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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 BICYCLE AND THE AUTOMOBILE.

The history of sports and pastimes in this country furnishes no parallel to the rapid growth in popularity of the bicycle, and its even more sudden decline as a means of recreation. Its decline is rendered the more puzzling when we remember that the medical profession indorsed bicycle riding as being, when followed in moderation, of valuable assistance in keeping the body in good condition, and in the cure and prevention of certain ailments that arise from sedentary habits and the lack of a proper amount of outdoor exercise. So true is this that if it were possible to gather the testimony of the hundreds of thousands of people in this country, whose "wheels" are to-day rusting in the cellar, or stored ingloriously among the top attic lumber, it would be found that not a few thousands of them would readily admit that they have never enjoyed the perfect health which was theirs when the Sunday trip into the country or the evening ride on the boulevards or cycle paths formed an important and pleasurable item in the routine of their lives.

The causes for the decline were many. The chief trouble was the very one that is threatening the automobile to-day—people rode too fast and too far; and those who were not gifted with the muscular and constitutional equipment necessary for riding centuries, or even half-centuries, without distress, began to associate the bicycle with aching limbs and an exhausted body. Another and scarcely less active cause of the decline was the introduction of cheap bicycles, and the placing of the wheel within reach of everybody who could find the necessary forty or fifty dollars for its purchase. Bicycling became unfashionable; and in this respect the decline of wheeling is one of the most startling signs of the fact that the American people are fast losing that independent, democratic spirit which for three centuries has been one of the distinguishing characteristics of the race. When the fad became unfashionable its death-knell as a pastime of universal popularity was sounded. The bicycle was relegated to uses purely utilitarian. As a means of transportation it will always fill a useful place in the economy of everyday life; but that bicycling will ever win back anything of its former position as one of the most fashionable and popular means of recreation is most improbable.

But what of the automobile? Will like causes produce like effects? Already the speed mania is threatening to work injury to automobile interests by multiplying the lists of casualties and provoking a prejudice in the public mind. It is gratifying to know that earnest efforts are being made by the great body of automobilists as a whole to prevent reckless driving, and save this splendid sport from the harm that was done to bicycling by the growth of the "scorching" habit. The introduction of cheap and reliable automobiles (and if the plans of certain firms do not miscarry, the market will within the next two or three years be flooded with such) will bring the automobile within reach of the pocketbook of ten times as many people as can afford a machine under existing conditions. Before many years the boulevards, concourses, and turnpike roads will swarm with devotees of the latest sport. Shall we in this splendid means of recreation see repeated the history of the bicycle? Will it become unfashionable? Possibly in a limited degree it will; although it must surely remain to the end of time one of the most useful means of transportation, both for freight and passengers, that invention has placed at the service of man, rivaling, if not surpassing, the locomotive and the trolley car.

There is this much to be said in favor of the prospects of the automobile maintaining its present popularity as a means of recreation, namely, that, unlike the bicycle, it affords a means of travel that is comparatively free from effort, and may be made, if so desired, positively luxurious.

## LOSS OF THE FLAGSHIP "MIKASA."

It is the very irony of fate that the flagship "Mikasa," after enduring the stress of eighteen months of bitter warfare upon the high seas, should be lost ingloriously, during the piping times of peace, while riding at her moorings in a home port. Not merely the Japanese themselves, but the whole world must feel a sentimental interest in the ship that flew Admiral Togo's flag from the first naval engagement at Port Arthur to the final splendid triumph in the Sea of Japan. What the "Victory" was to Nelson, and the "Hartford" to Farragut, the "Mikasa" was to Togo; and when the latest chapter of naval history comes to be written, the two names will be indissolubly associated.

The "Mikasa" was a noble ship. She "looked the part" she was supposed to play, and she played it well. In the two great battles in which she was engaged, both the ship and its crew suffered more severely than any other Japanese ships in the line. At the time of her construction in 1901 she represented the latest theories and practice in battleship construction, and she will be surpassed only by the monster battleships, now proposed, whose distinctive features have been based upon the lessons derived from the performance of the "Mikasa" and her class when in action.

According to the dispatches, the loss of the ship was due to a fire, which started during the night and spread to the after magazine, which exploded and "blew a hole through the side of the ship," causing her to founder. It is difficult to understand how the explosion of the magazines could inflict merely a local injury. A catastrophe of that magnitude usually, as in the case of the "Maine," tears the ship absolutely in two. Hence the cabled statement that the ship sank in shallow water and can be raised is extremely puzzling. The mystery can be explained only by the publication of the official details of the disaster—something which the extreme reticence of the Japanese naval department renders very unlikely.

## RISK OF DERAILMENT ON ELEVATED RAILROAD CURVES.

When the elevated railroad system in this city was opened, about a quarter of a century ago, it was freely predicted that sooner or later a derailment, accompanied by great loss of life, would occur. The public of that day considered that there was great risk in the operation of a railroad that was carried entirely upon an elevated structure, 20 or 30 feet above the street level. It is a really remarkable fact, and one that must be mentioned to the credit of the company, that in spite of the enormous traffic over the elevated system, a traffic which in density is not paralleled in any other place in the world, this is the first accident that has occurred involving a heavy loss of life. Such fatal accidents as have happened were due chiefly to collisions; derailments have been less frequent, and it was reserved for the shocking mishap of September 11 to record the first serious loss of life due to this cause.

The elevated railroads, considering the extremely sharp curves and the great number and comparatively high speed of the trains, have been, in fact, singularly free from derailments, and this is due to the excellent system of guard rails adopted, there being a guard rail on both sides of each rail, or four altogether to each track. Moreover, the guard rails are deep and well bolted, so that should a wheel leave the track it would be difficult for it to mount the guard rails and get away from the structure. At the same time engineers generally have realized that the elevated railroads in this city have presented and do now present a very serious source of danger at the sharp curves by which the tracks run from the avenues into cross streets. The tracks, as we have said, are heavily guarded at these points; where it is possible the outer rail is superelevated; and in every case a heavy steel rail takes the place of the ordinary guard rail on the inner track. These precautions are necessary, for the curves are so sharp that, if the trains are run around them at any speed above eight or ten miles an hour, the centrifugal force becomes excessive and there is a decided risk of the wheels climbing the track. Although the superelevation of the outer rail is a safeguard for moderate speeds, it affords but little protection when the speed rises above the particular maximum speed corresponding to any given superelevation, and there is no denying that elevated trains are being run around the curves at a speed much higher than the latter have been built for. An easy method of detecting whether the superelevation and the speed are properly related is to notice whether, on passing around a curve, the passengers are swung to the outside of the curve. If they are, the train is going too fast for that curve, and the more violent the outward fling, the more severely are the guard rails and the flanges of the wheels on the outer rail being strained. If the pressure upon them passes a certain point, it will become sufficient to enable them to "bite" and climb the track.

About the time of the introduction of electric traction on the Elevated, the engineers were running their trains around the curves at such a reckless speed that this journal entered a strong protest and pointed out the great risks incurred. The speed was immediately modified, and for some time after the line was electrified, we noticed that great care was being taken in passing the curves. Gradually, however, as the motormen, and possibly the superintendents and other officials, have become familiarized with the higher speeds which are possible under electric traction, they have permitted, unconsciously perhaps, the use of an excessive rate of speed around these curves, until, as matters now stand, the trains, and especially the last few cars, are being whipped around the curves at a speed that simply invites disaster.

As we have shown elsewhere in this issue, the accident at Ninth Avenue and Fifty-third Street was due to the fact that a train which was running down Ninth Avenue found itself suddenly switched into the curve leading to Fifty-third Street. It is probable that the whole train would have remained on the tracks and gone straight around the curve, had the outer rail been properly superelevated; but superelevation is impossible at this point, for the reason that the outer rails of the Fifty-third Street curves have to be kept down at level grade in order to carry them across the Ninth Avenue rails.

The crossing at which this accident occurred is a notoriously dangerous one. Much of the risk is due to the present system of operation in which too much is left to the "human element." The danger could be eliminated by introducing the automatic stop and placing it in such a position that when the switch was set for Fifty-third Street, it would stop Ninth Avenue trains, but would allow Sixth Avenue trains to run through. This is an age of automatic control, and in the presence of the late awful disaster, it is binding upon the Interborough Company to place the control of this dangerous crossing as far as possible under automatic supervision.

## AN IMPORTANT INNOVATION IN TELEGRAPHY.

The important problem of economy in the works of telegraphic services has just been solved by a new technical application of the very greatest importance. The gravity of the problem in question will at once be recognized when it is borne in mind that, at the present day, there is a steadily increasing rise in the cost of public services in all civilized countries, due to a growing demand for new and indispensable lines and for increased speed in transmission, thus necessitating use of costly apparatus requiring an augmentation in the electromotive energy employed in electric stations.

Signor Magini, an Italian electrical engineer, well known already for several useful innovations in the field of electro-technics, has recently been devoting much study to the operation of the coherer inserted above a telegraphic wire subjected to electric vibrations originating from a low-power induction coil. His observations have led him to the discovery of an extremely simple arrangement which solves in a very happy manner various problems still existing in connection with every-day telegraphy. In addition to this the device works equally well whatever the distance may be between the telegraphic stations, and whatsoever the material condition of the wires in use on existing lines. There would thus be no need to make alterations in existing services but, it may be pointed out, that with the new system telegraphic communication may also be carried out under existing generic conditions by means of very thin wires, instead of the thick and expensive conductors or "leads" now generally employed—a point of exceptional importance, especially in connection with the erection of new installations. All competent persons will at once recognize the importance of the innovation from the above brief remarks as to the actual condition of telegraphic wires. As a matter of fact, interruptions in telegraphic services depend almost always upon defective insulation of the conductors (especially during bad weather), upon short circuits, "earths," etc.; fortunately all these causes have no effect at all upon the transmission of the new currents selected and practically employed by Signor Magini. These currents are of an oscillating character and neither disturb, nor are disturbed by, ordinary currents—a fact the importance of which cannot escape the attention of those who understand anything about telegraphy; furthermore, they have the singular property of rapidly passing over electric conductors even when such "leads" are imperfectly insulated (whether due to bad weather or other causes) or have not been insulated at all, and also if short-circuited to earth or if the continuity be even interrupted. To put the matter briefly, the new "Magini system" insures perfect telegraphic communication under even the worst possible conditions in the electric status of the leads.

Magini's transmitter comprises a small Ruhmkorff coil, into the primary circuit of which there are sent, by means of a special key, currents emanating from the few cells of some dry batteries, while one of the terminals of the secondary circuit is placed in communication with the lead. The current, inducted by a special arrangement of the circuit which is as simple as it is original (both at the transmitter and receiver ends) is transformed into a vibratory pulsating current; at the receiving station it reaches a coherer of special construction and causes the operation of any suitable telegraphic apparatus, using either Morse signals or printing signs, etc., on the Hughes principle. This coherer (which is apparently directly opposed to all coherers hitherto known) establishes or breaks its coherency with rapidity and certainty; once placed in operation it continues to work with perfect precision, all the drawbacks (such as excessive sensitiveness, always causing great variability) common to other types so far known having been successfully done away with. This new coherer will, therefore, be of great value for use in connection with wireless telegraphy.

Although only a few volts are used at the transmitting station, and while there are only two dry cells at the receiving center, still messages can be safely forwarded over distances amounting to hundreds of miles; hence with the new Magini system the use of cumbersome and expensive batteries of cells or accumulators at telegraphic stations becomes a thing of the past.

The new system practically admits of duplex telegraphy, without recourse to the actual complicated means employed—means which necessitate scientific and special technical knowledge on the part of the employes and which, furthermore, are exposed to all those multiple causes which induce modifications in the electric condition of the wires, thus necessitating continual variation and readjustment of the electric accord existing between the different offices or stations. When mounted in derivation on the two extremes of an electric wire, Magini's transmitter and receiver do not necessitate any alteration in existing plant, and two different messages can also be sent over the same wire at one and the same time.

A further, and very valuable, application of this system lies in its applicability to use in submarine work; not only does it double the power of the cable, but it also enables two messages to be sent together over one and the same cable.

The high charges made for sending telegrams over long submarine cables is due to their low capacity, when considered in proportion to time and to the large amount of capital invested therein. The possibility of doubling their present capacity, and of transmitting two messages at once, hence will be equivalent to reducing the present charges for cables by one-half.

As the currents employed by Magini have the peculiar property of being able to jump over gaps or breaks in the leads and continue their journey undisturbed, this gentleman has been able to maintain uninterrupted communication over wires and cables, the inner core or conductor of which has been broken—i. e., under conditions with which existing methods would have been entirely unable to cope. Consequently, should a submarine cable become worn out, or unserviceable for any other reason (e. g., accidental breakage of the core during laying, infiltration of sea water and consequent rusting due to electrolysis, *et hoc genus omne*), telegraphic communication can nevertheless be kept up with Magini's system until the long and costly operations of fishing up and repairing the cable are completed.

### THE EFFECT OF HYDROGEN ON GAS ENGINE COMPRESSION.

BY GEORGE M. S. TAIT.

As many are aware, one of the main difficulties encountered in the steady performance of a producer-gas-operated gas engine is caused by the fluctuation in the quality of the gas generated by the producer, and as a proof of this we have all noticed the excellent performances obtained from gas engines operating on illuminating or natural gas, of a fixed analysis, as compared with the somewhat varying runs obtained with the same engines when operating on producer gas. This absence observed in the operation of the engine is more noticeable in conjunction with the suction type of producer where no gas holder is employed, the reason for this being that momentary variations which always occur in the present type of producer are not felt so much where a large gas holder is employed, as the lean gas has an opportunity for mixing with the other gas already in the holder, with the result that the supply drawn by the engine is more or less of a constant quality.

In acknowledging, therefore, that the quality of producer gas varies, our next step is to ascertain the cause of this variation and to indicate if possible a remedy therefor.

The theoretical analysis of producer gas made from anthracite coal would be about as follows:

| | |
|---|---|
| CO | 27.0 per cent by volume. |
| H | 12.0 per cent by volume. |
| $CH_4$ | 1.2 per cent by volume. |
| $CO_2$ | 2.5 per cent by volume. |
| N | 57.0 per cent by volume. |
| O | 0.3 per cent by volume. |

B. T. U., 137.5 per cubic foot.

Unfortunately, however, in practice the quantity of CO will be found to be much lower than the above, while $CO_2$ and H will correspondingly increase. This change in the gas is, however, not shown by the usual calorimeter test, due partly to the fact that as the CO decreases it is offset as far as heating value goes by the increase of H; this increase sometimes causes a rise in B. T. U. above the figures first mentioned.

However, a gas high in B. T. U. is not necessarily a good gas for engines, especially if by this increase we have to sacrifice high compression in order to guard against pre-ignition; and as, in the case of the present producers, high B. T. U. generally means a high percentage of H, this increase in heating value proves to be rather a detriment than otherwise to the engine performance.

The engine builder is aware that his compression must be governed by the maximum amount of hydrogen which his engine is liable to encounter at any time during the run, and he therefore is forced to put the compression much lower than he otherwise would do in order to safeguard himself against pre-ignitions. It would appear, therefore, that if a gas sufficiently rich, but at the same time having little or no H, could be manufactured, ideal results would be obtained.

That this is the case has been demonstrated by the wonderful results obtained in Europe from gas engines operating on blast furnace gas, which, although of a very low heating value, are free from H and consequently admit of a very high compression on the engines. In support of this argument it is interesting to note that gas engines are now operating on 9,500 B. T. U. and even less per brake horse-power on this gas, where the compression has been raised to 200 pounds, whereas the same make of engines operating on producer gas of a richer quality, but containing H, are found to consume from 11,000 to 12,500 B. T. U. per brake horse-power, but with a compression of only 130 pounds. The present outfit for the manufacture of producer gas comprises a producer, scrubber, purifier, and in some cases a gas storage tank or holder. The fuel is burned incompletely in the producer either by forced or induced draft, the resulting gas passing off to the engines.

Now in practice it is found that the fuel bed would get intensely hot if supplied with air alone, and as this condition would cause undue clinkering of the fuel as well as a lean gas, there is introduced steam or water vapor along with the incoming air for the double object of lowering the temperature of the fire by the heat-absorbing property of the steam, and in cases where the temperature is high enough the dissociation of said steam or water vapor occurs, the oxygen uniting with the carbon of the coal to form CO while the H passes off in the gas, enriching the same materially.

The one defective feature of this system is that the percentage of H is continually changing, owing to the varying temperatures of the fire, which at one time is too cool to decompose the steam and merely allows the same to pass through the fuel bed in a superheated condition; while at other times when the demand for gas is greater and the rate of combustion consequently higher the resultant rise in temperature dissociates the steam, making a variation in all of from 5 to 20 per cent of H in the gas by volume.

The engine builder, being aware of this unknown quantity in the form of H upon which his engine has to operate, is compelled to sacrifice high compression and the incident economies therefrom in order to guard against pre-ignitions and to lower the compression so that the working efficiency of the plant is very much impaired.

That the compression at which the engine operates has a powerful effect on the economy of the plant is well set off by the performances of a certain well-known make of engine on producer gas containing hydrogen, and blast furnace gas containing no hydrogen, as follows: In the first instance the engine, the compression of which was set to 120 pounds, uses 11,500 B. T. U. per brake horse-power per hour, while in the second instance engines of the same make with a compression of from 170 to 200 pounds are operating steadily on 9,500 B. T. U. per brake horse-power.

This enormous saving accomplished solely by increasing the compression, is very obvious, and when it is realized that these results are only possible where H is eliminated from the gas it would seem that a producer which would supply a gas sufficiently high in CO to obviate the necessity of too large a cylinder would give ideal results in engine practice.

Having this object in view, producer manufacturers have long been experimenting with other diluents to take the place of steam, but until very recently nothing satisfactory had been accomplished. Now, however, there are two or three plants in the course of erection upon which a new system is being tried in which the steam is replaced by a diluent consisting of cooled exhaust gases, which bids fair to answer all requirements.

The action of this substitute for steam is said to be very marked, the $CO_2$ in the exhaust gases burning back to CO when passing up through the fuel in the producer, absorbing heat, while at the same time the analysis of the gas shows a higher percentage of CO, which along with the high compression admissible is expected to offset the absence of H.

The special feature of the gas in this system that should recommend itself to engine builders is the fact that the analysis remains fairly constant under varying loads, and owing to the absence of hydrogen and consequent dangers from pre-ignition very high compressions should be safely carried without danger accruing therefrom.

It is expected when the installations embodying the improvements are perfected a solution may be found for the difficulties heretofore experienced.

### THE PHONOCARD.

The phonopostal, says La Nature, is an apparatus which registers and afterward reproduces the human voice, by means of a sheet of pasteboard, shaped like a postal card. Jules Verne conceived the idea of replacing the old wax cylinder used in other phonographs by a sheet of paper, which could be posted like a letter.

The advantages of the phonopostal are numerous. The records are made by an ordinary phonograph of the simplest possible type simply by means of a stylus provided with a sapphire point. This point presses on an impressionable substance, called "*sonorine*," spread on the surface of the card. The merit of the invention consists in the discovery of a substance which can be easily spread on a sheet of cardboard and possesses all the advantages of the wax-coated cylinders. Moreover, sonorine is able to stand the strain of transmission by mail. The sounds are inscribed in a spiral, which commences at the outside edge of the card and continues in an ever-narrowing curve until it forms a small circle, hardly the diameter of a small coin. The record is so deeply engraved in the coated cardboard that not more than two or three syllables are lost by the two stampings of the post office on the concentric lines.

Seventy-five or eighty words can be inscribed on a phonocard, which is sufficient for news. One object of the phonocard is to replace the illustrated postal card. Furthermore, it is possible to be far more chatty on a phonopostal than on an ordinary postal card, for on the latter there is only a little rectangular space left which can be written on.

### THE CURRENT SUPPLEMENT.

The United States Geological Survey has for a number of years been studying the underground waters beneath the central great plains. The investigation is reviewed in a strikingly illustrated article which opens the current SUPPLEMENT, No. 1551. Mr. M. T. Cook writes on the banana. A highly instructive article is that on the spider and its web, by Maurice Koechlin. Prof. Sommer explains simply and clearly some methods which he has devised of investigating movements of expression. Sir William Crookes delivered an impressive paper on diamonds before the South African meeting of the British Association for the Advancement of Science. The first installment of the paper is published in the current SUPPLEMENT. A number of extensive automobile testing laboratories have recently been fitted up in Paris. One of these is very fully described and illustrated. Mr. Walter L. Webb contributes an instructive paper on reinforced concrete, explaining its principles, with practical illustrations. "Electric Lighting for Amateurs" is the title of a lucidly-worded and fully-illustrated article describing some simple electrical work that can be carried out at home. Mr. H. Lemmoin-Cannon discusses the problem of sewage and its disposal. J. H. Long discusses the important question of protein and its relation to food.

### PRODUCING HIGH VACUA.

The German scientific journal Prometheus states that the English physicist Dewar has found a new process for obtaining high vacua, which forms another practical employment of liquid air. It is known already that charcoal possesses the property in a high degree of absorbing gases. Dewar has demonstrated that this absorptive property of charcoal increases manifold if it is cooled to the temperature of liquid air (about 185). The absorption takes place so energetically that if the charcoal is contained in a closed vessel the latter soon becomes void of air.

Where formerly the quicksilver pump had to be worked incessantly for hours and days, it now suffices to attach a tube to the vessel intended to be freed of air, into which some charcoal, preferably of cocoanut shell, is placed, which has been immersed in liquid air. In this manner a vacuum is obtained within a few minutes suitable for producing cathode or X-rays. This method possesses also the advantage that the moisture, which can sometimes be only removed with difficulty from the vessel, is at once condensed in the tube.