the draw span. This span was a wooden truss whose general construction is seen in our cuts. Its moving involved the lifting of it from its old central pier, its transfer to the site of the temporary bridge, followed by a lowering of about eight feet to conform to the grade of the rest of the bridge.

The fact that the Harlem River is a tidal stream was taken advantage of for the operations. Two seventy foot deck scows were moored, one on each side of the central pier. Two cross beams were provided for fastening the scows together, which beams were bolted to the deck. One was unbolted and drawn back as the scows were put in position, so as to make way for the central pier, which had to come between them while the free ends of the scows were temporarily secured by tackle.

Cribwork was now built up on the decks of the scows, Georgia pine timber twelve inches square in section being employed. As the tide fell the cribwork was carried up close under the bridge, and when the tide rose the scows rising with it lifted the truss bodily from the stone pier. Guy ropes were fastened to the ends of the truss and the scows were moved away with it, the cross timber being replaced as soon as there was room. The whole was then moved to the new position.

The span had now to be lowered about eight feet. The tides were utilized for this purpose. The scows brought the span over the site of the temporary center pier, which was built up with cribwork to approximately the level of the old pier. As the tide fell the truss rested on this. A few layers of blocking were removed from the top of the cribwork on the scows, so that as the tide rose the truss, while raised, was not lifted to its old level. Some of the timber was next removed from the pier, so that as the tide fell and the truss took its bearings on the pier it was lower than before. By repeating this process the draw span was eventually left in place and at the desired level.

The entire operation, executed by the firm of T. & A. Walsh, of this city, was carried out without any accident, and was completely successful.

Why Woman Ought Not to Work.

"The problem of woman from a bio-sociological point of view" is treated by Signor G. Ferrero in the current number of the *Monist.* "The essential condition of feminine existence," which he desires to analyze in his paper, is that which he names "the Law of *Non-Labor.*" "As it is a natural law that the man must labor and struggle to live, so is it a natural law that the woman should neither labor nor struggle for her existence. Biology clearly shows us that the physiological prosperity of species depends on the division of labor between the sexes, for in exact ratio to this is the duration of life." Marriage, as found among the higher animals, is "a perfected form of the division of labor and mutual co-operation of the sexes." During hatching time the male bird does all the providing for his brooding mate. At other times her functions in seeking food are merely auxiliary. Similarly with lion and hyena. The fearful toil which falls to the savage woman the writer pronounces to be "merely a passing phase, a very dangerous aberration, produced by the excessive selfishness of man, which does not and cannot last long." He remarks that the races in which it is found "have remained in a savage state and have made scarcely any progress." In civilized nations female toil is not necessary for the production of the wealth needed for humanity. "Man alone could do this. Woman labor only tends to lower the marketable value of male labor; for, while woman is working in the factories, there are everywhere, and especially in Europe, crowds of men vainly seeking employment, to whom the cessation of work is an oft recurrent and terrible evil. This shows that, even from a sociological point of view, female labor is a pathological phenomenon.

"Statistics show us an increase of mortality among women and children in countries where industrial life has pressed mothers into its ranks. A perfect woman should be a *chef d'œuvre* of grace and refinement, and to this end she must be exempt from toil. . . . The working woman grows ugly and loses her feminine characteristics. . . . Womanly grace and the love which men bear a beautiful woman have perhaps been the origin of paternal love and of all the other sweet and tender feelings of which the male is capable. Grace is the æsthetic side of weakness. Woman, more than man, enjoys all the benefits of civilization, which nevertheless have been in great part acquired by him alone. . . . Man labors and toils to-day, just as he did of old, and there is nothing abnormal in this fact, for it is his positive duty. What advantage, then, can be gained by participating in man's struggle for existence, when woman has only to wait until he places these benefits at her feet? I cannot understand why the question of woman suffrage should so excite public opinion. It is entirely profitless to her. . . . If her husband strains every nerve already to provide her with all the luxuries of life, he will certainly not be lax in defending those interests which are identical with those of his family."

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AGAIN A TORPEDO BOAT SINKS A WAR SHIP.

The value of torpedo boats was again illustrated during the recent Brazilian revolt. Among the vessels seized by the insurgents was the ironclad war ship Aquidaban. After her escape from the harbor of Rio she went to Santa Catalina Bay, and here she was followed by the improvised fleet of the Brazilian government, consisting of the Nictheroy, one of the merchant steamers bought and armed in New York, and a few other boats of similar class, and a fast yacht formerly known as the Aurora, but supplied with torpedoes and newly christened Gustavo Sampaio. Three other small torpedo boats from Germany completed the attacking force. Having located the Aquidaban, the fleet approached in the dead of the night. A correspondent of the New York *Herald* says: The Sampaio ran up near the ironclad and received the fire of her small arms, but without serious damage. The Sampaio then discharged one torpedo, which missed the ship; then running up within a hundred feet of the ironclad, another torpedo was sent, which struck the great vessel on the port bow. The explosion was terrific. The bow of the big ship was lifted considerably, then with a quiver she settled down by the head in the water; but the ship did not sink. The crew of the Aquidaban, however, fled and made their escape in boats. The Brazilians boarded and took possession of the ship.

Her two forward compartments were found full of water up to the main deck. A topsail had been drawn over the hole in her bow by the crew; a diver was sent down to report on the damages. It was stated that a hole five meters by two meters existed between the first and second water tight divisions, that the steel framing and strapping were smashed, and the plates above the hole to the water line were badly cracked.

After two days' pumping work she was floated up high enough to allow her forefoot to rest in the mud. In this condition she will undergo temporary repairs to enable her to reach a dock at Rio. On her forecastle a 50-pounder Whitworth was mounted. Five Nordenfelt 1-pounders as a broadside battery were on her port side, together with a few 3-pounder Gardner field pieces of the same caliber and two Hotchkiss 3 pounder field guns on the starboard side. These, with her four 9·2-inch turret guns, comprised her armament.

Ammunition of all sorts and sizes was abundant, while cartridges for the small arms were not lacking. The hoist and shot cradles in the turrets were filled with projectiles, and fixed cartridges for the machine guns were in readiness to be served. The entire armament of the ship had been rendered worthless by the rebels. Breech bolts and blocks were missing, and the inside linings of the guns had been hacked with chisels, so that the guns are now utterly unfit for service.

The closing of the water tight doors must have prevented the entire hull being immersed, and the compartments exhibited their strength, having withstood the water pressure from two divisions. The after part of the ship was perfectly dry. The location of the guns on the Aquidaban was bad; that is to say, their position to efficiently meet attacks from torpedo boats was wrongly determined.

THE GREAT RAILROAD STRIKE.

The Inter-State Commerce Commission, organized by the Federal government for the purpose of studying railroad statistics, recently completed a report on the operations of the United States. It appears that there were 1,890 railroad corporations in the United States during the year ending June 30, 1893. They received in that period nearly a billion and a quarter of dollars. They carried 593,560,612 passengers over 14,229,101,084 miles and transported 745,119,482 tons of freight a distance of 93,588,111,833 miles. These operations were conducted on 176,461 miles of railroad. In round numbers 900,000 employes of all grades are supported by these roads, making one person in every ninety of the population of the United States. Accepting the stated capitalizations which the companies have reported, it appears that on an investment of $10,500,000,000 less than one per cent of dividends were paid. It is calculated that out of every dollar that was received by the railroad companies, 75 cents went to their employes.

It is self-evident that the railroad industry of the United States is an enormous one. The vast body of men who operate it are a power for good or evil. Every citizen has his interest affected by them. Perhaps the investor in railroad securities is as little affected as any one by their actions, but the suburban residents all over the country have their very home life at the mercy of the train which transports them to and from their business, the dweller in the extreme East finds the price of his meat raised by a railroad strike hundreds of miles away in Chicago or other center, and the merchant in the delivery of his goods is greatly impeded in his business by any irregularity of the running of trains.

The papers of the entire country have been full of the accounts of a great strike now in progress. It is conducted ostensibly by an organization termed the American Railway Union. It started originally in consequence of an announcement made by the Pull-

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man Car Company that they could not continue to run their works without a reduction of wages. This would seem to be a very small matter, but Pullman cars are run on roads all over the United States, and a boycott aimed at the Pullman Car Company took the form of a refusal on the part of the American Railway Union to permit its members to take a part in running any trains that were made up in whole or in part of Pullman-made cars. In this way, from a small beginning and from a cause involving a few hundred workmen, the strike has assumed large proportions and has finally become a contest between the United States government and the American Railway Union.

Several causes have brought about the Federal interference. Some of the affected railroads are in the hands of receivers appointed by the United States courts, and the operations of such roads are of course under the supervision of the United States government. The majority of the roads are engaged in interstate commerce, and practically all of them carry United States mail. This makes them objects of Federal intervention and protection. Accordingly, a representation of the small standing army of the United States has been summoned to the scene, and a number of regular soldiers have been dispatched to different places where the strike is at its worst.

Very peculiar features have been noted. In some cases, where the militia were ordered out, they have refused to act, evidently being in sympathy with the strikers. The United States troops in some cases were baffled by the acuteness of action and movement of the strikers, some of whom would uncouple cars protected by the troops, and would then disappear so quickly in the crowd that they could not be fired at. In another case, where some women uncoupled a train, their sex operated to prevent the regular soldiers from firing upon them.

The operations of the strikers have included derailment of trains and general interference with the operation of the roads. It is evident that a problem in practical politics of the most difficult kind is before the country. To define the action of the strikers as anarchistic, while doubtless etymologically correct, gives no clew to a remedy. The increasing interdependence of mankind brings more forcibly to the front every day the necessity of order in the social world. In the destruction of property the social economist recognizes the loss of all, not merely of the individual directly affected. Every strike in a railroad interferes directly or indirectly with the well-being of all the people of the United States. The seriousness of the problem cannot be overstated. Mr. Debs, the president of the railroad union, announces that the first shot fired by the regular soldiers at the mob will be the signal for a civil war. On the other hand, Mr. Debs himself is threatened by arrest and prosecution by the Federal authorities. It now remains to be seen whether the government is the real ruler of this country or whether the supreme power is wielded by the American Railway Union.

On the Mechanism of Electrical Conduction.

Prof. C. V. Burton, D.Sc., read a paper on April 27 before the Physical Society (London) on the "Mechanism of Electrical Conduction," the first part of which dealt with conduction in metals. The following brief abstract of his paper is clipped from the *Electrician:*

"Considering a body not at absolute zero of temperature, the author shows that electromagnetic radiation would result in heat being degraded into a lower form of energy, if any parts of finite electric conductivity were present, and from the fact that our planet is not devoid of heat, deduces the following Theorem I.: 'In a region containing matter, there may be (and probably always are) some parts which are perfect insulators and some parts which are perfect conductors, but there can be no parts whose conductivity is finite, unless every finitely conductive portion is inclosed by a perfectly conductive envelope.' This conclusion is in accordance with Poisson's theory of dielectrics and with Ampère's and Weber's theories of magnetism and diamagnetism respectively. Theorem II. is enunciated as follows: 'In metals and in non-electrolytes whose conductivity is finite, the transmission of currents must be effected by the intermediate contact of perfectly conductive particles;' and as a corollary Theorem III. is given: 'If we suppose that in a substance at the absolute zero of temperature there is no relative motion among the molecules or among their appreciable parts, it follows that every substance at this temperature must have either infinite specific resistance (which does not imply infinite dielectric strength) or infinite conductivity.'

"Fleming and Dewar's experiments on pure metals tend to confirm this. The author then shows why, on the intermittent contact hypothesis, a conductor is heated when a current flows through it. On the assumption that in ordinary conductors the relation between the electromotive intensity in the intermolecular spaces and electric displacement is a linear one, and that the electric forces are small in comparison with the ordinary intermolecular forces, Ohm's law is deduced. A model is next described, by means of which contact E. M. F. and the Peltier effect can be represented and explained, and in considering Volta E. M. F.'s, the author points out that it is doubtful whether experiments in a perfect vacuum could decide the questions at issue in the contact-force controversy. The fact that the transparency of metals is much greater than Maxwell's theory indicates might be explained without attributing any new properties to the electromagnetic field by supposing the dimensions of molecule not quite negligible in comparison with the wave length of light."

Nature's Most Invincible Creatures.

BY DR. EUGENE MURRAY AARON.

We are apt to consider ourselves the most powerful and all-conquering members of the animal world, and next to us we range such creatures as the lion, tiger, grizzly bear, and elephant, as capable of maintaining their own against all comers in an open hand-to-hand or mouth-to-mouth fight. Yet in doing so we err greatly, simply because we consider mere bigness or muscular force, forgetting the energy and the intellectual powers that make one of nature's tiny creatures, when combined in the vast numbers in which they are always found, by far the most formidable animal force known on land. Therefore, when the question is put to us, "Which do you consider the most resistless of all animals?" it is always safe to reply that if warlike manifestations are referred to, the soldier or driver ants are far and away the most terribly invincible creatures with which we can be brought in contact.

Monsieur Coillard, a French missionary in the Barotse Valley of South Central Africa, thus writes of these terrors there: "One sees them busy in innumerable battalions, ranked and disciplined, winding along like a broad black ribbon of watered silk. Whence come they? Where are they going? Nothing can stop them nor can any object change their route. If it is an inanimate object, they turn it aside and pass on; if it is living they assail it venomously, crowding one on top of the other to the attack, while the main army passes on, businesslike and silent. Is the obstacle a trench or a stream of water? Then they form themselves at its edge into a compact mass. Is this a deliberating assembly? Probably, for soon the mass stirs and moves on, crosses the trench or stream, continues in its incessant and mysterious march. A multitude of these soldiers are sacrificed for the common good, and these legions, which know not what it is to be beaten, pass over the corpses of these victims to their destination."

Against these tiny enemies no man, nor band of men, no lion or tiger, nor even a herd of elephants, can do anything but hurriedly get out of the way. Among the Barotse natives a favorite form of capital punishment is to coat the victim with grease and throw him before the advancing army of soldier ants. The quickness with which the poor wretch is dispatched is marvelous when it is considered that each ant can do nothing more than merely tear out a small particle of flesh and carry it off. Yet in a surprisingly short time the writhing victim will have been changed into a skeleton of clean and polished bones that will make the trained anatomist envious.

All are familiar with the tales of how these armies of ants enter a tropical village and take entire possession of it, driving its inhabitants out in terror, and at last in a few hours or a day or two abandoning it cleaner than the arts of the most orderly housekeeper could ever make it. These are not travelers' tales. The most gifted pen must fail to give an adequate idea to the uninitiated of just how thorough and searching these creatures are in ridding a house of every bit of animal or vegetable matter in it. Perhaps, however, the narration of the following bit of personal experience may help to illustrate it. I had returned from a day's tramp in the hills, laden with trophies in the shape of tropical insects, some of them, perhaps, new to the eyes of scientists, and all of certain value, when I was called out of my house by the cry, "The driver ants, the driver ants." Hastily placing most of my collections in glass jars and tin boxes, so as to be out of the reach of the invaders, and gathering such clothes as I would need for a day or two, I made a rather undignified retreat. After I had done so I remembered that I had left some rare bees pinned in a box that was in the pocket of my collecting coat, but as the coat had been placed in a strong chest and this chest was heavily scented with naphthalin or "tar camphor," and the lid fitted down very tight, I felt that they were safe. The next morning when I went back, after a night spent in my hammock in a tamarind tree, I found that of a bunch of bananas, consisting of a thick stem and about 100 of the fruit, there was no trace whatever, save the dangling string with which it had been hung from the ceiling; and not a vestige of bread, chocolate, coffee, and other eatable odds and ends could be found on the thoroughly cleaned shelves on which some food had been left. Even the cracks between the floor boards had been cleaned out, the particles of edible matter having been carried away or devoured and the mere dust left where it could easily be swept away.

This was not so bad, for a good cleaning never hurts a house in the tropics; but when I came to examine my chest and found that a hole quite two inches in diameter had been torn in one end through an inch board of hard wood, that the box in my coat pocket had also been pierced and every one of the pins on which my beetles had been arranged stood in place as empty and clean as when taken out of the paper, I had a better idea of the thoroughness of these tiny scavengers than ever before.

The Economy of Gas Engines.

In a paper read before the Incorporated Institution of Gas Engineers, at their recent meeting in London, Mr. Bryan Donkin gave a number of facts as to the extent to which gas engines are used, and the degree of economy they have attained. He said that, according to Mr. Dowson, gas engines for electric lighting, developing about 7,000 horse power, had been sold in England, and Otto engines for 11,000 horse power in Germany. Messrs. Crossley informed him that the number of Otto gas engines in use in England was about 20,000, and he might assume that there were about nearly double this number for all kinds of gas engines. At "Chateau Lay" an Otto gas engine, feeding about 650 glow lamps, consumed 1·2 pound of fuel per indicated horse power hour for the manufacture of its Dowson gas. At the Chelsea Flour Mill, a 60 nominal horse power twin cylinder gas motor with Dowson gas used during a full load test about 0·87 pound of anthracite and coke per indicated horse power per hour. The engine had a cylinder 17 inches in diameter by 2 feet stroke, and made 156 revolutions per minute. It had been at work about two years. At the Leven Tweed Mills there were, he said, four gas engines with Dowson gas, developing about 200 horse power. These engines used, during a six days' test, 1¼ pounds of anthracite per brake horse power per hour. With coke from the gas works the consumption was 1¾ pounds per hour. At Godalming Paper Mills there were gas engines giving 400 indicated horse power, with an average consumption of 1 pound of fuel per indicated horse power per hour. At a weaving mill in Halifax there were four gas engines of about 200 indicated horse power, using 1·4 pound of gas coke per horse power per hour. At the Uxbridge Water Works a water pumping test was made in February, 1892, using generator gas. The consumption was 1 pound of coal per indicated horse power, or 1¾ pounds per horse power of water lifted per hour. The approximate power was 16¾ indicated horse power. The whole of Messrs. Crossley Brothers' large works are driven by gas engines, using Dowson gas, made from anthracite coal. There are eight gas motors from 12 to 30 nominal horse power, indicating collectively about 325 horse power. The firm stated that the consumption was from 1 pound to 1¼ pounds per indicated horse power hour. The net cost to them of the anthracite fuel, labor, interest on capital, and repairs worked out at about 2½*d.* per thousand cubic feet. Comparing this with average town gas, and allowing for the difference in thermal value, the equivalent cost would be about 10*d.* per thousand cubic feet. A single cylinder gas motor, indicating 280 horse power, driving a large flour mill in France, was lately seen by Mr. Donkin working with generator gas from French coal. The preliminary trials gave about ¾ pound per indicated horse power per hour. The engine will give a maximum of 320 indicated horse power.

The Niagara Falls Power Company.

The supply canal leaves the Niagara River about 7,000 feet above the Falls. It is 188 feet wide and 12 feet deep, with cut stone walls. From this canal water passes by gates and penstocks to the turbines. At present the wheel pit is constructed only on the western side of the canal. This pit is 21 feet wide, 179 feet deep, and 150 feet long, and the turbines are now being placed in the northern end of it. The penstocks which supply the turbines are 7½ feet in diameter, and the turbines themselves, each of which is double, take the water at the center and discharge outwardly. These are 5 feet 3 inches in diameter, and each double turbine will develop 5,000 horse power. The shaft from the turbines is of hollow steel, 38 inches in diameter and ⅜ of an inch thick. At bearings, the shaft is solid and 11 inches in diameter. The turbines are so arranged that the weight of shafts, turbines, and gear is counterbalanced by the upward thrust of the water, so that when running the thrust will be on the bearings at the top. These are to run at 250 revolutions a minute. The breadth from the surface of the water in the canal to a point half way between the two double turbines is 136 feet. The tailrace is a tunnel, 7,000 feet long, 21 feet high, 18 feet 10 inches wide, lined throughout with brick. It has a fall of 52½ feet, and opens at the bottom of the gorge, just below the upper Suspension Bridge, at the level of the stream.

THE largest European city park is in Denmark; it contains 4,200 acres.

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