOINTS.

For many years the belief has obtained among engineers that in laying railroad tracks it is necessary to leave a certain space, about one-sixteenth of an inch, between the ends of the rails, in order to provide for expansion and contraction due to the changes of temperature. On the advent of electric welding, a very obvious application of it seemed to lie in the welding of rail joints, if the assumed trouble in regard to expansion and contraction could be got rid of. Various experiments went to show that this necessity was rather of the nature of a myth. The Johnson Company, of Johnstown, Pa., which proposed to apply electric welding to rail joints, tried an experiment to test the question. They firmly riveted, with long fish joints, fifteen hundred feet of track, so that it was practically continuous, the rivets being turned to fit the holes accurately. No trouble was experienced, the fifteen hundred feet of track not changing in any way. Other experiments have been made in the same direction, going to show that there is no danger to tracks incident to tight joints.

The electric street car companies have shown a disposition to adopt welded joints, not only to secure a continuity of track for mechanical reasons, but for electrical ones also. As the track is used for the return current, it is obvious that its conductivity should be as high as possible, and such conductivity is evidently favored by welding the joints together.

We illustrate in our present issue one form of the welding machine used by Johnson Company. It consists of a Thomson welding machine of special construction arranged to be carried on a crane projecting from a construction car. Looking at the cut, there will be seen two pivoted levers working in a vertical plane transverse to the track. Between them lies the induction coil, while above is a toggle joint operated by the large wheel in front, by which the ends of the levers can be pressed together or separated with considerable power.

In welding a joint, the current is not passed from rail to rail, but is passed transversely to the two rails. For each joint four lugs are used; these are short pieces of iron fitting pretty closely to the sides of the web of the rail, and also extending around part of its head and the upper part of its flange. When a joint is to be welded, the construction car is advanced and a small emery wheel driven by a flexible shaft is first applied to the sides of the rails in order to brighten them. The two lower lugs, resting on the lower flange of the rail and extending half way up the web, are put in position, the jaws of the electric welder are placed upon the lugs, and the current is turned on. The dark red color due to the heat appears almost instantly, and keeps brightening until a full white heat is reached. At this point one of the workmen suddenly turns the wheel, closing the toggle joints and squeezing the lugs against the sides of the rails. This not only welds them to the rails, but it is supposed to force some of the metal between the ends, so as to make a true butt joint. Gun metal clamps keep the rails in alignment during the operation. As soon as the lower lugs are welded, the upper pair are put in position, and practically fill the remaining gap, the current is passed through them, they are squeezed home when white hot, and the joint is complete.

The operation is so perfect that after the welding is done and the ground is filled to its level, it is almost impossible to tell where the weld has been completed. In closing the joints, every third joint is left unwel d in order to allow for the expansion due to the changes of temperature incident to the operation. Afterward the line is gone over a second time and the missing joints are welded. All of this is in the direction of reducing the resistance of the rails, and of so providing a better path for the return current. Whether it will do away with electrolysis or not may be considered an open question.

The process illustrated has already been successfully applied in Boston, St. Louis and Brooklyn, and bids fair to have an extensive application on trolley roads especially. The coming winter will put many miles of track to a severe test, which there is every reason to believe they will stand perfectly.

We are indebted to the *Street Railway Review* for the photograph from which our engraving was made.

THE ELECTRIC WELDING OF RAIL JOINTS.

The Plague in China.

We have received further telegraphic information from our correspondent in Hong-Kong, from which it appears that little doubt is any longer entertained by scientific opinion in China as to the importance of the discovery by Professor Kitasato of a bacillus in the organs of those attacked by the plague. To say that Professor Kitasato is himself convinced of its specific nature is to infer that it has responded to all the tests that are essential to the diagnosis of a pathogenic micro-organism. Professor Kitasato has found the bacilli in great abundance in the bubonic swellings and in the spleens of the victims to the plague. The epidemic is stated to be on the decrease at Hong-Kong, but it is increasing at Canton.—*Lancet.*

Great Railroads.

The Atchison, Topeka, and Sante Fe Railroad Company has 7.125 miles of line in operation; the Southern Pacific, 6,500 miles; the Chicago, Milwaukee, and St. Paul, 6.083 miles; the Louisville and Nashville, 4,700 miles; the Northern Pacific, 4,400 miles; the Chicago and Northwestern, 4,300 miles; the Chicago, Rock Island, and Pacific, 3,500 miles; the Illinois Central, 2,900 miles; the Pennsylvania, 2,500 miles; the New York Central and Hudson River, 2,100 miles; and the Baltimore and Ohio, 1,000 miles.

Battleship Le Carnot.

The new French battleship, which was launched early in the present month, is to be called Le Carnot. The length of the vessel is 396 feet, her beam 71 feet, her draught aft 27½ feet, and her displacement 11 882 tons. She has a complete steel belt with a maximum thickness of 17·7 inches, and a curved steel deck 2·75 inches thick. Above the water line belt there rises for an additional height of 4 feet a steel belt of 4 inch armor. The machinery of the ship consists of a pair of compound vertical engines, with three cylinders, fed by twenty-four Lagrafel & D'Allest boilers. At 95 revolutions with forced draught, 13,500 horse power should be developed, giving a speed of 18 knots, and with 85 revolutions, natural draught, 9,500 horse power, giving a speed of about 17 knots. The machinery weighs 1,178 tons. The normal coal capacity is 800 tons, or enough for 4,000 knots' steaming, but when all subsidiary bunkers are full, coal for 5,000 knots can be carried. The cost of Le Carnot will be, for the ship $4,800,000, for her gun and torpedo armament $520,000, and for machinery and boilers $636,000, or in all, $5,956,000.

The armament will consist of two 11·8 inch guns, one in a 14·6 inch turret forward and the other in a similar turret aft, the forward gun being 26 feet and the after gun 19·5 feet above the water line; two 10·6 inch guns, one in a 14·6 inch turret on each beam; eight 5·5 inch quick-firing guns, mounted singly in 3·9 inch turrets, four on each beam; four 2·5 inch quick-firing, twelve 1·8 inch quick-firing, and eight 1·45 inch quick-firing or Maxim automatic guns. There will also be four above-water and two submerged torpedo-launching tubes. The most significant feature of the vessel is the enormous power of her right ahead and right astern fire. In each case this is furnished by one 11·8 inch, two 10·6 inch, and four 5·5 inch, besides smaller guns. Beam fire is furnished by two 11·8 inch, one 10·6 inch, and four 5·5 inch guns, so that in every direction the ship is offensively strong to an exceptional degree.

Force of a Cannon Ball.

In dwelling upon the wonderful power of the guns of the Indiana, Albert Franklin Matthews, in an article on "The Evolution of a Battleship" in the *Century* for July, gives illustrations from the recent Chilean civil war, showing the effectiveness of the smaller sizes of breech-loading rifle guns.

A shot weighing 250 pounds from an 8 inch gun of Fort Valdivia, in Valparaiso harbor, struck the cruiser Blanco Encalada above the armor belt, passed through the thin steel plate on the side, went through the captain's cabin, took the pillow from under his head, dropped his head on the mattress with a thump, but without injuring a hair, passed through the open door into the mess room, where it struck the floor, and then glanced to the ceiling. Then it went through a wooden bulkhead an inch thick, into a room 25×42 feet, where 40 men were sleeping in hammocks. It killed six of them outright and wounded six others, three of whom died, after which it passed through a steel bulkhead five inches thick, and ended its course by striking a battery outside, in which it made a dent nearly two inches deep. It was filled with sand. Had it released deadly gases, no one knows what damage it might have done.

A 450 pound missile from a 10 inch gun in the same fort struck the same vessel on its 8 inch armor. It hit square on a bolt. The shell did not pierce the armor, but burst outside the vessel. It drove the bolt clear through, and in its flight the bolt struck an 8 inch gun, completely disabling it. Such is the power of the small-sized guns.

Increase of Fireproof Building.*

In the last twelve or fourteen years a decided change for the better in our building has occurred. This was partly brought about by the success met with by the "mill mutual" insurance companies, in what is known as mill constructed buildings, a method which was about ten years ago first introduced into the construction of the modern city warehouse. From the theory of having each floor cut off completely from other floors, it is only a step to the demand that the interior division walls, the floors themselves, and, in fact, all of the interior except the inner finish, shall be made of incombustible materials. The growth toward this demand has been slow, but it has been progressive and hence healthy. The underwriters have not been far in advance of public opinion—not so far, possibly, as they should have been; but they have been in advance, and are now doing all that they can to induce, by the advantages they offer in the way of rates of insurance premium, the owners of real estate to put up fireproof buildings, and the manufacturers and merchants to occupy these.

The practical question is, What are these inducements, and are they sufficient to lead to the construction of the fireproof type of building? I can answer this only by stating what they are and leaving it for those interested as owners and occupants of buildings to decide whether or not they are sufficient.

In the first place, it is well to point out that there was never a time in the commercial history of this country when it was so difficult for those owning property or doing business in the centers of our large cities to obtain the insurance protection which they require for safety and for the maintenance of their business credit as merchants. The number of fires in our large cities tends constantly to increase, which causes the managers of insurance companies, looking back on the numerous corporate wrecks of the past, to cut down their lines (that is the amount that they will insure on any one risk) to exceedingly small dimensions. Now this comes at a time when the requirements of business compel dealers to carry large stocks of goods and to occupy large stores. The result is that many of our merchants are running risks in the way of possible loss by fire which they do not like to think of, but which make them seriously alarmed when any fire occurs in the vicinity of their stores. Others of their number are ransacking the world for insurance protection, and failing to find enough of this in China, Australia and elsewhere, are trusting to the questionable guarantees of Lloyd and mutual associations which have been recently started in this country. Now, if these merchants occupied buildings which were recognized as distinctly fireproof—that is, buildings in which wood and other combustible substances were only used for mere purposes of finish—there is little doubt that companies which limit their lines to say $10,000 on a risk will quickly increase it to $25,000 or $30,000. In a word, the possibilities of obtaining insurance would be increased from one hundred to two hundred per cent. To the owner of a building this would sometimes mean the difference between having a tenant and not having one. The same foreign companies which limit their lines to say $10,000 on a large departmental store in an American city will write the equivalent of $100,000 on the Louvre or Bon Marché in Paris, because they know that these two establishments are carried on in strictly fireproof buildings.

And then comes the matter of rate of premium. If I am not mistaken, the rate on the Bon Marché in Paris has varied in recent years from one-quarter to three-eighths of one per cent per annum, or about one-fifth of the rate paid for insurance by such establishment as Jordan, Marsh & Co., in Boston, Macy & Co., in New York, or Wanamaker & Co., in Philadelphia. In other words, for $1,000,000 insurance, the proprietors of the Bon Marché would pay about $2,500, while the similar American establishments would pay for the same volume of insurance protection from $12,500 to $15,000. The difference in this case is chiefly in the matter of building construction. The conditions of the business are substantially alike, while the fire department of Paris can hardly be said to equal in efficiency those of our large American cities. In the opinion of the fire underwriters who insure both the Paris risks and similar risks here, there is a difference in safety in favor of the former equal to the interest that would be earned on several hundreds of thousands of dollars.

SOME experiments made on the Brotherhood engine of a Whitehead torpedo by Mr. F. M. Leavitt, and recorded in *The Stevens Indicator*, show that the air used per brake horse power per hour varied from 61 pounds to 118 pounds. The initial pressure of the air ranged from 425 pounds to 750 pounds, and the horse power from 19 to 43. The engine had three cylinders 3⅛ inches in diameter by 2¾ inches stroke, and we believe the weight is under 40 pounds, so that 1 horse power has been attained for less than 1 pound weight of engine.

* Osborne Howes, in the *Brickbuilder*.

Wellman's Arctic Expedition.

Authentic news has lately been received of the American North Pole expedition, known as the Wellman expedition.

The Wellman party sailed on the steamer Ragnvald Jarl from Bergen, Norway, three months ago. The steamer went to the edge of solid ice, off the coast of Spitzbergen, where the party set out over the ice in sledges for a lively sprint to the north.

Wellman had with him, among others: Professor Owen B. French, of the Coast and Goedetic Survey; Dr. Thomas B. Mohun, a surgeon; Charles C. Dodge, a constructor in the United States navy, and a party of scientific graduates of the University of Christiania.

August 2, the fishing vessel Malygen arrived at Tromso from North Spitzbergen with Captain Boltolfsen and three seamen of Wellman's steamer Ragnvald Jarl.

They report that, after several struggles in the ice, the Ragnvald Jarl arrived on May 12 at Table Isle, one of the Seven Islands, situated off the northeast coast of Spitzbergen, in latitude between 80° and 81° and east longitude between 20° and 21°. The ice compelled the party to return to Walden Isle.

On May 24 Wellman set out with thirteen men, forty dogs, and provisions for 110 days. May 28 the steamer Ragnvald Jarl was crushed by ice and was totally lost. Only some stores were saved. A message concerning the disaster was sent to Wellman, and it reached him on Martens Island, near Seven Islands.

Wellman, Dodge, and two others returned to Walden Island. They built there a solid house of the wreckage. The house accommodated the majority of the crew, and would afford ample shelter to the explorers should they be compelled to winter on Walden Island.

Wellman departed on May 31 for Martens Island. The last news from him was received on June 17, when Winship and another left the expedition six miles east of Platen Isle, which is not far from Seven Islands. There the party had come upon an impassable ice field. Wellman was waiting for the opening and all were well.

Upon Winship's return to Walden Island, Bottolfsen and some others journeyed southward in aluminum boats, hoping to meet fishing vessels. Thus they met the Malygen.

A new vessel will be chartered to bring back the expedition. Meanwhile Wellman and his companions are crossing the ice, probably in the direction of Gillei-land.

The ice conditions in the early part of the expedition were exceptionally unfavorable. Trygve Heyerdahl, the young philosophical student who accompanied the expedition, has gone to Danes Island to join Peter Oyen, the geologist.

Inclined Plane Railways of Cincinnati.

The operation of inclined planes forms a very important part of the street railway system of Cincinnati. The business portion of the city is located on a plateau, which rises abruptly from the river to an average elevation of about seventy-five feet, and which is backed by an irregular line of bluffs, having an average altitude of from 300 to 350 feet above the river, over and beyond which the city has already spread.

The principal hills are named respectively Price Hill, Mt. Adams and Walnut Hills. Walnut Hills is on the north and extends almost to the bank of the river. The heights are all reached by inclined planes, cable roads, and, in some instances, by the electric lines, so that the rapid transit facilities of the city embrace almost every known method of traction, including horse car lines, cable and electric roads, inclined planes and one dummy line. There are four inclined planes, on three of which the electric cars are transferred from one level to the other and continue their course. The planes are provided with triangular shaped trucks, with platforms on the level, so that the electric cars are readily run on or off at the terminals. All the inclines are provided with the latest types of safety devices, and are operated in a very safe and satisfactory manner.

The Price Hill incline is designed for both passenger and freight traffic. The two lines are located near to each other, but are operated from separate stations. The passenger traffic is transferred from the street cars to the cab of the incline, and at the top of the hill a second transfer is made to connect with the lines on the upper plane. The freight section is designed for vehicle traffic, and the cars are capable of taking three or four heavily loaded wagons with teams at a trip. This is the only one of the Cincinnati inclines that has not been before described in these columns. The tracks are 800 ft. in length, and are laid on an average of 44·6 per cent, making a total rise of 350 ft. During the morning and evening hours, or when traffic is heavy, trips are made every three minutes. The incline carried about 1,000,000 passengers in 1893. The fare is five cents, except where the trip is to be continued, when five cents includes the street car fare into the city. On the other line the round trip for ordinary vehicles is twenty-five cents, and for heavily loaded trucks eighty-five cents.

The freight incline is operated by a 200 horse power poppet valve, duplicate engine, manufactured by Frisbie, of Cincinnati. The winding drums are thirteen feet in diameter. The passenger engines are 100 horse power, manufactured by John Cooper & Company, Mt. Vernon, O. They have been in service since 1875, and are still in good condition. The power station is located at the top of the incline, and adjoining it is a park and summer garden, well shaded and provided with rustic seats, and with a railing along the edge of the bluff. From this location one of the most interesting views is had of the city and surroundings. All the bridges which cross the river, also Covington and Newport, are embraced in the outlook.—*Street Railway Journal.*

Spraying Solution for Elm Trees.

In some parts of the country during the past spring and summer months the ravages of the elm tree worms in destroying the fine foliage of these grand trees have been terrific, until now large numbers of trees are bereft of foliage.

In Central Park, New York, the trees have also been attacked, but, by special care in spraying, the park entomologist, Professor E. B. Southwick, has preserved them to a remarkable extent.

He sprays the foliage of the tree early in the season with the following solution :

London purple	⅜ of an ounce.
Flour	1 teacupful.
Water	1 pail.

Thoroughly mix and spray on the trees.

In August the larvæ are coming down the trees and will turn into the beetle state ; they will be found in quantities at the base of the tree. These should be sprayed with an emulsion made of

Soap	1 pound.
Kerosene oil	⅛ a pint.
Crude carbolic acid	⅛ a pint.

Mix in four quarts of hot water into an emulsion, which can be then diluted with six pails of water and be used as a spray. It is important also that the apparently inert pupæ at the base of the tree be sprayed in the same way, as it will help materially in lightening next year's work.

Something for Strikers to Remember.

General Army Orders No. 23, issued July 9, 1894, contains, among other things, the following :

A mob, forcibly resisting or obstructing the execution of the laws of the United States, or attempting to destroy property belonging to or under the protection of the United States, is a public enemy.

Troops called into action against such a mob are governed by the general regulations of the army and military tactics in respect to the manner in which they shall act to accomplish the desired end. It is purely a tactical question in what manner they shall use the weapons with which they are armed—whether by the fire of musketry and artillery or by use of the bayonet and saber, or by both, and at what stage of the operations each or either mode of attack shall be employed.

As a general rule the bayonet alone should be used against mixed crowds in the first stages of a revolt. But, as soon as sufficient warning has been given to enable the innocent to separate themselves from the guilty, the action of the troops should be governed solely by the tactical considerations involved in the duty they are ordered to perform. They are not called upon to consider how great may be the losses inflicted upon the public enemy, except to make their blows so effective as to promptly suppress all resistance to lawful authority, and to stop the destruction of life the moment lawless resistance has ceased. Punishment belongs not to the troops, but to the courts of justice.

A Carpet Tack Causes a Disastrous Fire.

On August 2 a tack dropped in a picker machine caused a $70,000 fire in the four-story mill at Randolph and Jefferson Streets, Philadelphia, occupied by McCloskey & O'Hara, carpet cleaning works, and John A. Cronin & Co., yarn spinners, and two firemen were killed and seven injured by a falling floor.

About 4:45 P.M. a tack dropped into the machine at which an operative of Cronin & Co.'s was at work on the third floor.

The sparks flew into the inflammable yarn and started a blaze that rapidly spread through the room. There were about forty men and women at work in the carpet cleaning works.

A Spark from a Horse's Shoe Causes a Gas Explosion.

A gas main running near a drinking fountain at Montclair, N. J., recently became broken, and gas escaped in large quantities. Word was sent to the gas company, and as soon as the notice was received men were sent to repair, but before their arrival the explosion occurred. The base of the fountain was badly wrecked and the sidewalk torn up. It was said that the escaping gas ignited from a spark from a passing horse's shoe.