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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.

SPEED AND SAFETY IN RAILROAD TRAVEL.

In another column of this issue we publish a letter from a correspondent who proposes, as a safeguard against the perils of railroad travel, that the speed of trains should be regulated by legislation, no train being allowed to run above a speed of forty miles per hour. This suggestion is made as presenting a more effective safeguard than that offered by a correspondent in our issue of January 20, who believes that the use of block signals and the automatic stop is the best solution of the problem of combining high speed and safety. There can be little doubt that, if all things be considered, the best compromise of the several conflicting interests which have to be considered in determining this question, is that of combining high running speed of trains with the automatic block signal and the automatic stop. For it is certain that an attempt to restrict, by law, the speed at which our railroad trains shall be run, particularly if the limit were set at forty miles an hour, would not only retard the progress of our whole system of industrial life, but would so far limit the capacity of our railroads that the lines would become congested, and the risk of accident be proportionately increased.

Our long list of railroad fatalities and accidents is not due to the high speed of trains; it is not due to the failure of the block signal system on such lines as use it; but it is due in part to the fact that enginemen play fast-and-loose, and in many cases are encouraged to do so by the management, with the fundamental principle upon which the block signal system is built up. This fundamental principle is that the commands of the semaphore arm or the colored light are absolute and final; that whether they say "stop" or "proceed," there is no possible appeal from their commands; that nothing is left to the discretion of the engineer, who must obey with the most literal obedience.

If the block signal were permitted, in the operation of trains, to exercise absolute authority, we believe that the percentage of accidents would at once be very largely reduced. As it is, however, that usually excellent trait of our national character which leads us to believe that nothing is so perfect but that it can be improved, has, in the case of the block signal system, led us astray; and in the attempt at improvement, we have robbed it of much of its value. On many roads the engineers are permitted to use their discretion by passing a signal and proceeding cautiously, the object, of course, being to save time by keeping the traffic moving forward. If we would secure the full benefit of the block signal system, this discretionary power should be removed from the engineer.

Furthermore, it may happen that even when the block signal is strictly obeyed, various accidents, which need not be recapitulated here, may prevent the engineer from stopping his train according to the signal; and it is in order to eliminate, as far as possible, these errors, due to the "human element," that the automatic stop has been introduced. Its advantages are so many and so obvious, that one would have thought that this device would have met with quick recognition, with universal recognition, we might say, on those roads which make use of any kind of an automatic signal system. Although various disadvantages have been urged against it by those who are responsible for keeping the traffic moving, we believe that the chief objection rises from the same considerations that led our railroad men to rob the block signal of its proper authority. They look upon the automatic stop as one more hindrance to that unimpeded movement of the trains, which is the prime object of the superintendent and his train dispatcher. We do not believe, however, that the ultimate effect of this device would be to hinder the flow of traffic. On the contrary, if the block signal were made more authoritative, if its commands were backed up by the automatic stop, we should rather be prepared to see the speed of trains steadily increase, as a direct result of the lessened risk of accident.

SUPERHEAT AND BOILER PRESSURES.

It is surprising that the advantages arising from the use of superheated steam should not have led to its earlier use on the locomotive; for it is only during the past two or three years that the superheater has begun to establish itself in locomotive practice. This development we owe chiefly to the Germans, who, with their characteristic thoroughness, are just now paying particular attention to the question of locomotive efficiency. The advantage of the use of superheated steam is that, by preventing cylinder condensation, it renders it possible to obtain from a simple locomotive an economy that compares favorably with that of the compound locomotive. It also permits of the use of a lower boiler pressure without any appreciable sacrifice of economy. This fact should render the superheater particularly attractive to the American master mechanic, to whom the high pressures which are now common are a source of increasing trouble and anxiety.

The great increase in boiler pressure has been one of the striking features in the recent development of the American locomotive. The most rapid increase took place during the decade, 1890 to 1900, when the pressure rose from 160 to 200 pounds to the square inch, several roads making use of the latter pressure. During the past five years 200 pounds has become common, and on some locomotives the pressure has risen to 210 pounds to the square inch; indeed, the writer has ridden on one make of compound, the needle of whose pressure gage was maintained at over 220 pounds to the square inch.

The increase in boiler pressure, like the increase in heating surface, has been due to the ever-present demand for greater power; but as far as the gain in power due to higher pressure is concerned, it has been secured at the cost of several disadvantages, such as increased leakage loss, a marked increase in boiler repairs, and a decrease of earning capacity due to the greater time spent by the locomotive in the repair shop. Now the introduction of the superheater offers a way of escape from the dilemma, a fact which is dwelt upon by Mr. H. H. Vaughn in a paper in the Proceedings of the Master Mechanics' convention, in which he states that, with the proper amount of superheat, it will be possible to return to pressures of 175 pounds or even less without loss of economy.

FORESHORE PROTECTION WITH CHAIN-CABLE GROYNES.

The experiments which are being carried out in Ireland with a novel method of protection against sea erosion, by means of cable groynes, devised by a Dublin engineer, will interest every government that is confronted with the problem of protecting its foreshores. In this system heavy chain cables are employed, to which are attached thorn bushes, or other suitable materials. The chains are laid at right angles to the foreshore, and at the sea extremity are held in position by means of concrete blocks or other suitable anchorage, while the shore ends are secured by means of strong iron pins driven in between the links of the chain. When a light cable is utilized, it is held in position at intervening points between the two extremities by concrete sinkers. The cable is then freely covered with trees, bushes, and so forth, which catch the sand, gravel, and shingle. These groynes are found to accommodate themselves easily to the contour of the seabed.

A few months ago ten of these groynes were erected on the foreshore at Bray, near Dublin. At this point the shore line faces due east, and the conditions are very unfavorable to any protectional devices. The shore is very steep, and there is a triple line of railroad along the shore, protected by a seawall, which is constantly in danger of being undermined. On a stormy day, with the wind dead on shore, the waves wash right up to the wall at low water, and there is a continuous travel of heavy shingle, gravel, and sand, the marl being exposed and subjected to continual erosion through the sawing action of heavy traveling detritus.

With a view to testing the efficiency of the chain groyne system, which is inexpensive to install, the railroad authorities arranged for these ten groynes to be constructed on this principle. The groynes are each about 100 feet in length, commence at mean sea level and extend beyond ordinary low water. They are pinned down to the marl with strong iron bars pointed and capped. They are placed about 130 feet apart. They were installed before the last equinoxial gales, so that the efficiency of the system was submitted to a severe test. The gales raged with great fury from the northeast, but failed to dislodge the structures. Considerable quantities of shingle, sand, and gravel, however, were brought in and still remain, the depth of reclamation at points ranging from 4½ to 5 feet.

The system has established its value, and already it has been decided to apply it to other parts of the British coast where other systems of foreshore protection are either impossible or difficult to carry out. It is anticipated that those at present in position will be carried further out to sea, so as to offer a greater measure of protection.

The installation of groynes upon this method certainly possesses many advantages. The flexible hedge is very adaptable to the inequalities of the seabed, while should it by any untoward circumstance be carried away, it cannot be lost owing to the shore anchorage. Furthermore, they can easily be removed from one point to another more advantageous if desired. The cost of construction is less than that of any other groyning system, while they can be placed in position much more expeditiously. They cannot be impaired by the ravages of the shipworm, are inexpensive to maintain, while it is impossible to destroy the main portion of the structure. It is certainly possible to carry the groyning farther seaward than by any other system, and thus influence the travel of material over areas far greater than has heretofore been possible. The developments and results of the installations are being closely followed by continental engineers, since there are many points around the European coast line demanding protection from the heavy sea erosion now taking place, but where the exigencies do not permit of any of the usual groyning systems being erected.

ELECTRIFYING THE ST. CLAIR TUNNEL.

The announcement was recently made that electric locomotives were to be used in conveying passenger and freight trains through the St. Clair tunnel, and a contract has just been closed for the complete electrical installation, including six locomotives fitted with Westinghouse single-phase motors. This change of motive power is due not only to the difficulty of ventilating the tunnel, but also to the congested condition of traffic at this point. The St. Clair tunnel consists of a single tube about 21 feet in diameter, and over a mile long, with approaches which make the entire tunnel line over 3½ miles long. When the tunnel was built, to provide for ventilation, a pair of tubes were extended from the center of the tunnel to the entrances, where they were connected to large blowers. Evidently this system of ventilation has proved inadequate, for quite recently a serious accident occurred, when a freight train broke in two in the tunnel, and several lives were lost by suffocation in the foul air before the stalled section of the train could be drawn out.

The congestion of traffic at the St. Clair tunnel is due largely to the fact that the freight trains arriving at this point are too heavy to be hauled through by a single locomotive. Consequently, the trains must be divided, and this involves considerable delay. While the approaches to the tunnel are double-tracked, there is only a single track in the tunnel proper, and this also contributes to the delay of traffic. The electric locomotives will be powerful enough to haul through trains of 1,000 tons, this limitation being due entirely to mechanical considerations; heavier trains may be conveyed through the tunnel with a locomotive at each end.

The adoption of the single-phase system is interesting as showing the trend of electrical engineering. While engineers abroad have been experimenting with the alternating-current motors, we in this country have clung to direct-current systems, because multiple-phase currents require a triple trolley, and the motors do not possess the speed-torque characteristics of direct-current motors. Recently, however, the development of the single-phase motor has removed these objections to alternate-current systems, and we now have a motor which combines the advantages of the alternating-current transmission with an efficiency favorably comparable with that of direct-current motors.

THE ELECTRIC FUSION OF GLASS.

An exhaustive study has been made by M. Bronn, of Paris, of the numerous types of electric furnaces constructed for the production of glass, and his conclusions have recently been published in a technical contemporary (Bulletin de la Société d'Encouragement) from which we cull the salient and most interesting features.

Most of these furnaces are of the arc type, which, it is pointed out, have (among others) the disadvantage that there is considerable loss by radiation; in addition to this, when carbon electrodes are used, these latter throw off carbon dust. This latter becomes mixed with the glass, more or less, as its quantity increases with the length of the arc. Endeavors have been made to conquer this drawback by adding oxidizing materials to the raw ingredients, but so far with no great meed of success. Experiments have been carried out with metallic electrodes, but it was found that brass melted, while iron became magnetized and was drawn into contact. In some systems the arc is produced above the glass, an electro-magnet being used to deflect it against the material. In this way certain advantages are secured, but the pointed form of arc raises the glass to a high local temperature, and frequently burns through the side of the container. Tests made with furnaces with this kind of arc show that from 4 to 6 kilowatt-hours are requisite to produce 1 kilogramme (2 pounds 3¼ ounces) of molten glass.