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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.

RAILWAY BLOCK SIGNAL LEGISLATION.

One of the most important acts of the last session of Congress was its instructions to the Interstate Commerce Commission to investigate the use of block signals for railroads, and gather the necessary data to enable Congress to frame and pass a suitable law calling for their adoption by the railroads of the country. The joint resolution of the two houses is the somewhat tardy reply of Congress to the oft-repeated recommendation of the Commission that a law be passed requiring the use of block signals and other modern devices for the protection of passengers and employes.

As a powerful commentary upon the need for such legislation there comes the recently-issued bulletin of the Interstate Commerce Commission, covering the quarter ending March 31, which shows that we are keeping up our unenviable distinction of killing and maiming a larger percentage of passengers and employes than the railroad systems of any other country on the face of the earth. We learn from this bulletin that the total number of collisions and derailments for the three months was 3,490, and that of this number 289 collisions and 167 derailments affected passenger trains. It is probable that 75 per cent of these 289 collisions would not have occurred if the lines on which they happened had been equipped with an adequate block signal service, or if the block signal system, as installed, had been permitted to exercise its proper absolute control over the movement of trains.

Theoretically, and, if we may judge from the wonderful immunity from accident of the best European systems, practically also, block signals are an absolute preventive of collision, and this for the obvious reason that they are based on the principle that no train shall ever pass any point on a stretch of track until it is certain that that track is clear of all other trains up to a certain point beyond; or, in other words, that there shall always exist a definite space interval between any two trains, whether they are running in the same or in opposite directions on the same line of track.

The method of control of trains from a central train dispatcher's office, by means of telegraphic orders delivered to the train crew, has been tried and found wanting, at least in respect of its ability to safeguard the lives of the passengers. It embodies, and depends too much upon the human element to attain that degree of faultless working which the tremendous issues at stake demand. Telegraphic orders are forgotten; trainmen read wrongly the orders that are delivered to them, or mistake their contents because of careless and hasty writing. Occasionally, an agent will forget to deliver an order, while there is the ever-present danger that the train dispatcher, careful and conscientious as he may be, may make some fatal error in keeping the record of his trains. The surest preventive of these errors is to adopt one of the many successful block signal systems which are now available, and make an ironclad law for the trainmen that its indications are to be absolutely obeyed, and that there is to be, under no circumstances, any running past signals and creeping up to the one beyond.

National legislation for the protection of the public and the employe is no new thing. The use of the automatic coupler and the air brake was long ago made compulsory by law; and the effect of this legislation was soon apparent in the statistics of accidents, and particularly those affecting the employes. Many of the important railroads of the country have adopted the block signal system, but there are others which seem to need the pressure of national legislation before they will move. In the interests of humanity, and as a matter of national self-respect, it is to be hoped that the next Congress will witness the passing of a suitable law which, as in the case of the legislation regarding the air brake and the automatic coupler, will insure the gradual extension of this admirable device to every railroad in the country.

THE RISK OF LOCKS IN FLIGHT.

It should be clearly understood that while the general type of the Panama canal (lock in preference to sea level) was settled by the bill passed in the last Congress, the final location of the locks and dams was left for further deliberation, and will probably be determined upon at the December session. As our readers are well aware, the SCIENTIFIC AMERICAN was in favor of the adoption of the lock canal as recommended by the minority report of the Advisory Board of engineers and adopted by the Canal Commission. We considered that, in view of the critical juncture which occurred when the Advisory Board found itself divided on the question of type, it was advisable, in indorsing the minority plans, to refrain from certain criticisms of its details which suggested themselves to us at our very first inspection of the plan. Criticism of details might readily have been mistaken for criticism of the lock canal plans on general principles. Now that the crisis is past, and a lock canal of some type or other is assured, it is in order to indicate one or two features of the plans to which we think the most searching criticism should be directed before the nation is committed to their construction.

The largest interrogation mark is to be set against that feature of the plans which calls for the construction of three great locks with a total lift of 85 feet, "in flight"; that is to say, with the locks leading directly from one to the other in the form of a flight of gigantic steps. Our objection to this arrangement is not based so much upon considerations of the difficulty of finding a continuous stretch of suitable rock foundation to carry the great structure, although doubts have been raised upon this point, but upon considerations of the undoubted risks of operation to which the whole canal would be exposed by placing these locks in flight. We have in mind the ever-present danger to which the Gatun locks, in common with every lock throughout the world, will be exposed of being run into and carried away by some steamer that is making the passage. If a vessel, after crossing the lake, whose level will be 85 feet above the level of the canal at the foot of the lowest lock, were, through some misunderstanding of engine-room signals, to collide even at a very low speed with the gates of the upper lock, they would be crushed in like an eggshell, and a veritable Niagara of water, 90 feet wide and 28 feet deep, would rush into the lock below, carrying the vessel with it at a speed of probably 10 to 15 knots an hour. The impact of the water on the gate at the end of the second lock, to say nothing of the momentum of the ship itself, would carry this gate away, and a second 28-foot cataract would be formed, the process being repeated until the ship had swept through the whole flight and the waters of the lake above, covering over 100 square miles of area, were roaring down through the 85-foot cataract on their way to the Atlantic Ocean. The impact of the ship as she was swept through the locks, coupled with the enormous momentum of the falling waters, would unquestionably fracture the walls and bottom of the locks, and the mass of water would speedily loosen up and sweep away the whole fabric, cutting out for itself in the alluvial soil and underlying clay a channel which, by the time the lake was drained dry, might easily be 200 or 300 feet wide and over 100 feet in depth.

The above picture has nothing in it sensational or overdrawn, as any engineer who is familiar with the extraordinarily disruptive and disintegrating effect of swiftly-moving masses of water very well knows. Granted, then, that the carrying away of the upper lock gates would end in the washing out of such a vast chasm at the site of the locks, how many years would it take to rebuild the structure, much of whose natural foundations had been torn away?

In this connection, it is a significant fact that the strongest objections raised by those engineers on the Advisory Board who advocated a sea-level canal were based upon this very danger of the wrecking of the locks by some vessel that was out of control.

Of course, any kind of a lock is liable to be wrecked in the same way; but the peril is particularly great where a series of locks is arranged in flight. In a single lock the fall of water is limited, and the loss of water is due merely to the stretch of level between that lock and the one above it; in the Panama canal the fall would be enormous, and the whole summit level would be drained dry.

That the earnest protest of Mr. Hunter, chief engineer of the Manchester Canal and a member of the Advisory Board, against the Gatun flight of locks was based upon well-considered reasons, will be understood when we state that during the few years that the Manchester ship canal has been in operation, lock gates have been carried away by colliding vessels on no less than four occasions; and, mark you, these vessels were ships of very moderate tonnage, and not the great ocean freighters of from ten thousand to thirty thousand tons displacement, which in the future years will be passing through the Panama canal.

The latest carrying away of locks on the Manchester canal occurred as recently as June 21 of this year. It seems that the steamer "Cassia," carrying a cargo of 1,438 tons of sulphur ore, through some error, made for another lock than the one of two adjoining locks which was prepared to receive her. She collided with the lock gates, and although she had very little way on her, carried away the gates, with the result that the reach of canal above was drained of its water, and the whole traffic of the canal stopped until new gates could be put in.

The risk of collision is due to the ever-present danger of a misunderstanding of signals from the bridge to the engine room, a striking illustration of which was the recent collision of the "Deutschland" with a pier at Dover. This is a menace which will be present on every ship that uses the canal; and although the minority plan calls for the construction of safety or fender gates fifty feet from the main gates, it is easily conceivable that a thirty thousand or forty thousand ton ship would crush through both gates before her momentum, even at slow speed, was expended.

In view of the accidents in the Manchester ship canal, we think that every alternative plan which would enable the locks to be separated and placed as far as possible in single steps should receive most careful study before the final plans of the canal are definitely determined upon.

THE THICKNESS OF THE EARTH'S CRUST.

Further information of a valuable character concerning the thickness of the earth's crust, and the intensity of the heat of the globe's internal fires, has been obtained as the result of a series of investigations continued over a prolonged period by the Hon. R. J. Strutt, F.R.S., the well-known British scientist and son of Lord Rayleigh. Since the first discovery of radium by Madam and Prof. Curie, this scientist has been engaged in a continued and deep study of its various and peculiar phenomena, and has contributed to our scientific literature an excellent work on this new element. Simultaneously he has been engaged in a careful computation of the average amount of radium contained in the various representative igneous rocks to be found on the external surface of the earth.

The rocks have been gathered from all parts of the world, and comprise granites from Cornwall and Rhodesia, basalt from Greenland, the Victoria Falls, and Ireland; syenite from Norway, leucite from Mount Vesuvius, the object being to extract and ascertain the proportionate amount of radium present in each.

The fragments of rock were decomposed by means of chemicals, thereby breaking up the various constituents, the yield of radium present being determined in a quantitative manner by the extent of its emanations. Owing to the slow decay of these emanations, they may be safely stored with a mixture of air in a suitable holder, thereby enabling the photographic and electrical action to be investigated at a later date. Strutt stored the dissolved rock solutions until the emanations had developed to the required extent, at which point they were extracted by boiling and measured in a specially-designed electroscope, by which process it was possible to ascertain the extent of the radium present. In order to render his calculations absolute, and to establish a standard of measurement, a similar process was carried out with a uranium mineral, with which was associated a known radium content.

As the result of these prolonged investigations, Mr. Strutt has been able to determine the percentage of radium present in the earth's crust. He has ascertained that the presence of radium, whether it exist in minute or large quantities, can be easily denoted in all rocks of igneous origin, but the percentage is highest in granitic formations, while the basaltic rocks contain the minimum proportions of the element. He has also provisionally calculated the total quantity of radium present in each mile of depth of the globe's crust, from its uniform distribution, and estimates on this basis that not more than one-thirtieth of the total volume of the earth is composed of rocks which are to be found on the surface. As a result of his mathematical deductions, he estimates that the depth of the earth's rock crust is approximately forty-five miles. This deduction coincides to a certain degree with the calculations of Prof. Milne, the well-known seismologist, who has been engaged in investigations to the same end by the observation of the speeds of earthquake tremors. Prof. Milne concludes that at a depth of thirty miles below the earth's surface exist rocks whose physical properties are similar to those to be found on the exterior.

Mr. Strutt has also advanced interesting data regarding the temperature of the internal heat of the globe at the base of the rock crust forty-five miles below the surface. This he computes to be approximately 1,500 deg. C. Such a heat indicates the melting point of iron, but it is considerably below the melting point of platinum, which Dr. Harker has fixed at 1,710 deg. C.

Furthermore, as a result of his researches Mr. Strutt is in agreement with the assumption advanced by several astronomers, more especially Mr. Pickering, that the moon is not a "dead" sphere, but that it continues to possess volcanic energy. And moreover, he makes the startling statement that he is of opinion that the internal heat of that body is far in excess of that obtaining within the interior of our own globe.