speed attained is said to rival that of the fast express train. We are indebted to Mr. L. O. Wood, of Hays City, Kansas, for the photograph from which our engraving of a sailing car, devised by Mr. C. J. Bascom, of the Kansas Pacific Railroad, is prepared. The vehicle is said to average a speed of 30 miles per hour, and, with a strong breeze, to travel at the rate of 40 miles in the same period. This last speed was reached with the wind right abeam. A distance of 84 miles has been passed over in four hours, the car sailing part of this time close hauled and over disadvantageously curved track.

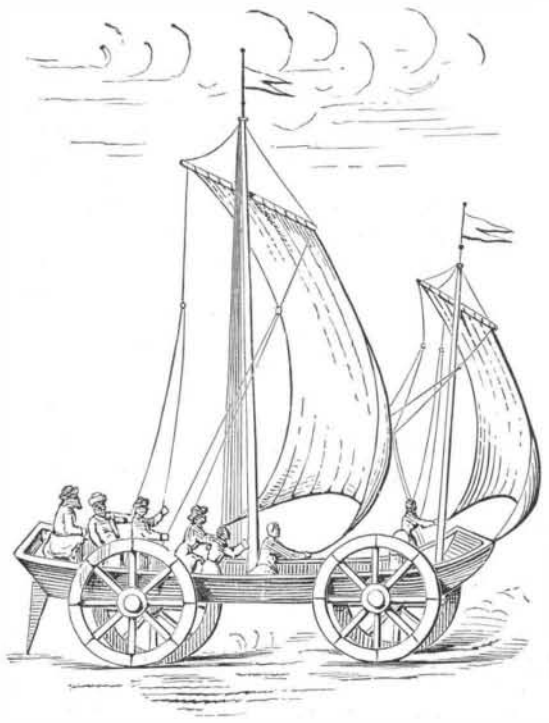

Fig. 2.—SAILING CHARIOT.

The vehicle has four wheels, each 30 inches in diameter, is 6 feet in length, and weighs 600 lbs. The sail has two booms, respectively 14 and 15 feet in length, and an area of about 81 square feet. The mast is 11 feet high, tapering from 4 inches square at the heel to two inches at the truck. It will be obvious that many of the laws applying to the ice boat apply equally well to the sailing car. A little consideration will show that when the latter is sailing at 40 miles per hour it is traveling faster than the wind that impels it, and this is constantly the case in ice boat sailing. On the other hand, ice boats always sail best close hauled, in fact the sheet is almost constantly kept flat aft; the sailing car, as stated above, goes fastest with the wind directly on the beam or side. Of course the difference is due to the greater resistance offered by the larger and more elevated surfaces of the car body and its occupants, and to the friction of the axle journals, which probably, under ordinary condition, is sufficient to prevent the sailing car ever attaining the ice boat's speed.

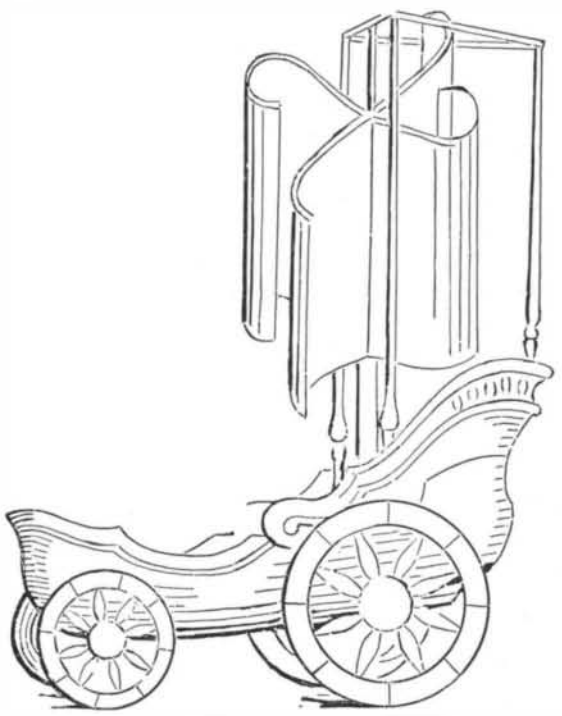

Fig. 3.—BISHOP WILKINS' CHARIOT.

Mr. Bascom informs us that his car has been in active operation on the Kansas Pacific Railway for the past three years, being employed to convey repairing parties to pumps, telegraph lines, etc., along the route. It is of course exceedingly cheap to construct and maintain, and saves the labor involved in running a hand car.

HERR F. SIEMENS, of Dresden, has succeeded, it is said, in remedying the tendency of hardened glass to shatter itself without any apparent reason. He has discovered that the unpleasant effect is caused by over-hardening, which can be detected by the prevalence of violet tints exhibited by the polarizer when the glass is examined.

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VII. CHESS RECORD.—Biographical Sketch and Portrait of Joachim Lowenthal.—Problems by Dr Moore, Geo. E. Carpenter and G. F. Bibby.—Enigmas by John Gardner, W. A. Shinkman, Max Judd, L. W. Davis, in the Dubuque Problem Tournament No. 1.—Anderssen vs. Paulsen. The concluding game with notes.—Solutions to Problems.

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EVERY MAN HIS OWN KEELY MOTOR.

John Aylwin Bevan, M.D., has settled it. Now it is perfectly clear what it is that makes people die so soon. It is clear, too, that it is quite unnecessary for the human machine to run down, so to speak, so much before its time. Indeed, thanks to Dr. Bevan's discovery, it is entirely our own fault if we do not straightway bring down our rate and style of living from its present destructive high pressure speed to something like the slow serenity of tortoise life, or at least to the long drawn out existence of semi-imbecile guests in public asylums for aged paupers. Everybody has noticed how their lives run on and on, like Tennyson's brook, "forever," comparatively speaking; but no one before Dr. Bevan ever satisfactorily explained the secret of their staying power, or undertook to demonstrate the superiority of their life conditions.

Scientific physiologists pretend to tell how our life forces and activity are kept up by the transformation of food within the system. So much food, in such and such complex chemical combinations, reduced to such and such lower combinations, evolves so much force to carry on the work of living. It is all as simple as a sum in arithmetic; but, Dr. Bevan indirectly demonstrates, it is all wrong. Our supply of living energy is not kept up that way. Instead of supplying force, the food we eat diminishes our force; and the more forceful the food, according to the physiologist's rules, the more rapidly it hastens the exhaustion of our original stock of energy, our thermo-motoric bankruptcy, so to say; in other words, our death.

Dr. Bevan has discovered a new physiological force, which he calls thermo-motor force. He has discovered also that this newly discovered force resides in the medulla oblongata, making it a sort of physiological Keely motor. Just as a little water in Keely's machine supplies an incredible (though exhaustible) amount of physical force, so this little lump of brain matter is endowed with, and furnishes from its miraculous store, all the thermo-motor force required to keep the bodily organization running from birth to death; a supply which with proper husbanding would suffice to keep us alive for ages. How or when the thermo-motor force gets into the medulla is not explained, but that is no more an objection to Dr. Bevan's theory than is Keely's neglect to explain how so much force gets into the water he uses an objection to his. The grand result obtained is the thing to think about.

The importance of Dr. Bevan's discoveries, as indicated by the space it gets in newspaper reports, justifies an extended statement of them here. It appears that "the medulla has a certain quantity (amount not stated) of stored-up thermo-motor force in a state of rest, which once expended in motion can never be restored." "This force is produced (?) in the same way as the electric current, by the application of conductors of force to the galvanic battery, and every time our hearts contract, every time we move, we lose a part of that stored-up force which once expended in motion can never be replaced." "Thermo-motor force resides in the medulla oblongata, and, being essential to the digestive process, wields the power of life and death; for upon its integrity depends the preparation of those fluids which nourish the body, diffuse through it animal heat, and defend it against the destructive action of oxygen. Everything that tends to weaken this force helps to hand over the body to destruction;" a couple of years sufficing on the average to enable oxygen to do its fatal work, when once it gets the upper hand. "How jealously, then, should mankind economize this force!"

"In what way?" does the reader ask? By eating cereals and refraining from a flesh diet, Dr. Bevan replies. The red-blood cells carry oxygen to every part of the body and release it in the capillaries, where it performs its functions of decomposing the tissues and brain and releasing thermo-motor force. "The more freely, therefore, these cells are supplied, the quicker the rate of decomposition and the release of this once-lost-never-regained force, and the sooner its exhaustion—that is, death—must occur," and *vice versa*. Consequently if you want to live long eat vegetable food, and thereby reduce the number of your red blood cells. The white (that is, cold) blooded shall live long and prosper. For animal food multiplies red blood cells rapidly, and vegetable food slowly, and the rate of expenditure of thermo-motor force corresponds. Therefore, we say, eat roots!

This philosophy is impregnable. It is as if Mr. Keely should say: "Here, gentlemen, is a pint of water in my machine. Stored up in it is forty million horse power, more or less. Every time you agitate the machine force is evolved, and of course the less you agitate it the longer your power will last. Be prudent, therefore, and do not squander your latent wealth!"

We fear, however, that Dr. Bevan is not prudent. Some parts of his last lecture read as though he had recklessly indulged in a mutton chop or some other blood heating compound. Witness the following: "By the help of the discovery of the thermo-motor force man will become his own savior, for he will now need no physician to teach him self-control. For just in the same way that the discovery that the principle of 'do as you'd be done by,' based on love of others, underlies the thousand varieties of religious creeds, will overthrow the wily devices of priestcraft and the evils of fanatical hatred and persecution among races of different religions by causing them to recognize that they are all members of one great brotherhood, so the discovery of thermo-motor force, and that waste of said force is the concealed cause of every form of disease and its corresponding prin-

ciple based on love of self, will overturn the rival schools of medicine by rendering them superfluous, and priest armed with threats of eternal woe and physician with bolus and globule will be consigned, along with the rack and the thumb screw, to the wonted oblivion of the dark ages, and in their stead will rise up, under the shelter of friendly colleges, men who will consecrate their lives to the discovery and promulgation of these great truths upon which man's physical and mental welfare depend." Modesty has always been a characteristic of great discoverers!

HOW FAST CAN YOU THINK?

"Quick as thought" and "Quick as lightning" are commonly used as synonymous expressions. But their difference is really great. An electric impulse traverses a wire as a wave of motion; a nervous impulse proceeds by a development of chemical change in the nerve. It runs along the nerve somewhat as combustion follows a train of gunpowder, and not much if any more rapidly. Indeed Helmholtz has clearly determined the rate of nervous propagation to be less than a hundred feet a second, or about a mile a minute. To use a rude illustration, if a railway could feel, the sense report of a train starting in New York would reach Albany but little in advance of the fastest trains that have been run upon the Hudson River Road. Even along courses as short as the nerves of the human body an appreciable time is required for the passage of nervous impulses.

With a simple apparatus, Hirsch found that a touch upon the face could be recognized and responded to by a predetermined signal operated by the hand, in one seventh of a second. With a sound test, acting, of course, upon the ear, the answering signal was made in one sixth of a second; when the eye was addressed, the response came in one fifth of a second. Since the distances traveled by the nervous impulses were very nearly the same in all these experiments, it is evident that the greater part of the difference of time noted must be charged to the greater or smaller rapidity of the act of recognition; the entire process in each case being the transmission of a sensation (touch, hearing, or sight) to the brain, its recognition, the willing of the signal agreed upon, the transmission of the order to the muscles of the hand, and the movement of those muscles. Thus it would appear that less time is required for recognizing a touch than a sound, less time to hear than to see. But what part of the fifth, sixth, or seventh of a second, as the case might be, was consumed in the act of recognition?

Donders was successful in answering this question by the use of several forms of apparatus, involving entirely different methods, yet yielding the same results. He found, for instance, with the "noëmatachograph" that the double act of recognizing a sound and willing the response required seventy-five thousandths of a second. Of this time, forty thousandths of a second were required for simple recognition, thus leaving thirty-five thousandths for volition. With the "noëmatachometer" he found that the same time, forty thousandths (or one twenty-fifth) of a second, was required to judge which was first of two irritants acting on the same sense. A slightly longer time was required to judge the priority of signals acting on different senses, as a sound and a light. It also took longer to recognize a letter by seeing its form than by hearing its sound.

This in a man of middle age. Young people thought quicker, but the difference was not great. In all the experiments the time required for a simple thought was never less than a fortieth of a second. In other words the mind can perform not more than twenty-four hundred simple acts a minute, fifteen hundred a minute being the rate for persons of middle age.

From these figures it will be seen how absurd are many popular notions in regard to the fleetness of thought, how exaggerated are the terrors of remorseful memory that moralists have invented for the moment of dying. And we may reasonably "discount" also the stories told by men saved from drowning, cut down before death by hanging, or rescued from sudden and deadly peril from other causes. No doubt a man may think of a great multitude of experiences, good or bad, in a few minutes; but that the thoughts and emotions of a long life may surge through the mind during the seconds of asphyxiation are manifestly impossible.

Admit that the speed of mental action is abnormally rapid at such times, say twenty-five hundred simple cognitions a minute, or 150,000 an hour. If a man were an hour in drowning, instead of a few minutes, and all the time be given to a mental review of his life, he would, if forty years old, have time to give ten thoughts of the simplest character to each day that he had lived. In other words memory would have time to review the experiences of at most the hundredth part of one second out of each day's waking thousands.

THE INTENSITY OF TELEPHONIC SOUNDS.

The scale of intensities of the sounds perceptible to our ear is very great, a fact easily appreciable when the difference between the faint hum of an insect, audible at barely a yard's distance, and the thunder of artillery a couple of dozen miles away is considered. These intensities being relatively as the square of the distances, the first would be but a fraction of the second, the denominator of which would be 1,600,000,000, all other things being equal. In order to compare the intensity of the sounds transmitted by the telephone with the intensity of the primitive sound, M. Demoget has recently made some interesting investigations, an account of which we find in *La Nature*.

Two telephones were employed, one of which the operator held to his ear, while into the second instrument an assistant repeated a given syllable with a uniform intensity of voice. The sound transmitted by the telephone and also that reaching the ear directly were both heard, and it was thus easy to make a comparison between them.

At 288 feet distance the intensities appeared equal, the vibrating plate being held at a distance 1·9 inches from the ear. The relation of the intensities was then as 25 to 81,000,000; or, in other words, the sound transmitted by the telephone was only about $\frac{1}{3000000}$ of the sound emitted. "But," adds M. Demoget, "as the stations of the observers could not be considered as two points vibrating in space, it was necessary to reduce the ratio by half because of the influence of the ground, and hence to consider the sound transmitted by the telephone to be 1,500,000 times weaker than that directly communicated."

It is well known that the intensity of two sounds is proportional to the square of the amplitude of the vibrations, and hence it may be concluded that the vibrations of the two plates of these telephones were directly proportional to the distances, that is, as 5 to 9,000, or that the vibrations of the receiving telephone were 1,800 times smaller than those of the transmitting telephone. They may thus be compared to molecular vibrations, for those of the receiving telephone have already a very small amplitude. From the foregoing M. Demoget argues that the telephone as a machine is far from being perfected, since it transmits but $\frac{1}{1800}$ of the primitive energy. Investigations looking to its improvement, he thinks, must be in one or the other of the two following directions: First, by attempting to augment the vibrations of the diaphragm of the second telephone by means of electricity from a battery; second, by augmenting the useful effect of the apparatus by improving the parts so as to give more amplitude to the vibrations of the transmitting telephone.

Following out these trains of thought, M. Demoget has placed, at a distance of 0·03 inch in front of the diaphragm of a telephone, one or more similar vibrating plates, in one of which was pierced an orifice of a diameter equal to that of the magnetized bar, and in the second a larger opening. By this simple means, he states, not only are the sounds transmitted augmented in clearness, but in intensity also. At the ends of a line 96 feet long, disposed between the stories of a house, it was possible to converse in a very low voice. By this arrangement, the magnetic vibrating mass being greater in relation to the magnet, the electro-motive force of the currents is augmented, and consequently the vibrations of the plates of the second telephone are also increased

PROGRESS AT THE PATENT OFFICE.

The Commissioner of Patents has just issued an order to the examining corps relative to pending cases in arrears, which will command the hearty approval of every one having business before that bureau. As we have taken occasion to point out already, thousands of people are inventing at the present time who never did so before, in the hope of retrieving impaired fortunes, through disposal of their patented devices. Especially to these inventors delay is a hardship; to all classes of patentees it is annoying, and sometimes prejudicial to their interests, while it adds materially and unnecessarily to the labors of all those who have constant dealings with the office.

The present official staff appears to be large enough to keep the work clear of arrears if all the members of the staff were strict in attention to duty. But the members of the bureau are so mutually dependent that laxity on the part of any is certain to hinder and affect the labor of all. No matter how hard a commissioner may strive to make his administration satisfactory, he will labor uselessly if he does not insist upon real industry on the part of his subordinates. If one, Examiner A., conceives the idea that sitting with his heels on a desk from 10 A.M. to 2 P.M. reading newspapers is most promotive of inventors' benefits, Examiner B., although possessing conscientious ideas about what he ought to give in return for his pay, will see no harm in putting a tough case over until to-morrow or next week, and, in brief, the office will ultimately adopt the pace of its slowest member.

When Commissioner Spear strikes at the root of this difficulty and peremptorily orders, as he has lately done, that working hours be extended until 5 o'clock P.M. until further notice, that all the force in the examiners' rooms shall be kept at work, and that examiners shall make daily reports of what they and their assistants have accomplished during the preceding day, he is doing inventors a genuine service; and now that he has put his hand to the plow we trust that he will not look back until his bureau is as well regulated and as free from abuses as any properly managed private business house.

COLOR BLINDNESS.

Mr. T. F. Nelson, in the Chicago *Railway Review*, remarks of color blindness: This defect but rarely assumes the form that would be termed absolute color blindness or want of any sensation of color. Where this form is perfectly developed there is generally a sharp, well-defined appreciation of differences between light and shade, or even between the finest grades of apparent brightness or intensity; but recognition of color is entirely wanting; there being no distinction whatever between different colors having the same degree of intensity. A curious fact might be noticed in this connection, that these defects are but rarely found in women.

The more common form is that caused by the absence of perception of one of the three fundamental colors. These are mentioned in the order of their comparative frequency; namely, where the elementary sensation corresponding to red is wanting; next, the absence or imperfect perception of green; and third, of blue is excluded. It will be noticed as a remarkable fact that the first two mentioned are now used to make up the entire code of railway signals, and that this defect for red occurs more frequently than for any other color. This is an item of the greatest importance in railway and vessel management, since red is almost always used for the danger signal. To add still further to the deceptive and dangerous character of the defects, I have, in the course of my experiments, found a number of persons who were unable to distinguish between the primary colors at night, while their perception or sensation of color by daylight was apparently perfect. Again, I have found another anomaly which, until it has been more thoroughly investigated and the real causes that produce it are understood, I shall designate as a form of color blindness, although I am in doubt myself as to its dependence upon any of the principles that enter into that defect; this is an inability to distinguish between or to recognize the primary colors at certain distances, varying more or less in individuals. This was found to be the most difficult of all defects to detect in the various cases I have examined, amounting to some nine or ten, in the regular course of my business as optician during the past three years. I have found no two of them at all alike, except in general results.

I have kept records of various accidents that have occurred, both upon land and water, during the past few years, and I have gathered such information about some of them as I could get outside of official sources; often I was unable to get any of any value; but I am convinced beyond a doubt that a large proportion of them could have been traced to this defect for a correct solution as to the primary causes of the accident. The query has been made, If these defects in their various forms are as numerous and of such a dangerous character as has been shown, how can we account for such a comparatively small number of accidents occurring which might be charged to them? I have attributed it to the high average intelligence and acquired cautiousness of engineers and pilots as a class. They have become so accustomed to be on the lookout for danger that their suspicions are easily aroused, which creates a sort of instinct that governs their actions, and they do not recognize but that their perceptions are correct. My convictions in this respect have been greatly strengthened within the past few months, there having been related to me some experience with an engineer who was continually making narrow escapes, and, after watching his actions under different circumstances for a time, color blindness was suspected, proved, and afterward acknowledged by him. The correctness with which he formed conclusions under the existing circumstances would indicate that he had some means by which he was enabled to form a plan of action, but he declared that he had nothing upon which to base his actions but the cautiousness acquired in that branch of service.

It could be claimed that this illustration lessened the importance of perfect vision, and rendered it of no great consequence whether a person was defective in this particular or not, so long as he formed judgment correctly. This might be true if vision depended upon judgment or instinct; but as we form judgment in a large measure by comparisons upon impressions received through the medium of vision, it will be apparent to all that it will be impossible to form correct judgment when the basis upon which it is formed is imperfect. It is quite possible that such a person may continue to make narrow escapes, falling upon the side of safety each time; but as there is no natural law by which his judgment is made positive and certain, the very next occasion may by the merest chance result in a serious error. In investigating all of the different forms of color blindness before mentioned, I have invariably taken into consideration the quickness of perception. This I have found varied quite as much in the different individuals, and even in the same person at different times, as the defect has differed in form and degree. The correctness and quickness with which judgment is formed and will power exercised after the perceptions are received by the mind through the medium of the senses, depend in a great measure upon the physical condition of the body. I have found that very slight physical or mental weariness produced results which showed a difference of between 80 and 90 per cent in the time consumed.

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