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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.

SUPERHEATED STEAM.

Every engineer knows that the improvement in steam-engine economy witnessed during the last thirty years has been due primarily to the constantly increasing higher steam pressures employed and to the introduction of compound and multiple-expansion engines. To be sure, many mechanical details, such as valve gears and governors, have been perfected; but the fact remains that whatever progress has been made is due to the utilization of higher pressures. That improvement, it must be admitted, has probably reached its limit. Such is the increased cost of building more than a triple or quadruple engine, that the very slight increase in economy produced by an additional cylinder hardly proves remunerative. Moreover, certain limitations have been imposed by boiler design, limitations which have prevented the attainment of pressures greater than 250 pounds.

It is because the present system of steam engineering is incapable of any great advancement that we may expect a more general return to the use of the superheater. We use the word "return" advisedly; for, whatever may be the general impression among engineers, the employment of superheated steam dates back very nearly three-quarters of a century. As far back as 1828 a certain Capt. McGregor, in order to compete with the record established by a rival Cornish engine, whose cylinders had been insulated with sawdust, constructed a jacket of brick around the cylinder of his engine and the steam pipe, with an air space between the brickwork and the iron. In the open space he built a fire; and by the heat generated he increased the duty of his engine from 41,000,000 to 63,000,000 foot-pounds per bushel (86 pounds) of coal. The great Richard Trevethick himself made many an interesting experiment, which convincingly proved, to him at least, the great reduction in coal consumption to be effected by the utilization of superheated steam. Every great engineer has, at some time, conducted experiments of more or less value. Men of the stamp of Ericsson, Hirn, Isherwood, and Faraday were able to show an increase in economy varying from 20 to 27 per cent. Such, indeed, was the impetus given by their researches that superheated steam was very widely introduced in marine engineering in the two decades extending from 1850 to 1870, and this, notwithstanding the great difficulties encountered in lubrication, and notwithstanding the fact that the material of which the superheaters were made was unable to withstand intense heat for any length of time. The lubricant of those early days consisted, not of our present mineral oils, but of animal fats, which obviously were anything but commendable lubricating agents. But even animal oils proved of sufficient service with the low pressure of 50 pounds and the temperature of 100 deg. Fah. given to the superheated steam of that day. It was when the high-pressure, compound engine was introduced, that the development of the superheater was checked. The greater economy of the new engine, compared with the low-pressure, single-expansion machines that had been theretofore used, the consequent saving of space and weight, both of them important on shipboard, and the reduction of the temperature in superheating the steam to a point at which the difficulties of lubrication were overcome—all these contributed to the abandonment of the old-time low-pressure, superheated steam engine.

Ever since the days of James Watt, engineers have realized that the principal loss of efficiency in the steam engine is due to the condensation of steam in the cylinders. Assuredly, the most obvious way of overcoming the difficulty is to superheat the steam. This, moreover, would be one of the simplest methods of increasing the economy of the steam engine, still lamentably low, despite the progress of recent years. To those who are at all familiar with the history of steam engineering in the past century, may be commended a paper by Prof. Storm Bull, recently read before the Western Society of Engineers, and published in the current issue of the SUPPLEMENT, in which the subject is discussed with a fullness that cannot here be emulated.

It is rather remarkable that the improvement of the superheated steam engine has been undertaken chiefly in Germany. Many readers will doubtless recall the astonishing results obtained about nine years ago by Schmidt with a boiler and engine of his own design—results which showed that with superheated steam a consumption of steam of only 10.4 pounds per indicated horse-power was possible, and that the amount of coal used per indicated horse-power per hour could be reduced to 1.3 pounds. Schroeter has lately published results of equally interesting tests of a 250-horse-power steam engine. The difficulties which were encountered many years ago in the construction of superheaters that would not readily wear out have in a large measure been overcome. The problem of lubrication has also been solved with the introduction of suitable mineral oils. With these technical advancements, therefore, the outlook for the superheated steam engine is certainly bright.

STATE REGISTRATION OF UNITED STATES TRADE MARKS.

The status of the trade marks which have been registered in the United States Patent Office is indeed peculiar, for under the decision of the United States Supreme Court, which was rendered in the case of Warner vs. Searle & Hereth Company (195 U. S. 191), decided November 30, 1903, many registrations fail to afford the protection which, when filing their applications for registration, the registrants desired.

The authority of Congress to pass laws governing trade marks, and the right to their registration, as well as its authority to legislate on all other questions, is derived from the Constitution; and only when a law is founded on some provision of the Constitution which expressly authorizes, or by way of implication gives power to carry into efficient operation those powers expressly given, is the law constitutional. In all other cases, the law is unconstitutional and of no effect. Examining the Constitution, provisions can be found under which Congress is in certain cases authorized to enact laws for the registration and the protection of trade marks; but Congress is not authorized to register all trade marks, which are used in trade in the United States, and any general law for the registration of trade marks, which are the property of citizens of the United States and citizens and subjects of other nations, would, of course, be invalid. The early national trade mark law of the United States attempted to authorize the registration in the Patent Office of all trade marks by their lawful owners, and, as it exceeded the authority vested in Congress, it was declared unconstitutional in the trade mark cases, 100 U. S. 82, which were decided on November 18, 1879.

In that case, Justice Miller carefully considered the constitutional provisions and the trade mark laws passed by Congress, and, in his opinion, he stated that of the two provisions of the Constitution under which counsel claimed that Congress was authorized to enact general laws for the registration of trade marks, the first was the clause which authorized Congress to enact laws "to promote the progress of science and useful arts by securing for limited times to authors and inventors the exclusive right to their writings and discoveries;" and the second clause was that which, in connection with the granting clause, is as follows: "The Congress shall have power to regulate commerce with foreign nations, and among the several States, and with the Indian tribes." The first clause was held not to refer to trade marks, for neither originality, invention, discovery, science, nor art is in any way essential to a trade mark, nor was it made so under the laws for their registration. Considering the second clause, the Justice stated that "while commerce with foreign nations means commerce between citizens of the United States and citizens and subjects of foreign nations, and commerce among the States means commerce between individual citizens of different States, there still remains a very large amount of commerce, perhaps the largest, which, being trade or traffic between citizens of the same State, is beyond the control of Congress." As the law did not attempt to limit the right to registration to those cases when the applicant had a foreign trade or a trade with citizens of another State or with an Indian tribe, Congress exceeded the authority vested by the Constitution, and the laws were invalid.

Having before it the decision of Justice Miller, Congress enacted in 1881 another law for the protection of trade marks, which law is now in force, but because of the decision in the case of Warner vs. Searle & Hereth Company, it is not of the value which Congress intended to give it. The law of 1881, unlike the old law, authorizes the registration of trade marks in the Patent Office, only in cases where the applicant uses his trade mark in commerce with foreign nations or with the Indian tribes, and it therefore comes within the express terms of the Constitution, and the validity of the statute has not by the courts been questioned. The difficulty arises because of the construction which is given to the statute. In his decision construing the statute, the Justice states that as the law of 1881 was enacted to avoid the unconstitutional features of the old law, and as it expressly limited the right of registration to those marks which were used in commerce with foreign nations or with the Indian tribes, he held that a trade mark registration under the provisions of the law was not infringed unless the defendant injured the registrant's trade because of his use of the mark while engaged in foreign commerce or in trade with the Indian tribes. When the person copying the registered trade mark does not engage in commerce with a foreign country or with an Indian tribe, he cannot be held to have infringed the registered trade mark; for otherwise it would be possible for a registrant to secure the privileges which Congress previously attempted to confer under the general law, and which it was held that under the Constitution could not be done. It is therefore impossible for the owner of a trade mark to prevent, under the United States registration statute, its infringement, when the infringer is doing business in only one State, for Congress cannot enact a law protecting a trade mark in such a case; and where the infringer uses the mark in commerce between the States, the infringement cannot be prevented under the national registration laws now in force, for they do not provide for the protection of trade marks in interstate commerce, although the Constitution authorizes Congress to enact laws for the registration and protection of trade marks, which are used in commerce between the States. It is expected that Congress, at its next session, will amend the federal trade mark statutes, and, among other changes, there will undoubtedly be found one which will provide for the registration of trade marks, which are used in commerce between the States. Until that amendment is made, and in all cases where the proprietor of a mark wishes to be sure that his trade mark is protected, by all the provisions of the law, against infringement by persons engaged in business in only one State, it is advisable to comply with the trade mark registration laws which have been enacted by the legislators of many of the States.

While the protection afforded by a United States registration has been, by the decision referred to, limited, it is nevertheless important for manufacturers to secure the registration under the federal laws, for the Patent Office is an office of record, to which persons all over the world refer for evidence of the ownership of trade marks in the United States. The rights of seizure under the United States statutes and the remedies afforded for the infringement of marks are also of considerable value where the infringer is engaged in foreign trade.

When the proprietor of the trade mark and the infringer are citizens of different States, the federal courts have in many cases jurisdiction, independent of the Patent Office registration, but the rights of the parties are then founded on the common law, and not on the statutory registration.

ON THE STATE OF THE CARBON VAPORIZED IN GLOW LAMPS.

Glow lamp filaments, as is known, are composed chiefly of amorphous carbon, by calcination of a vegetable fiber, which, on being brought to a white heat in the vacuum by the electric current, will yield a trace of carbon vapor, the condensation of which on the walls of the bulb in most cases results in lining the glass with a brown coating producing a gradual darkening of the lamp.

In a paper recently read before the French Academy of Sciences, Prof. Berthelot examines the state of this vaporized carbon at the lowest possible temperatures, comparing it with such well-known allotropic modifications of carbon as the diamond, graphite, amorphous carbon. The main results of this investigation are the following:

Carbon gives off an appreciable vapor tension at a temperature not exceeding 1,500 deg. C.; this tension being so low as to require several hundreds of hours to produce some milligrammes of condensed carbon, even in the nearly absolute vacuum of electric lamps. On the other hand, the carbon thus vaporized *at the lowest possible temperatures*, is, under Prof. Berthelot's experimental conditions, amorphous carbon without any addition of graphite or diamond. The temperature at which a vapor tension of carbon may be noted proves thus about 2,000 deg. below the boiling point, which, according to Prof. Violle, is 3,600 deg.; this interval is very much larger than the interval of temperatures during which most of the remaining bodies exhibit an appreciable vapor tension. This tension, however, in the case of carbon, does not, in Berthelot's opinion, correspond with a simple vapor-

ization, occurring without any intimate change in the chemical constitution of the body. Though representing the same chemical element, carbon assumes in the solid state a multitude of different conditions, exhibiting rather different physical and chemical properties. There seems to be a series of progressive condensations, the limits of which would correspond with the different modifications of carbon.

According to ordinary analogies, the physical properties of composite bodies, capable of being formed directly, are a consequence of those of their components, except that they are more or less modified on account of the loss in energy resulting by reason of this combination. The combination of hydrogen, boiling at —252 deg., and that of oxygen, boiling at —182 deg. C., will thus give water, which boils at +100 deg. C. The energy which maintains at the gaseous state the free molecules of hydrogen and oxygen, has thus decreased to an enormous extent, as corresponding with the 59,000 calories lost at the instant of their combination, with the formation of a molecule of gaseous water. The same seems to be true of carbon in its combinations with hydrogen. The real existence of this element in an identical gaseous state, no matter what may be the origin, is shown by spectrum analysis, both in the electric arc and in the sparks through its oxides, hydrides, etc., as well as in the flames produced by the combustion of these different compounds.

Taking into account the boiling points of acetylene and the gaseous carbides of hydrogen, as well as of the gaseous oxides, etc., of carbon and the analogy above stated, the normal condition of carbon at the ordinary temperature should be that of a permanent gas, the boiling point of which would be comprised between those of hydrogen and oxygen. A similar gas, however, would nearly instantaneously be transformed into polymerics by the reciprocal combination of its molecules, this change occurring with considerable amounts of heat given off.

THE HEAVENS IN JULY.

BY HENRY NORRIS RUSSELL, PH.D.

Nothing of much general interest has occurred in the astronomical world during the past month. The journals of the science have been full of the ordinary routine observations of planets, comets, variable stars, and the like, with occasional bits of mathematical heory; but there has been little or nothing of interest to those who are not specialists.

All that need be recorded here is that further observations of Brooks' comet show that its orbit is nearly parabolic, and that its period of revolution must be long, if, indeed, it ever returns at all. The calculated orbit of short period to which we referred last month, turns out to have been affected by a rather large error in one of the observations on which it was based, in the way which was explained at the time. There remains nothing remarkable about the comet except its great perihelion distance—over 250,000,000 miles. It is rarely that a comet is observed at such a distance from the sun, and this one, though telescopically inconspicuous, must really be a pretty big comet to be seen at all so far away.

A question has recently been raised by a correspondent whose answer may be of enough interest to warrant our spending a few moments on it. He asks: "Why do you refer to the Great Bear as feminine?"

We must go back into the age of classical mythology for the reason. Even then we do not reach the first historic recognition of this noble constellation. It was known to the Egyptians, who called it the Hippopotamus! We need hardly regret that this designation has become obsolete. The people of southern Europe saw in the same stars the more familiar figure of a bear, and the legends which grew up around it were finally given a permanent shape by Ovid in his "Metamorphoses." As he tells the story, Callisto, an Arcadian nymph, was beloved by Jupiter. Juno, in fierce anger, turned her into a bear, depriving her of speech that she might not appeal to Jupiter. Her son, Arcas, while hunting, came upon her, and failing to recognize her in her metamorphosed form, raised his bow to shoot her. Jupiter, moved by pity, prevented the matricide by transforming the son also into a bear, and took them both up to the heavens, where they were placed among the constellations, and Neptune granted them the special favor that they should not be obliged to set and pass into his domain, as the sun and planets did. The constellation has had still other names, and been represented by other figures, notably the very ancient one of the Plough or the Wain, in which the four stars of the quadrilateral are the wheels of a wagon, and the other three are the horses. Our own common name—the Dipper—appears to be an American invention—at least it is so regarded in England. It is certainly realistic, but it does show some evidence of modern date—certainly later than the invention of tinware. But Ovid has undoubtedly fixed the permanent designation of this group of stars, and from his story there can be no doubt that Ursa Major is really a she-bear, while Ursa Minor is masculine. Both the Bears have very long tails, as anyone may see for himself.

Admiral Smyth, in his "Cycle of Celestial Objects," quotes an explanation given by a Cambridge astronomer in 1590, which deserves to be given *verbatim*.

"Scholar.—I marvell why (seeing she hath the formo of a beare) her taile should be so long.

"Master.—I imagine that Jupiter, fearing to come too nigh unto her teeth, layde holde on her tayle, and thereby drewe her up into the heaven; so that shee of herself being very weightie, and the distance from the earth to the heavens very great, there was great likelihood that her taile must stretch. Other reason know I none."

THE HEAVENS.

If we go out at nine o'clock on a clear evening in the middle of July, and look due south, the most prominent constellation will be Scorpio. Its brightest star, Antares, is fiery red—one of the reddest stars in the sky. A smaller star flanks it on each side, and three fairly bright ones form a vertical line on the right. These are in the Scorpion's claws, while his tail may be followed below Antares down to the southern horizon, where it curves back, and ends in a conspicuous group of stars which mark the sting. To the left is Sagittarius with the little Milk Dipper, and beyond is Capricornus, into which Saturn is just rising.

The bright star in the Milky Way above Scorpio is Altair, and the one of almost equal brilliance, much farther north, is Alpha Cygni; while Vega, which lies just to the west of the galaxy, surpasses them both.

The great square of Pegasus is the only prominent group in the east. On the meridian are Draco (above the pole), then Hercules, and next Ophiuchus, above Scorpio. West of Hercules are Corona and Boötes, The latter constellation contains Arcturus, the brightest star now visible. Virgo lies south and west of Boötes, and Leo west of it, close to the horizon. Ursa Major is high in the northwest, and Casseopeia and Cepheus are lower down in the northeast.

THE PLANETS.

Mercury, Venus, and Mars are invisible during the month, being too near the sun. The first two are evening stars in the early part of July, but soon pass through inferior conjunction—Venus on the 8th and Mercury on the 9th—and become morning stars. Mars is morning star, but is still too near the sun to be seen, though he may perhaps be picked up at the end of the month, when he rises an hour before sunrise.

Jupiter is morning star in Pisces, and is the most conspicuous object in the morning sky. On the 21st he is in quadrature with the sun, and comes to the meridian at 6 A. M.

Saturn is in Capricornus and will soon be prominent in the evening sky. He is due south at 2 A. M. in the middle of the month and more than an hour earlier at its close.

Uranus is in Sagittarius, and is well placed for evening observation. On the 15th he is in R. A. 17h. 46m., dec. 23 deg. 37 min. south, and comes to the meridian at 10.15 P. M. He is not near any conspicuous star, but he can easily be identified if one has a good star map.

Neptune is in Gemini, too near the sun to be observed.

THE MOON.

Last quarter occurs at 6 P. M. on the 5th, new moon at midnight on the 12th, first quarter at 3 P. M. on the 19th, and full moon at 4 A. M. on the 27th. The moon is nearest us on the 14th, and farthest away on the 2d, and again on the 30th. She is in conjunction with Saturn on the 1st, Jupiter on the 6th, Neptune on the 11th, Mars on the 12th, Mercury and Venus on the 13th, Uranus on the 26th, and Saturn again on the 28th.

Cambridge Observatory, England.

THE PURCHASE OF A RESERVOIR SITE.

Another step has been taken toward the transformation of the arid West. The Secretary of the Interior has authorized the purchase of the Hondo reservoir site in New Mexico for the sum of $20,000. It is in Chaves County, about 12 miles west of Roswell.

The site of this proposed reservoir is a natural depression, which, with a small amount of embankment, can be given a capacity of 40,000 acre-feet. This will hold practically all the water that the Hondo will furnish during low-water years. It is proposed to store here the flood waters of this stream and draw on them through lateral canals for irrigating the lands below the reservoir.

The lands that will be benefited by the reservoir waters are naturally fertile and may be easily irrigated at slight expense. They are free from alkali and will be ultimately worth at least $100 an acre when planted to alfalfa and corn. If used for fruit growing, to which they are specially adapted, they may have a far greater value.

No engineering difficulties are expected in the work. The natural reservoir will have to be enlarged and canals built for the inlet and outlet of the waters. It is estimated that the cost of constructing the reservoir and bringing the water to the arid lands will approximate $240,000, or $20 an acre for a minimum acreage of 12,000. It is believed, however, that nearly 15,000 acres will be served.

SCIENCE NOTES.

The oldest working clock in Great Britain is that of Peterborough Cathedral, which dates from 1320, and is conceded to have been made by a monastic clockmaker. It is the only one now known that is wound up over an old wooden wheel. This is some 12 feet in circumference, carrying a galvanized cable about 300 feet in length, with a leaden weight of 3 hundredweight. The cable has to be wound up daily. The gong is the great tenor bell of the cathedral, which weighs 32 hundredweight, and it is struck hourly by an 80-pound hammer. The going and the striking parts of the clock are some yards apart, communication being by a slender wire. The clock is not fitted with a dial, but the time is indicated on the main wheel of the escapement, which goes round once in two hours. This clock is of most primitive design, more so than the famous one made for Charles V. of France by Henry de Nick.

According to the report of M. R. Gallerand, a French scientist, the Sakalaves of Madagascar use the pith of a certain palm tree as an article of food. The tree is found in the Ambongo region and is known as the *satranabe*. According to Pernir, it is the *Medemia nobilis*, nearly related to the *Hyphæne*. In that region the *satranabe* covers vast spaces either along the seacoast or bordering the rivers. After cutting down the tree, the natives take out the pith, which runs from 4 to 10 pounds per tree, then dry, powder and sift it, thus forming a kind of flour. Some of this flour was sent to Marseilles to be analyzed at the Industrial Laboratory. It is a fine yellow powder and when fresh has a somewhat sweetish taste, which it had lost, however, upon arriving, and its solution did not act upon a beam of polarized light. When shaken up with water, the flour swells up and a light yellow liquid is obtained which has the odor of beer. About 17 per cent of the matter is dissolved. When fresh the product contains 13.3 per cent of water. After drying to expel all the water, it anaylzes as follows: Starch, 66.833 per cent; cellulose, 12.939; albuminoid matter, 10.538; fatty matter, 1.037; mineral salts, 8.2 per cent. Among the salts are sulphate of potash, chloride of sodium, phosphate of lime, magnesia, oxide of iron; silica is also found. What is to be remarked principally about this product is the relatively large proportion of albuminoid matter it contains. In this respect it ranks ahead of the potato, manioc, and sweet potato, seeing that the latter contain 6.23, 3.30, and 3.38 per cent of nitrogen substances.

Some highly interesting and valuable archeological discoveries have been made on the site of the ancient Greek city Olbia. The site is situated on the southern bank of the Boug, about midway between Otchakoff and Nicolaieff, and not far distant from the estuary of the Dnieper. This ancient city was a colony of Miletus 655 B. C., and was a great center for Greek trade with the interior. It is generally maintained among archeological authorities that a trade route extended from Olbia across country to the northern sea, and when a find of ancient Greek coins was made, it was contended to be substantial proof of the fact. Recently, however, it was proved that these coins were spurious. Olbia was destroyed by the Getæ about 70 to 60 B. C., but it revived, and when it was visited by Dion Chrysostum about 100 A. D., it was again a flourishing city. The excavations that are now in progress upon the site of this city are being carried out by M. Formakovski under the auspices of the Russian Archeological Society. Mr. Formakovski has succeeded in unearthing extensive portions of the walls and foundations of the original city, which date back from the seventh century B. C. The masonry is identical with that of the ruins of ancient cities excavated in various parts of Greece. Before this depth was reached, two different strata of walls and basements bearing descriptions of the fourth and first centuries B. C. were encountered. The stone blocks composing the ruins of houses, temples, etc., in these upper strata are of remarkably exact area, square proportions, and excellently dressed. The more solid constructive work is, however, found in the remains of the original city. At this depth there was unearthed a perfectly preserved wine cellar. Some fifty huge jars or vases had evidently contained red wine, now turned to a light powdery substance. A large collection of valuable antiques in gold, marble, and ancient pottery has also been found in these newly-uncovered ruins. These have been dispatched to the Hermitage at St. Petersburg. M. Formakovski, however, is carefully examining every antique unearthed, to establish its genuine character, as it was on this site that the spurious tiara of Saitapharnes, now in the Louvre, was alleged to have been discovered.