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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.

THE SCIENTIFIC AMERICAN AERONAUTIC TROPHY.

Despite the fact that very many inventors throughout the United States are wrestling with the problem of aerial navigation by means of a true dynamic flying machine, that is, a machine heavier than air, no public flight has been made in this country with such a machine up to the present time. The most advanced knowledge of heavier-than-air navigation seems to be held by two young western experimenters, of whom much has been written. These men have undoubtedly made flights with their aeroplane, and these flights have been witnessed by a considerable number of people. The general appearance of their machine is known, and other experimenters are making good progress along somewhat the same lines.

We feel, therefore, that the time is ripe for the offering of a suitable trophy commemorating the conquering of the air by a heavier-than-air machine. As the Scientific American is the oldest journal in this country treating of Science and the Arts, its proprietors feel that it is fitting that this journal should be the first to encourage the development of the latest great invention—a machine that shall conquer the air. The proprietors have, therefore, decided to offer a valuable trophy for competition for heavier-than-air flying machines. The trophy is to be given under a deed of gift to the Aero Club of America, to be competed for annually by both American and foreign inventors. The rules for the competition will be drawn up by a committee of the Aero Club, and it is expected that the first competition will occur at the Jamestown Exposition, September 14, and will be for a flight of one mile or less in a straight line. The competition is to be progressive in character, that is to say, if the flight of the predetermined distance is accomplished this year, next year a longer flight will be required, or a flight of a mile with turns. In other words, the conditions of the yearly contests will be such that they will be just ahead of the art, in order to induce inventors continually to strive to improve and perfect their machines. Should any one inventor win the prize three times, it will then become his property.

Further particulars regarding the first competition will be given from time to time in the columns of the Scientific American.

BROKEN RAILS AND RAILROAD ACCIDENTS.

It is a significant fact that, side by side with the alarming growth in the number of railroad accidents which has been noticeable during the past winter, there has been an increasing frequency in the breakage of the steel rails, upon which, after all, the security of railroad travel immediately depends. There is evidence that not a few of the disasters have been caused directly by these broken rails; and there can be little doubt that many of the unexplained accidents have been due to a similar cause. According to one of our technical contemporaries, an engineer who was present at a recent railroad wreck stated that, within a distance of one mile in the vicinity of the wreck, he counted nineteen broken rails which had been removed from the track during the winter.

The writer was recently given an opportunity to examine an official report, made to the president of a certain trunk line, on the subject of broken rails; and he was dumbfounded to learn that, during two months of the present winter, there had occurred on this road over 600 cases of broken rails. When we remember that every such break puts the trains in immediate peril of derailment, we are filled with wonderment, not that there are so many, but that there are so few, disastrous accidents.

Time was when American rails, bought in the open market and rolled to the specifications of the engineers of the railroads, and by them held strictly to these specifications, were equal to any in the world. To-day the rails that are received from the one colossal concern which can furnish them, are of the very poorest quality—a constant and positively fearful menace to every passenger that rides over them.

The depreciation, rapid depreciation, in the quality of rails is due to the introduction by the makers of cheaper and quicker methods of manufacture.

These methods have been adopted with a single eye, not to the improvement of quality, but to the increase of profits on the output.

That the broken rail is a growing peril will be realized, when we state that, during the past few years, the rails supplied to the railroads by the concern which has the monopoly of their manufacture, have become so poor in quality, that breakages have gone up several hundred per cent.

And every broken rail is an invitation to a railroad disaster!

The blame for the present alarming conditions lies then at the door of the manufacturers. This fact will be fully appreciated, when we have made the American public familiar with certain astounding facts in the recent history of the relations between the railroads and the one concern upon which they are dependent for rails.

THE CRUISER OF THE FUTURE.

The recent launch of the British first-class cruiser "Indomitable" marked the advent among the fleets of the world of the most notable warship of the day. In saying this, we do not exclude even the "Dreadnought," epoch-making vessel though she was.

The "Indomitable" is so entirely unlike any other warship as to be quite in a class by herself. She is swift enough to overtake, and powerful enough to sink, the fastest cruisers that are afloat on the high seas to-day. Were the most formidable battleship to attack her while she was destroying her quarry, she could swing her guns upon the ship, and overwhelm it by pouring in a long-range armor-piercing fire from her battery of eight 12-inch guns. Armed, as she will be, with a new pattern of 12-inch rifle, of considerably greater range and hitting power than any naval gun afloat to-day, she would be a fair match, if we except the Japanese "Kashima" and "Katori," for any two existing battleships that might be opposed to her; for with her high speed of 25 knots an hour at command, she could choose her own bearing and range, and place her shots in greater numbers, and with greater remaining energy at the range adopted, than could the enemy. By taking position where the shells of the enemy must strike her armor obliquely, her 7 inches of face-hardened Krupp steel protection would, at the long range selected, be proof against a vital penetration.

The leading particulars of the "Indomitable" and her sisters the "Inflexible" and "Invincible" are as follows: Length, 530 feet, or 30 feet more than that of the largest cruiser afloat; beam, 78 feet 6 inches; draft, 26 feet; displacement, 17,250 tons; horse-power, 41,000; and speed, 25 knots. Although the armor is not so heavy as that usually carried on the battleships (though it equals that of the "Duncan" class) it covers almost the whole of the hull, being carried nearly to the level of the upper deck. It has a maximum thickness of 7 inches amidships, and tapers to 4 inches at the ends.

Next to her speed, the most surprising feature of the "Indomitable" is her armament, which consists of eight 12-inch guns—twice the number carried in battleships—carried in four turrets, one forward, one aft, and one on either beam, the last-named turrets being placed *en echelon*, or diagonally to the center line of the ship. This renders all of the 12-inch guns available on either broadside, and enables the "Indomitable" to concentrate six 12-inch ahead, six astern, and eight on each broadside. The high freeboard of these vessels will enable them to fight their guns in heavy weather, since both the forward turrets and the two wing turrets are carried at a height of from 34 to 36 feet above the water line, the after pair of guns being about 26 feet above the water line.

The growth in power of the cruisers of the British navy in the past seven years has been very striking, the displacement having nearly doubled and the collective muzzle energy from one single round of all guns having increased over twelve times. Thus, the "County" cruisers of 1900 were of about 10,000 tons displacement, and the total muzzle energy of one round was about 30,000 foot-tons. The "Drake" of the following year, of 14,100 tons, has a collective muzzle energy of 64,000 foot-tons; the "Duke of Edinboro" of 1904 can deliver a total energy of 100,000 foot-tons; and the "Minotaur" of 1906, 137,000 foot-tons; while the "Indomitable" of 1907, displacing 17,250 tons, has a collective muzzle energy from one round of her guns of 381,000 foot-tons. Furthermore, while the 6-inch guns of the "County" class of 1900 have an effective fighting range of 3 miles, and the "Drake" can do effective work with two of her guns (the 9.2-inch) at 4 miles range, and the "Minotaur" class can use four guns at the same range, the "Indomitable" will be able to bring to bear the whole of her eight guns at 5 miles range, and engage at this range on equal terms of gun fire any two battleships, with the single exception of the Japanese ships, now afloat.

The *raison d'etre* of the remarkable combination of high speed and heavy armament in these three cruisers is to be found in the necessity of getting in touch with the enemy; breaking through his outer screen of scouts and cruisers; determining the exact strength of his battleship squadron; and returning with the information thus gleaned for the guidance of the admiral of the fleet. For such work the "Indomitable" class are perfectly suited, their power being sufficient to enable them to crumple up the scout and armored cruiser formation of the enemy, and their speed sufficient to bring them safely away, after drawing the fire and determining the numbers and power of the enemy's first line of battle.

SUSTAINED ELECTRIC OSCILLATIONS.

The simplest method, and practically the only one hitherto employed, for obtaining currents of sufficiently high frequency to emit electric waves suitable for the transmission of wireless telegraph messages, is by means of a spark set up between the terminals of the secondary of an induction coil.

The opposite arms of an oscillator thus formed are the equivalent of a condenser, and hence when the pair of surfaces are discharged the circuit at the moment the spark passes has a negligible resistance and in consequence the negative and positive electric charges are permitted to equalize the difference of potential and the released energy to surge through the system in the form of high frequency currents or electric oscillations.

This phenomenon is due to the fact that a very small portion of the static, or stored-up, energy is required to burn out the air forming the insulating partition between the terminals or spark-balls, while the larger portion of the energy which is suddenly released and converted into kinetic electricity, and which is under a very high pressure, rushes first to one end of oscillation circuit, then back to the opposite end of the conductor, each time passing through the spark-gap, whose resistance is no longer of appreciable value, and so repeating the cycles of oscillation until the total energy is damped out by the emission of electric waves and other resisting influences.

If the oscillation circuit is an open one, that is if the opposite sides of the spark-gap are connected directly to conductors that end abruptly, or are open at both ends, the energy of the oscillations is very quickly converted into electric waves, the high frequency currents being damped out in two or three swings. Oppositely disposed, if the oscillation circuit is a closed one, that is if the circuit forms a loop and is continuous, the oscillations surging in it will be more persistent and the currents thus set up within it will swing thirty or forty times back and forth, depending on its electrical dimensions.

By the term electrical dimension is meant the capacity, inductance, and resistance of the circuit, and on these factors depends the frequency of the oscillations, which may surge at the rate of from thousands to millions of times per second. It must be borne in mind, however, that these high-frequency currents are by no means continuous in character, but are periodic, and decrease in geometric ratio reaching zero in a very small fraction of a second. By using a closed circuit instead of an open one, the decrement of the oscillations may be reduced, a shorter period of time will elapse between each successive series of swings. It is during this time that the oscillation system is recharged for the next succeeding discharge.

In wireless telegraphy the open circuit system possesses the advantage of sending out electric waves that are more penetrating than a closed circuit, while the latter is, in virtue of the persistence of its oscillations, which more nearly approach a sine wave form, much better adapted for producing sympathetic electrical resonance, so that an oscillating current set up in the first or transmitting circuit will start a series of oscillations of a similar frequency in a second or receiving circuit.

From the preceding it will be clear that both open and closed circuits possess certain commendable features for the emission and reception of wireless messages, and indeed these have been combined in what are termed compound systems which are well adapted for the production of resonance effects. By employing such compound circuits it is possible to receive at will one of two incoming messages of the same strength, but this is as near selectivity as can be obtained with periodic oscillations produced by a spark-gap, however feebly damped the former may be.

Fortunately there are other methods known by which high frequency currents can be set up, and in which the usual spark-gap plays no part, and yet more fortunately the oscillations thus produced are continu-