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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

"HOW MUCH, THEN, IS A MAN BETTER THAN A SHEEP ?" Matt. xii., 12.

The Editor is not about to preach a sermon. He is merely going to indulge in a few reflections on the cheapness of human life, as shown by the wholesale slaughter of passengers that is occurring day by day on our railroads.

It will not be a pleasant reverie; certainly it will not be flattering to our sense of national esteem; and it must needs make the most thoughtful of us, and the truly patriotic among us, realize that with all our boasted advancement in the useful arts of modern life, there are certain respects in which we are a long way behind some of those older countries, which we are apt to think we have left far behind us in all things that affect the comfort, safety, and sanctity of the life of the individual citizen.

Some time ago the British Board of Trade was able to announce that during a period of twelve months not a single passenger had been killed on the railroads of Great Britain. Since then another three months has passed without a fatality, making a straight record of fifteen months' operation of the most crowded railroad system in the world without a single loss of life.

Here, in the United States, our railroads have killed 77 passengers in fifteen days!

In cases of such astounding disparity as this there are usually to be found some mitigating, explanatory conditions. Let us then ask, are there any elements in American railroading that will satisfactorily explain why it is that the British railroad system can carry its teeming millions of passengers in fifteen consecutive months without killing one, while American railroads cannot carry a fraction of the number in fifteen consecutive days without killing 77 of them?

We have to confess that, so far from there being any mitigating circumstances, the more we look into the question the more inexcusable does our own shocking death list appear; and for the following reasons: First, the total number of passengers carried is greater in Great Britain; second, this greater number is handled upon one-eighth as many miles of track—24,000 miles in Great Britain as against 200,000 miles in the United States; and, thirdly, the average speed and the frequency of the trains is greater there. So that the slaughter that is going on is actually less excusable than the mere figures—and Heaven knows they are bad enough—would show. For with a smaller total number of passengers and trains, and in spite of the fact that they are spread over eight times as many miles of track, we kill 77 in 15 days while they kill not one in 15 months.

But why this appalling difference; and what, if any, shall be the remedy? Perhaps the trouble is that we have not as yet arrived at a proper estimate as to by how much a man is better than a sheep. Some people have been trying to solve the problem, and we believe that it is a fact that an enlightened legislature once put the difference at $5,000, or to be more exact $4,995—a fair average market value for a sheep being, we are told, about $5. It is true the correctness of this legislative estimate has been called in question, and twelve of the fellow citizens of a recent railroad victim have set the worth of a man at $60,000—an appreciation in value which has been sustained recently in one of the highest courts of appeal. There is no doubt that this higher valuation will go a certain distance in reducing the death rate on railroads; but it will never teach us to run our railroads 15 months without killing anybody.

We recently presented this comparison of railroad fatalities to the chief engineer of one of the leading railroads entering this city, who is a specialist on the question of block signaling, and asked him to explain the 77 fatalities, fully one-half of which, by the way, occurred on roads that were equipped with as fine a block signal system, and perhaps a better, than any in Europe. In his prompt reply he put his hand at once on the weak spot: "The different results are to be explained by a difference in national temperament—here, we take chances." He was right; our engineers do take chances; they interpret signals to please themselves; run past them, and—kill 77 passengers in 15 days.

But what are we to do? We cannot change "national temperament." True; but we can at least curb it, and we can do so in the case of the railroad engineer by extending the automatic principle, so that if he does not shut off steam for green lights and put on air for red lights, it will be done for him.

Let us place two levers on the engine and two corresponding trips on the track, one within sighting distance of the green and the other within sighting distance of the red signal. Let the green trip register with a lever that shuts an auxiliary throttle valve near the smokebox; let the red trip register with another that will set the emergency brake. Then should the engineer fail to shut off steam and let his engine coast on approaching the distant green signal, it will be shut off for him; and if he fail to set the brakes on sighting the home or red signal, the trip will open the train pipe. The levers could be so arranged that if the engineer manipulated his throttle and brakes in accordance with the signals, there would be no connection made between the trips and the engine. The suggestion as to automatic air-brake connections with the red signal was made several years ago, and it is excellent; the green light trip acting on the throttle is a logical extension of the idea.

"But," says the railroad official, "by the use of an absolutely automatic system you would destroy that element of watchfulness which it is our desire to cultivate in our engineers. They would become careless and would cease to watch for the signals. Then, should the signals fail, the chances of accident would be greater than before." Very good; then let the roundhouse foreman set a seal upon the automatic levers on the locomotive before it starts on its trip; and let it be a cast-iron law of the railroad that if an engineer come back with the green signal seal broken, he will be fined thirty days' pay, and that if the red seal be broken he will lose his job, and be blacklisted from Maine to Florida and from New York to the Pacific coast.

Here is a system that would prove an almost absolute preventive of collision, and that, incidentally, would produce in the first brief month of its operation a set of engineers who for alert vigilance would be hard to match.

But to extend this method to all the block systems would be enormously costly. True; but not so costly as to keep on killing 77 passengers in 15 days; especially if, as recent jury verdicts are suggesting, the people of the United States are waking up to the belief that the "how much" between a sheep and a man is some big multiple of 4,995 dollars.

Furthermore, we must remember that, to-day, of our 200,000 miles of tracks, only 25,000 miles, or one-eighth, is equipped with a block signal system of any kind. And here we find another potent cause of our perpetually-recurring railroad horrors. Train dispatching by telegraphic orders assists in keeping up the frightfully high average of railroad disasters. Take note of Accident Bulletin No. 5 just issued by the Interstate Commerce Commission, which records that in the three months ending September 30, 1902, 263 persons were killed and 2,613 injured in railroad disasters. At that rate, in the 15 months of which we have spoken, the total number of killed would run up to 1,315 and the injured to over 13,000.

And to think that it is all preventable! Moreover, just as soon as we really understand how infinitely much a man is worth more than a sheep, it *will* be prevented—if not by the initiative of the railroads, then by legislative act compelling the application of a direct, engine-controlled, block signal system to every one of the 200,000 miles of track.

GERMAN-AMERICAN WAR GAME.

The series of war games now being played at Portsmouth, between representatives of the American and German navies, has passed through the first critical stage. The close of this stage was an important battleship action in the Philippines, in which the American fleet, owing to numerical inferiority, was practically wiped out. As those of our readers who are following this very interesting series in the Supplement are aware, at the opening of the war game the various contending fleets and squadrons on the checker boards were assumed to be in the exact positions in which the fleets of the two nations were at the date of the opening of the game. In the Pacific were stationed only four of our battleships, the 'Wisconsin," "Oregon," "Illinois," and "Kentucky," with the monitors "Monterey" and "Monadnock." Immediately upon the declaration of war the Germans dispatched, post haste, to the Philippines a battleship fleet made up of the very latest of their new battleships that have been completed within the last five years, all ships of 18 knots speed. The principle of concentrating in superior force upon some chosen weak spot of the enemy's line is a sound one, and is unquestionably the course which would be followed by Germany in a state of actual war. The United States players, to meet this move, wished to dispatch the North Atlantic fleet to Manila, but were prevented by the umpires from doing so on the ground that American public opinion along the Atlantic coast would not allow the seaboard to be left in such an undefended condition. The umpires demanded two or three weeks' delay of the North Atlantic squadron until a system of patrol by monitors, etc., could be established. Even with this loss of time, however, the situation in the Philippines might have been saved had the Panama Canal been built and in operation; for it would have been possible to send additional battleships to Manila in time to provide an equal United States fighting force, if not a preponderance of strength, for the great naval battle that was impending off Manila. The full significance of these strategical lessons of the war game will be appreciated, when it is remembered that the war game at Portsmouth is being fought out with absolute impartiality by British officers, who take up the opposing fleets simply with a view to training themselves in naval tactics and strategy. Hence, to everyone who takes an intelligent interest in naval affairs in general, and is therefore capable of forecasting the trend of events in case of a German-American war, it will not be surprising to learn that the three great lessons of the war game thus far developed are: first, that the far-distant Philippines are our most vulnerable point, and therefore the probable seat of attack in our next naval war; second, that if we are to render our navy fully efficient to cope with the new situation opened by the possession of the Philippines, we must dig the Panama Canal, and do it with all possible dispatch; and thirdly, that the United States fleet, at its present strength, is totally inadequate to cope with the larger series of operations now demanded of us as a colonial power.

After the defeat of the American fleet the German troops disembarked from the transports and made an assault on Manila which was repulsed, and this repulse, coupled with the advent of the American North Atlantic fleet, led to the re-embarking of the troops and the retreat of the German fleet to its naval base at Kiao Chau, China. Meanwhile, the second German battleship fleet, which crossed the Atlantic, captured Havana, and proceeded to recoal and refit, while the American fleet concentrated at Key West; so that the situation to-day consists in the juxtaposition of two opposing fleets: a German Pacific fleet in Kiao Chau Harbor blockaded by an equally powerful American fleet, and another German fleet in Havana Harbor watched by the American home squadron. In both hemispheres the combatants are so equally matched that the outcome is considered to be uncertain; but likely in any case to terminate the war.

A REFRACTORY PISTON NEEDED.

This title may cause a cynical expert to say to himself that pistons are generally refractory enough without calling for a new type, but that is as may be. The piston itself is a docile detail unless too much enforced by persons who follow tradition instead of exercising good judgment in the management of it. It is nothing more or less than a sliding, steam-tight partition in a cylinder; but to secure it against leakage various devices are used, most of them not only useless but harmful as well. Tradition teaches many that packing rings should be very wide and heavy, and provided with stiff springs behind having set-screws through them. Whoever achieved this last-named absurdity in a piston should have had special mention, for he could not have given much thought to the matter, or he would have seen that a spring with a set-screw through it was no spring at all, the elasticity and resiliency of it being destroyed.

In so far as the rings are concerned, the best practice now makes them as light as possible, in many cases dispensing with springs entirely. This type of piston is used on the heaviest kind of work, with very high pressures, in locomotive and torpedo-boat engines, and is wholly reliable against leakage. The advantages are that being relieved from abnormal and unnecessary pressure on its walls, the cylinder wears true and is not scored or cut by the packing rings. These last are called "snap rings," from the fact that they are sprung into the piston, having elasticity enough to go over its flanges and resume their form when they get into the grooves provided in the piston for them. In the early history of the steam engine great difficulty was experienced in getting true cylinders, for the lack of proper boring mills; and it in said that Watt, in alluding to this, wrote to a friend that they had at last succeeded in getting their cylinders so nearly correct in this respect that they "could not insert a crown piece between the packing and the cylinder walls anywhere." I do not know how thick a crown piece may have been in those days, a scant sixteenth of an inch possibly; but with such crude workmanship metallic packing rings were not possible, so recourse was had to hempen gaskets, driven in tightly between the piston and cylinder wall. It is not so very long ago that this method was still in use, for I have seen it put in in my day. With modern machine tools cylinders can now be perfectly bored, and as a result there is no occasion for jamming rings tightly into cylinders, a snug fit being all that is required; but it is necessary with this plan that the piston flanges should fill the cylinder, with no allowance for clearance, beyond that needed to let the piston move freely in the cylinder without touching it. Some very large cylinders and pistons have been made in this way with the best results, especially in the direction of revolutions per minute of the crankshaft. Friction being very much reduced, permits of increased piston speed.

Now that higher steam pressures are employed, and superheated steam is introduced, in many plants metallic packing of whatever description is giving more or less trouble, from the fact that hot metal bearing upon hot metal with any pressure at all does not behave satisfactorily; and designers are casting about for relief in this direction. Were it not for mineral oils with a high flash point, superheated steam engines would be impracticable, and even this makeshift, so to call it, does not wholly overcome the cutting of surfaces in contact. Gasoline and other explosive engines which generate high temperatures in their cylinders, experience the same trouble; and if it is possible to devise a piston which shall be immune from all derangements by excessive heat, a great advance will have been made. I am of the opinion that it can, and suggest, as one medium, plumbago rings of special design to suit the work required. As this substance is entirely neutral toward expansion and contraction, and capable of being molded into permanent forms suitable for packing rings, I do not now see any reason which would render plumbago rings impracticable. Confined as they would be in a cast-iron case, and not subjected to shock or jar, they should last a long time, with the possible exception of wear by attrition. This last would certainly give trouble for a short time until the cylinder became of mirror-like surface and polish; but when this is obtained, I believe that difficulties experienced with all metal rings would disappear for the work previously mentioned.

There is room for a great diversity of form and detail in the application of plumbago rings for packing, and the best and cheapest cannot be predicated; trial and error will show the fittest, and an experiment to determine this would cost so little that, from my point of view, it is worth a trial. E. P. W.

MR. WESTINGHOUSE ON AMERICAN METHODS IN STEEL-MAKING.

At a banquet given in London recently to a large company of British railway men, financiers, and scientists Mr. George Westinghouse made a noteworthy speech, in which he graphically compares European and American methods of steel-making.

Lord Kelvin had previously spoken of American methods. Mr. Westinghouse remarked that one of the English difficulties is inherent in an old-world, highly developed country. After a nation has worked prosperously for a long time, it opposes improvement or suggestion, thinking: Success with the old, discourages the introduction of the new. In America, however, the necessities have produced different results. Lord Kelvin said that England sent many men to America. Mr. Westinghouse acknowledged that, and added that it had also sent many ideas. The American patent records, patent decisions in infringement suits, show that among the references many inventions are of English origin, some of them containing ideas so complete, the wonder is that the inventions disclosed were not established fully and completely in your own land. These records seem to show that Americans and Englishmen have invented the same thing many times.

America has always been short-handed with regard to labor. Manufacturers have been obliged to find methods whereby one man may accomplish the work of two or three men as compared with your practice here. The works of the country have had the best men from Europe: Englishmen, Germans, French, everybody—skilled men, highly trained men, as well as laboring men; their experience has been combined with that of Americans, and thus there have been achieved results unattainable in a country like England, where there is more labor than can well be kept employed.

As an illustration of what has been accomplished by the use of electricity in a great industry, Mr. Westinghouse cited the Homestead Mills of the Carnegie Company. "Mr. Schwab," said Mr. Westinghouse, "is a genius in his way, particularly in the management of men. Mr. Carnegie believed in him, and if Mr. Schwab made a suggestion in regard to the use of new appliances, even if it involved the tearing down of an old mill and putting up a new one, the new one was ordered. What Mr. Schwab thought should be done, was done. As a result of such progressiveness we may see the splendid mills at Homestead where they produce with about 4,000 men three times as much steel as the Krupp works produce with 15,000 men. The results are simply wonderful. You can start there today, in a building containing steel-melting furnaces, and you will there see three men mounted on a car with the charging apparatus which is moved and operated by electricity. With a few movements of this ingenious contrivance three men charge twenty furnaces, which prior to the use of electricity, would have required the labor of over 200 men.

"You may go into the yard of the Homestead Mills where they pile the metal in stock. This yard is covered by a system of overhead cranes, and the result is that not only here, but in the mill, and in every other place, you may see great weights lifted and many undertakings going on without a single man exerting himself a bit."

Continuing, Mr. Westinghouse said: "I took some English friends to Homestead. Mr. Schwab, after guiding us through several departments, said: 'I will now show you where we turn out 750 tons of plate girders per day.' The mill was in the shape of an 'L.' We went into the short end of the 'L' where the furnaces were fed by natural gas, of course requiring no stokers. The end at which we entered had a rather low roof, and there was in sight a contrivance like a battering ram in front of the furnaces; two workmen were sitting down eating their dinners near by; no one else was present. I thought: 'Mr. Schwab has made a mistake, he has asked us to see a mill that is not in operation.' But we went through the mill, which was about 200 feet long; and suddenly we heard a rattle and then saw a truck approaching loaded with a big ingot. No one touched the truck or the ingot. The load came to a platform, the crane overhead dropped a pair of tongs and quickly put the ingot on the roller table, and as it moved to the great rolls, it was automatically kept in place. The adjusting screws of the rolls were turned by little electric motors, and not a man in that house did a bit of work. We went back to the furnaces. There was a fifteen-year-old boy seated in a little place called the 'pulpit.' He was able, merely by the movement of levers, to open at will any of the furnace doors and move the car along. And we saw this car come in front of a furnace and the charging machine approach, and take out of the open furnace a hot ingot which was dropped on the car and moved off to its work. There was this boy doing absolutely no hard work, and his mill was turning out 750 tons of steel plate each day. My English friends said: 'England has no chance in competition with such methods.'"

All this came about in America because of our necessities. There were not enough men to do the work. There was a premium in favor of those who could invent machines to work and thus supply the deficiency.

"At the Carnegie Mills," Mr. Westinghouse narrated, "we went to see three blast furnaces. They were making 1,800 tons of pig-iron in twenty-four hours. We saw only two or three men on a truck, which was moved automatically. These men were letting the ore run from shoots and mixing it in the required quantity, and when they had filled a truck, it was carried up and its contents dumped into a furnace whence it returned for another load. They were running the metal into an immense receptacle into which the metal from all three furnaces was mixed. From this place the metal was taken as required, put into a special tank, mounted on a car and taken to Homestead, two or three miles away, to be poured into the furnaces; one heating only was required."

LIGHTNING STRIKES THE NIAGARA POWER PLANT.

BY ORRIN E. DUNLAP.

The Niagara Falls Power Company suffered from a very remarkable disaster on the night of Thursday, January 29, when lightning struck the cables in the covered bridge that connects the generating station with the transformer house. This bridge is a stone structure having a slate roof, and crosses the inlet canal. At one end of it stands power house No. 1, in which 50,000 horse power is generated at a voltage of 2,200. The greater portion of this vast amount of current is conducted by the cables of 1,000,000 cm. capacity across the bridge to the transformer station. The bolt of lightning that came out of the January sky shortcircuited the cables on the bridge, and fire started. Before it was extinguished the interior of the bridge and transformer station, as well as the roof of both, had been badly damaged, while the cable connections across the bridge were totally destroyed. Water thrown into the transformer station by the firemen wet several of the huge transformers, and these were useless until dried out.

The destruction of the cables on the bridge caused no end of trouble, for it made impossible the distribution of the 50,000 horse power of the station, with the exception of the rotary service supply to the local electric lines, the arc light station, and the Natural Food Company. None of the generators were injured. However, the electric power supply of several of the tenants on the Power Company's lands, as well as that of the Buffalo and Niagara Falls Electric line, the Lockport-Buffalo line, and of industrial establishments in the Tonawandas, Lockport, and Buffalo, was wholly cut off. All the Niagara power sent to Buffalo passed across the cables on the burned bridge, in order that its voltage might be raised in the transformer station, and Buffalo was without Niagara power for its lighting and trolley service. It would have been hard to find a more vital point at which to attack this great and wonderful generating station. For a brief time the machines in both of the big power houses were shut down; but as soon as it was found to be possible, which was within an hour or so, the local trolley and lighting services were renewed.

While several of the industrial establishments at Niagara Falls were forced to shut down, the Buffalo and Lockport public fared much worse than Niagara Falls, because in Buffalo Niagara power enters into the lighting to a great extent, while the energy of Niagara is also used for the operation of the Buffalo and Lockport trolleys. All of the Buffalo manufacturing establishments that have come to use Niagara power remained idle on Friday, the day following the Niagara fire, as did also several in the Tonawandas. Lockport was also seriously inconvenienced. In Buffalo many of the papers use Niagara power in the operation of their presses, and its absence forced them to take their forms to other establishments that had a source of power. In Buffalo the International Traction Company greatly cut down the number of cars operated. Its storage battery and steam plant were brought into service.

The scene of the fire had not had time to cool ere the repair work was in progress. Night and day the men worked under the watchful inspection of Supt. Barton. By noon Friday the company was prepared to send 10,000 horse power to Buffalo, but as this was about to be sent out a short circuit occurred, delaying the transmission until about 4:30 P. M. Later an additional 5,000 horse power was furnished Buffalo. By Saturday afternoon things were quite normal about the big power plants, and all but one of the local tenants of the Power Company were in the enjoyment of a power supply. Of course, all the effects of the disaster had not been eradicated, but the temporary cable installation gave all desired service, and work went on in the plants that had been idle.

While the extent of the disaster was severely felt, it is probable that it could not have happened at a more timely moment. It was approaching 11 P. M. on Thursday, January 29, that the power service to Buffalo and other places was shut off, and at this hour the necessity of light and power was small; and on Friday before darkness fell, Buffalo was in receipt of power for lighting, etc. The Niagara power plants are protected by lightning arresters, but this January bolt was unstopped by the apparatus, man had designed to make it prisoner. The electrical storm broke over Niagara Falls at noon Thursday, and at Echota, a suburb of the city, the lightning struck a house. During the evening there were many lightning flashes that were very sharp, while the thunder was very heavy.

The damage to the cables alone was estimated at $25,000, but this amount does not cover the loss that was experienced.

It is now a theory of some of the electrical engineers connected with the Niagara power development that the lightning came in over what is known as the Echota line. This line is an overhead construction and runs along the poles under the transmission line, branching off to go into the suburb of Echota. Its purpose is to feed the lights in the village of Echota and to supply power for the disposal works on the lands of the Niagara Falls Power Company. Despite the fact that it was midwinter, the lightning that night was very sharp, and the idea is entertained that after coming in over the line referred to, it started a fire in the basement of the transformer station, where probably it burned some few minutes, finally causing a short circuit, which opened the circuit breakers at the south end of the power house No. 1. The short circuit, it is supposed, set fire to the cable insulation, the fire spreading to other cables located in the vicinity. After the insulation of these had burned, there was a general short circuit, which necessitated using the emergency switch to open the fields of the generators. It is thus believed that the fire originated in the basement of the transformer station, and owing to the draft or air currents the flames quickly spread into and through the bridge over the inlet cable toward the generating station.

The rapidity with which the necessary repairs were made speaks well for the efficiency of the staff of the power company. A less admirably equipped plant might have been crippled for days.