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(Illustrated articles are marked with an asterisk.)

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For the Week Ending March 6, 1897.

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AMERICAN RAILWAY SPEEDS.

The Engineer, of London, is greatly disturbed from time to time because American railroad men—managers, master mechanics and engineers—persist in crediting their own locomotives with feats of speed and hauling power which are entirely beyond the capabilities of any English locomotive. This periodic irritation is discernible in every announcement of an exceptional American locomotive performance that may appear in the columns of our contemporary. Ordinarily the vexation appears in the form of an obvious query mark, deftly woven into the phraseology of what purports to be a simple announcement of the fact that a fast run has been made. But if the run should happen to have been particularly brilliant, the editor's wrath is manifested by his handing over the details of the performance to The Engineer's expert in figures, who proceeds to prove on general principles, and by the aid of sundry formulæ of unimpeachable antiquity, that, in the nature of things, the feat could never have been performed. No sooner does an American engineer "smash the record" than the expert proceeds to smash the engineer, burying the luckless wight under a very avalanche of theoretical calculations.

When locomotive No. 564, of the Lake Shore and Michigan Southern Railroad, hauled a 150 ton train for 86 miles at the rate of 72·9 miles per hour, The Engineer proved to an absolute demonstration that such a thing could never have occurred. Thereupon the editor was favored by the officials of the road with all the details of the performance, including a profile of the line, the statements being duly certified by the proper parties. This brought forth an acknowledgment that, in the presence of such overwhelming testimony, some revision of the elaborate calculations upon the basis of which the performance had been discredited by the expert was necessary—a somewhat superfluous admission.

After a brief period of well earned repose, our contemporary has again been disturbed by the performance of American locomotives, the immediate cause being a letter written to the Railroad Gazette by Mr. George S. Strong, in which he quotes certain runs made in 1887 by the Strong locomotive, runs which were certified by the proper officials and accepted as authentic by the engineering press throughout the country. It was acknowledged at the time that the loads hauled, the speed, and the indicated horse power rendered the performances among the most remarkable on record; but the trials were so carefully carried out, and the facts were reported by such impartial and unimpeachable witnesses, that they have never been seriously questioned.

The Engineer, however, again doubts the credibility of railroad men in this country, and does not hesitate to say so. It proceeds to demolish their testimony in its customary and familiar style. The controversy is too lengthy for reproduction in these columns, but Mr. Strong's letter to the Railroad Gazette, The Engineer's criticism, and a reply by Mr. Strong addressed to the editor of the SCIENTIFIC AMERICAN will be found in the current issue of the SUPPLEMENT.

We are given to understand that, as on the occasion of the Lake Shore run above referred to, The Engineer is to be supplied with the certified statements of the officials of the roads on which the runs were made, on the receipt of which, no doubt, our contemporary will proceed to revise its already revised calculations.

In general it may be said that it is altogether absurd to make the data of English locomotive performance the basis of an argument as to the possible or impossible performance of an American locomotive, so radically different are the leading features of the two designs. The American machine can haul the larger loads because it is specially designed to do so, and the same reason must be given for the relatively large horse power which it is able to indicate, and does indicate, on such runs as these in question. Indicated horse power is the product of piston pressure by piston speed, and the locomotive that is able to maintain a high mean piston pressure in conjunction with high piston velocity will show a proportionally large horse power. The American locomotive is provided with large port areas and drivers of moderate diameter; and in running a given distance, when working up to its full power, it will use a far greater volume of steam in its cylinders than an English locomotive with its seven or eight foot drivers and slower piston speed. The ports of an English locomotive's cylinders are short and cramped, ill adapted to give that free admission and escape to the steam which is essential to effective work at very high speeds. The slow piston speed and the low mean cylinder pressure will account for the small indicated horse power of English locomotives, which ordinarily ranges from 700 to 800; whereas the locomotives that haul the heavy expresses in this country will indicate from 1,100 to 1,300 horse power when working up to their full power. Just here lies the explanation of the relatively great size of locomotive boilers in America. Engines that use such large volumes of steam require large boiler capacity; and hence the latest boilers in this country have from 1,800 to 2,200 square feet of heating surface, as against from 1,000 to 1,300 square feet in England.

Other things being equal, the locomotive that can pass the greatest weight of dry steam through its cylinders, in traversing a given distance on the rails, will exert the greatest power. English engineers, who are continually expressing their surprise at the enormous size of American locomotive boilers, should bear in mind that it is its large boiler capacity which primarily enables the American locomotive to haul heavy loads at speeds which are altogether beyond the power of the English machine.

The English locomotive is handicapped at the very start by its small boiler with only 1,000 to 1,200 square feet of heating surface, and the valve gear and piston speed are proportioned to match it, the ports being small and the piston speed slow. The extremes of design are shown in a comparison of such engines as the new express locomotives of the New York, New Haven and Hartford Railroad in this country and the Northeastern Railroad in England. The New Haven locomotive, with 6 foot drivers and 20 × 24 inch cylinders, has 2,114 square feet of heating surface and 30 square feet of grate area. The Northeastern engine, with 20 × 26 inch cylinders and 7 foot 7¼ inch drivers, has only 1,216 square feet of heating surface and 20 square feet of grate area. For a supreme effort in hauling a maximum load at a maximum speed, which is the correct design? The Engineer might answer that the English engine is not designed for such excessive work. But the American locomotive is, and by virtue of its design it is capable of those extraordinary exhibitions of power which our contemporary finds it difficult to credit.

The locomotive which made the runs that are now called in question represents an extreme application of the distinctive features of American design. The double furnace gives 60 square feet of grate area, as against 20 square feet in the English locomotive; the gridiron valves give 34 inches lead line or length of port on each valve, with an area of 25½ square inches, as against 10 inches lead line or length of port on each valve with an area of 12½ square inches on the average English locomotive; and with a 75 per cent cut-off this locomotive has given as high as 150 pounds mean pressure in the cylinders.

In conclusion it may be said that if the designers of English locomotives would cease to strive after an ideal economy in fuel, and devote their attention to the more serious problem of hauling heavy loads at high speed, they could solve the problem at once by adopting the practical and common sense methods of American builders; moreover, if The Engineer would spend as much time and energy in teaching its readers *how* and *why* the American locomotive *does* certain things as it now spends in trying to prove that it never has and never will do them, it would be more in line with modern developments and less open to the charge of persistent and unreasonable prejudice.

"DEFECTIVE PATENT LAWS."

The love of criticism is a quality inherent in human nature. Perfection is never attained by man, and his work is always open to unfavorable comment. This statement applies broadly to almost every case, and holds even when the critic has accurate knowledge of the subject he treats of. But the wings of his imagination work with infinitely greater vigor when they move in an atmosphere of ignorance. He has but to assume the facts in the case and then to criticise them, and his work is done.

Recently the patent law of the United States has been thus criticised by one of our Chicago contemporaries. Among its editorial articles appears one bearing the title "Defective Patent Laws," which criticises unfavorably what the writer of the article in question conceives the patent laws of this country to be, and undertakes in this vein of ignorance to compare them with those of foreign lands. The utter ignorance of existing facts, and the misconception of the scope of the patent system, is impressive. It is also impossible to ascertain whether the writer thinks that the inventor is too hardly dealt with or whether he considers the public the sufferer. Our only inducement to notice an article containing such a mass of misstatements is the fact that the journal has a somewhat wide circulation, and will go to inspire discontent with the patent statutes. On them a vast body of decisions and rules of practice have been based, and, consequently, our patent law is so well formulated that its practice has become practically codified. A lawyer who takes out a patent for a client knows what he has to expect from the Patent Office examiners, and works in the full enlightenment of such knowledge. He has in his mind the general scope of decisions in the circuit and supreme courts, and formulates his claims in accordance therewith. Radical changes in the patent law would work irreparable harm to inventors by putting them at sea with regard to their rights. Stability is a necessity in the case of patent franchises.

A mistaken apprehension as to the scope and function of a caveat marks the opening of the article. The writer states that a caveat is objectionable, as by the payment of ten dollars per annum it may be kept alive and practically extend the life of a patent for an indefinite period, giving the inventor protection for any number of years. In this erroneous statement we find the expression of a common misapprehension. A caveat is simply a memorandum filed in the Patent Office, entitling the inventor to notice of the filing of an application by another. A caveat protects the inventor but not the invention. The protection it affords is not the same as that of a patent, and it has no standing in court which could render it a protection against infringements. While the caveat remains in force, the inventor may apply for a patent, and when the patent has been issued, and then only, his rights can be enforced. He may extend a caveat for a term of years by annual payment, but the extension is not one of right to a patent, but only of right to a notice of another person applying for a patent. A caveat extended for a long period would, on the contrary, imperil the standing of an inventor in court as showing want of diligence on his part in filing his application or perfecting his patents. The editorial then objects to the length of term of United States patents and cites the admirable practice of the Russian Patent Office in this respect, which issues a patent, it states, for a term not exceeding ten years. It seems rather strange that a progressive people like ourselves should be called upon to admire the antiquated patent system of Russia, with its exorbitant fees and impracticable methods; but the writer was again speaking in crass ignorance, for on July 1, 1896, the Russian government instituted a new patent system, making the life of a patent fifteen years.

The power of Congress to extend the term of United States patents is then taken up, and the writer waxes eloquent over the great wrong in extending these privileges to the bloated inventor. We would like to ask whether our esteemed contemporary is not aware that it is years since Congress has granted a petition to extend the terms of a patent, and then only with good cause.

So far the writer of the article which we criticise has taken a position opposed to the inventor, seeming to think that too much consideration is awarded him by the law. Now a change of front occurs, and an old complaint is brought forward by the writer, in the assertion that a patentee is at the mercy of infringers unless he has capital. If his patent is meritorious he never need be without capital. The federal government does what it can to protect the inventor; it opens to the patentee the highest tribunal of the United States for the determination of his rights.

The Patent Office examination, which is made before the patent is issued, is an admirable system and enables the inventor to learn definitely the state of the art before the term of his patent has begun to run. Our enlightened contemporary thus indorses the system of our friends beyond the sea: "In Norway and Great Britain questions of alleged infringements must be settled before a patent is issued, and the patentee may then reap the full benefit of his invention without fear of interference."

This statement is absolutely without foundation. In Great Britain there is no examination by the government, and the patent is issued, irrespective of novelty, to the first applicant. The issuing of the patent there is no guarantee or evidence of novelty, and the true value of the patentee's rights are not tested until after the patent is issued. In Norway there is a superficial examination only.

Another point made in the article we discuss is that the payment of the full fee before the patent is issued is onerous. The practice in other countries where annual payments are required is cited as an example of more liberal treatment of the inventor. Experience proves this not to be the case. In fact, the cost of a United States patent is in the aggregate less than that for any other country. The United States exacts two nominal fees only—one of fifteen and another of twenty dollars; and for this total of thirty-five dollars the seventeen year franchise is granted. No greater liberality could be rationally expected. The annual fees exacted under the laws of other countries are often onerous and aggregate quite a large sum if extended over many years, amounting in some countries to $1,500 in taxes alone.

The criticisms so often expended on the United States patent laws are generally the outcome of ignorance or misconception. The theory is especially an object of misapprehension. Practically the encouragement of inventors brings about the enrichment of the country and the advance of its most important interests. The way to render the protection at once ample for the inventor and fair to the rest of the country is to publish the invention and to lay it open to the world. This opening to the world is expressed, etymologically speaking, in the word "patent." This surrender of his closely guarded secret is the inventor's price for statutory protection.

We cannot better close this notice than by quoting the final words of our contemporary: "Where the genius of invention in all branches of industry is as active as it is in this country, the protection of the laws to the inventor should be as liberal as in any other country on the globe."

By all means, so be it. We believe our patent system already meets this high standard. That there are defects no one can deny, but we believe our system to be the most just, equitable and efficient system of that in force in any country.

THE HEAVENS FOR MARCH.

BY WILLIAM R. BROOKS, M.A., F.R.A.S.

THE SUN.

The sun's right ascension on March 1 is 22 h. 51 m. 26 s.; and its declination south 7 deg. 17 m. 16 s. On the last day of the month its right ascension is 0 h. 41 m. 21 s.; and its declination north 4 deg. 27 m. 8 s.

On March 20 at 3 A. M. the sun crosses the celestial equator on its northward journey, enters the first point of Aries, and spring commences.

Telescopic observation of the sun will prove of interest to the student. The great sun spot of January came into view again by the sun's rotation early in February, according with the prediction.

It was in good position on the 5th, when it was photographed, and drawings made at this observatory. It had changed in form considerably, and was smaller than in January, but was plainly visible to the naked eye through a smoked glass. In the telescope it presented a fine appearance. This spot will probably reappear by rotation, and be in good position the first of March.

MERCURY.

Mercury is morning star, but is not very well placed for observation except at the beginning of the month. On the first day of March at 8 h. A. M. Mercury is in conjunction with the moon, when the planet will be 1 deg. 57 m. south of the moon. The right ascension of Mercury on March 1 is 21 h. 29 m. 48 s.; and its declination south 16 deg. 32 m. 53 s. On the last day of the month its right ascension is 0 h. 23 m. 17 s.; and its declination north 0 deg. 56 m. 4 s.

VENUS.

Venus is evening star, and so glorious an object that no one can view it without an exclamation of delight. A peerless celestial diamond. It is now seen at a high altitude in the western heavens as soon as it is dusk.

Venus is at its greatest brilliancy on March 21, and for some time before and after that date is visible to the naked eye in the day time. After dark, on a clear evening when the moon is absent, the light of Venus is so intense at the period of greatest brilliancy that objects in its path will cast very distinct shadows. Upon the snow this is very marked indeed.

Venus is in perihelion on March 4, and on the 26th reaches its greatest heliocentric latitude north.

On the 7th of the month, at 8:30 A. M., Venus is in conjunction with the moon, when the planet will be 1 deg. 25 m. south of the moon.

On the first of the month Venus crosses the meridian at 2 h. 58 m. in the afternoon, and sets at 9 h. 45 m. P. M. On the last of the month Venus crosses the meridian at 2 h. 9 m. in the afternoon and sets at 9 h. 30 m. P. M.

The right ascension of Venus on the 15th day of the month is 2 h. 17 m. 42 s., and its declination north 18 deg. 45 m. 14 s.

MARS.

Mars is evening star, and is in quadrature with the sun, or ninety degrees therefrom, on March 18. Its distance from the earth is rapidly increasing, but very good observations of the planet may yet be made.

Mars is in conjunction with the moon on March 11 at 6 h. 43 m. P. M., when Mars will be 1 deg. 34 m. south of the moon.

On the first of the month Mars crosses the meridian at 6 h. 42 m. P. M. and sets at 2 h. 20 m. after midnight.

On the last of the month it crosses the meridian at 5 h. 43 m. P. M. and sets at 1 h. 20 m. past midnight.

The right ascension of Mars on the 15th of the month is 5 h. 47 m. 54 s. and its declination north 25 deg. 43 m. 42 s.

JUPITER.

Jupiter is evening star, having passed opposition with the sun on the 23d of February, when it changed from morning to evening star. It is a beautiful and conspicuous object in the eastern evening sky. Jupiter is in the constellation Leo, a few degrees east of Regulus. This is a most favorable time for telescopic work upon Jupiter, its wonderful belts and beautiful moons forming charming celestial pictures. The following are some of the interesting phenomena of Jupiter's satellites for March. On March 4 at 9 h. 50 m. P. M. the I satellite disappears in occultation. At 21 m. past midnight satellite I reappears from an eclipse. At 3 h. 53 m. the same morning the II satellite enters upon the disk of the planet in transit; and at 4 h. 22 m. the shadow of satellite II enters in transit.

On March 5 at 7 h. 9 m. P. M. the I satellite enters upon the disk in transit. At 7 h. 24 m. P. M. the shadow of satellite I enters upon the disk in transit. At 9 h. 19 m. 15 s. the III satellite reappears from an eclipse. At 9 h. 28 m. the I satellite will egress from transit; and at 9 h. 43 m. the shadow of satellite I will pass off the disk. Thus, in about two and one-half hours of a single evening, we have five distinct and interesting events in the phenomena of this giant planet. On March 13 at 8 h. 43 m. 44 s. P. M. the I satellite will reappear from an eclipse. At 1 h. 9 m. past midnight the II satellite will disappear in occultation. At 4 h. 52 m. 46 s. the same morning, the II satellite will reappear from an eclipse. On March 21, at 7 h. 24 m. P. M., satellite I will egress from transit; and at 8 h. 1 m. the shadow of satellite I will pass off the disk of the planet. On March 28, at 6 h. 51 m. P. M., the I satellite will enter upon the disk in transit. At 7 h. 36 m. P. M. the shadow of satellite I will ingress. At 9 h. 10 m. the same evening the I satellite will pass off the disk; and at 9 h. 55 m. the shadow of satellite I will follow.

On March 16, at 11 h. 22 m. P. M., Jupiter will be in conjunction with the moon, when the planet will be 3 deg. 15 m. north of the moon.

On the first of the month Jupiter rises about 5 o'clock in the afternoon, and comes to the meridian at 11 h. 46 m. P. M. On the last of the month Jupiter comes to the meridian at 9 h. 36 m. P. M. and sets at 4 h. 20 m. A. M.

The right ascension of Jupiter on the fifteenth day of the month is 10 h. 20 m. 36 s. and its declination north is 11 deg. 45 m. 49 s.

SATURN.

Saturn is in the morning sky and slowly coming into better position for telescopic observation. It is on the borders of Scorpio, about ten degrees northwest of the bright star Antares. On the ninth of the month Saturn is stationary.

On the first of the month Saturn rises at 24 m. past midnight, and crosses the meridian at 5 h. 18 m. A. M. On the last of the month it rises at 10 h. 25 m. P. M., and crosses the meridian at 3 h. 15 m. A. M. The right ascension of Saturn on the fifteenth of the month is 15 h. 56 m. 14 s.; declination south 18 deg. 9 m. 57 s.

URANUS AND NEPTUNE.

Uranus is in the morning sky, in the constellation Scorpio, and very close to Saturn. All through the month of March it is about two degrees southwest of Saturn.

Neptune is in the evening sky in the constellation Gemini. At the beginning of the month it is between the feet of Castor, one of the Twins. On March 7, Neptune is in quadrature with the sun.

Smith Observatory, Geneva, N. Y., February 19, 1897.

THE REMARKABLE LONG DISTANCE RUN.

The run of 1,026 miles at the rate of 58·74 miles an hour, mentioned in our last issue, by a special train over what is known as the Burlington route from Chicago to Denver, was in some respects the most remarkable of the many similar performances of recent years. There have been faster long distance runs for a shorter total distance, and other runs of this class have been made with heavier loads; but taken as a feat of fast passenger travel for the given distance it stands today as an altogether unrivaled performance.

There is a special merit attaching to this performance from the fact that it was called for at the shortest notice, and the railroad used the engines which were readiest to hand. Moreover, the object of the effort was not to gain the notoriety which attaches to a run of this kind, but it was the thoroughly legitimate one of placing a father as quickly as possible at the bedside of his dying son. The journey was made in a special car which was hauled by nine different engines.

The greater part of the work was accomplished with standard American 8 wheeled locomotives, with 17 by 24 inch or 18 by 24 inch cylinders, and weighing about 80,000 pounds. One stretch of 57 miles was covered with a mogul locomotive with 19 by 24 inch cylinders, and 185 pounds of steam, whose weight was 110,000 pounds; and for 143 miles of the trip a 10 wheeled locomotive, weighing 120,000 pounds, with 19 by 24 inch cylinders and 185 pounds of steam, was employed. It is noticeable that none of the driving wheel centers were above 62 inches—a remarkably small dimension, considering the high speed that was maintained.

The Denver station is 4,583 feet above the level of the Chicago station, and the total time occupied in covering the 1,026 miles between the two points was 18 hours 53 minutes. This gives an average speed of 54·27 miles per hour inclusive of stops. The average speed, exclusive of stops, was 57·53 miles per hour.

SAGACITY OF HORSES.

In the year 1872, during a skirmish with the Sioux Indians, the Third United States Cavalry formed an encampment in a valley on the southern border of Dakota. At nightfall the horses were tethered by a long line to the ground. Toward daybreak a violent storm of rain and hail burst over the valley, when the terrified animals broke loose from their fastenings and tore away up the steep sides of the valley into the territory of the enemy. Without horses, at the mercy of the enemy, we would have been lost; yet it was impossible, in the darkness, to go after them into an unknown country, probably full of Indians. The commanding officer, as a last resource, ordered the stable call to be sounded. In a few minutes every horse had returned to the encampment, and we were saved.—Thierfreund.