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NEW YORK, SATURDAY, JULY 29, 1899.

THAT AIR RESISTANCE PROBLEM.

Our discussion of the air resistance problems involved in the recent bicycle ride, paced by a locomotive, has brought to the editor's desk a considerable amount of correspondence and a varied assortment of theories. Most of the writers of these letters are laboring under a common delusion with regard to the nature of the assistance rendered by the locomotive, or by any form of "pacing" machine, mechanical or human, to the rider who follows it. The error is aptly expressed in the letter of a correspondent which we publish in another column, where he says, "if Murphy had taken his feet off the pedals after he had attained his maximum speed, he would have finished just as soon as he did," for the reason that the "suction or inrush of wind behind the train," amounting to "seven horse power of wind at his back," drove him along the track and rendered all exertion on his part superfluous. Our correspondent is by no means alone in his belief that the rider, to use a common expression, was "sucked along" behind the train, and *nolens volens* had to follow it at a speed of over 62 miles an hour.

Perhaps the best way to realize the nature of the assistance rendered to Murphy by the locomotive is to consider the conditions if he were to ride over the course at his fastest speed without pace. The resistance when he had reached full speed, supposing the track to be level, would be made up of the rolling resistance between the tires and the track, the internal resistance (friction of bearings, etc.) of the bicycle, and the air resistance. If our readers will turn to our article on this subject in the SCIENTIFIC AMERICAN of July 15, they will find two diagrams which show that the loss by friction in a special racing bicycle is only from one to five per cent, being less the greater the work that is being performed; and that with highly inflated tires the work absorbed in overcoming rolling resistance is also reduced to a minimum, especially on a smooth board track, such as that on which the trial was made. This leaves the air resistance as the chief obstacle to speed.

Let us suppose that he could ride the mile, unpaced, in two minutes, or at the rate of 30 miles an hour, and that the disturbance caused by his passage through the atmosphere were made visible by some system of coloring, the still air being colorless and the moving air colored. We should then find that a blunt wedge-shaped mass of rather dense air was pushed forward in front of him and a longer wedge of slightly rarefied air was drawn forward after him, the base of the wedge being of course in each case at his body. The rider in addition to the air carried before and behind him would also be surrounded by an envelope of eddying air, moving forward with him but at a greatly reduced speed. The sum total of the resistance of the atmosphere to the movement of the rider and the air which he carried with him, would be found to average so many pounds to the square foot, assumed in our article as equivalent to 15 pounds on 3 square feet of surface normal to the direction of travel.

Now in the case of a locomotive and car moving at 60 miles per hour, there would be the same piling up of the air in front and the same wedge of air following behind, and the same enveloping mass of air moving forward with the train at a slower speed. Speaking of the air which follows the car, we may say that relatively to the board track over which it passes, it is a 60-mile wind, and relatively to an object which, like Murphy, is moving within it at the same speed as itself, it is practically still air. As long as Murphy rode within this wedge of air, his exertions were directed solely to overcoming the internal resistance of the wheel and the rolling resistance of the tires on the track. For it is evident that the wedge of air, moving at the same speed as himself, could neither offer resistance from the front nor exert pressure from behind. The only way in which he could have experienced the pressure of a "60-mile wind behind him to carry him along," would have been by his motion being arrested, and the rush of air would last only until he had dropped out of the moving wedge of air that followed the train and the more slowly moving envelope which closes in and follows after it.

Another correspondent fails to understand why the air behind the moving car should assist the bicyclist and yet exert a retarding effect on a car in the same relative position and forming part of a train. The explanation is to be found in the difference of area of the bicyclist and the front face of a following car. Murphy, representing 3 square feet of area, could move back several feet from the rear of the shield and yet be within the wedge of moving air, but a car with its front area of say 80 to 90 square feet would expose a large percentage of its surface outside of this wedge, all of which exposed surface would offer resistance to the atmosphere, or, to speak more correctly, its passage would be resisted by the atmosphere.

A correspondent, whose letter is given elsewhere, assumes that the "body of air enveloping the entire train is swept along with it at about the same rate of speed," and, therefore, "small projections . . . add little or nothing to the resistance." In this we think he is entirely wrong. The action of a train on the air is fairly analogous to that of a ship on the water, where "skin friction," or the resistance of the surface of the hull to the sliding contact of the water, is so serious an element that yachts are built of costly alloys in order to reduce skin friction to the limit. The train does draw with it an envelope of air, but its speed is far below that of the train, and every projection on the latter, to say nothing of the broad front faces of the cars, adds to the retarding effect enormously.

ANNUAL REPORT OF THE COMMISSIONER OF PATENTS.

The Annual Report of the Commissioner of Patents cannot fail to produce general satisfaction, particularly when it is learned that some greatly needed reforms in the matter of the system of classification, which have been urged both by former Commissioners and the present incumbent of the office, have been at last carried out. This work is spoken of by Commissioner Duell as "the most notable advance of the year in the work of the office."

"The crying need of this bureau," says the Commissioner, "is for more room." This has been the plea of successive Commissioners for several years, and it is one which this journal has persistently urged on behalf of the vast commercial interests which have their root in the United States Patent Office. The building which was erected for and named after this bureau has been given up largely to the accommodation of the General Land Office, with the result that the overcrowding of the Patent Office has become notorious. The request of the Commissioner that "when the General Land Office vacates the Patent Office building," the Secretary of the Interior "will assign rooms sufficient for the needs of the bureau," finds emphasis in the vexatious delay to which the patrons of the Patent Office have so long been needlessly exposed.

Another crying defect in the accommodations of this bureau is that the priceless records of the office are stored in rooms which are in no sense fireproof—a fact which, if it were not so widely known, would at this late day seem almost incredible. The public will fully indorse the Commissioner when he says, "In view of the fact that millions of dollars of property would be jeopardized by the destruction of our assignment records—many of the original assignments having been lost by their owners, who depend upon duly certified copies—and in view of the fact that many of our other records are largely of a nature that money could not replace, I believe that a fire-proof structure should be provided in which to store them."

The summary of the operations for the fiscal year shows that 41,930 applications and caveats were received, and that the patents granted and trademarks, labels and prints registered numbered 25,404. The number of patents that expired was 16,670. The total receipts of the office were $1,209,554.88; the total expenditures were $1,148,663.48, the surplus turned into the Treasury being $60,891.40. A comparative statement of receipts and expenditures for the past decade shows that the total receipts were $12,700,977 and the total expenditures $10,971,338, making a total surplus of $1,729,637 in ten years.

A significant indorsement of the valuable work done in the new classification, to which reference has been made above, is found in the table showing the number of applications awaiting action on the part of the office in each year of the past decade. Commencing with 6,585 cases in 1890, the total rose to 9,447 in 1892 and then fell to 4,927 in 1895. It had doubled in the following year, and rose to over 12,000 in 1897 and 1898. By June 30 of this year, thanks to the working of the new system and an increase of the force of examiners, backed by a more liberal appropriation, the number of applications awaiting action had fallen to 2,989, a decrease of over 75 per cent.

As the result of the Spanish war the total number of applications, which in 1897 had risen to 47,747, fell in 1899 to 40,320, the smallest record for the decade being 39,206 in 1894. The present indications, however, show a steady increase in the business of the bureau.

EXPORTATIONS OF WHEAT FLOUR.

The millers of the United States have made their greatest record in the fiscal year 1899. While it is true that wheat, corn, oats, cornmeal, rye, and, in fact, all other lines of breadstuffs show a reduction of exportation on account of the decreased demand abroad, flour alone shows an increase which is a phenomenal one. For the fiscal year the total exportation of flour is over 18,000,000 barrels, representing over 80,000,000 bushels of wheat. The exportation of flour from the United States has made its chief development since 1875. Prior to that date American millers followed the old processes in the manufacture of flour, where European millers were experimenting with, and bringing to success, the modern roller-mill methods. As a result, the foreign flour trade of the United States met with serious reverses during the period from 1850 to 1875, the European consumers preferring to buy their wheat and make it into flour with their new processes. In 1854, according to a prominent American miller, we sent 1,846,000 barrels of flour to Great Britain alone, while in 1865 only 200,000 barrels were sent to all Europe. During the period 1825 to 1830, over 99 per cent of the value of wheat and flour exports was flour; in the five years 1870 to 1875, only about 27 per cent of wheat and flour exports was in the form of flour. In 1875 the exportation of wheat flour was 3,973,128 barrels. In 1880 it was almost double. In 1885 it was nearly 11,000,000, and in 1895 it had risen to 15,268,892, while in 1899 the figures were 18,300,000 barrels. This is a most gratifying increase and is in the line of our success in the exportation of manufactured articles. It is especially pleasing to note the quantity of flour sent to the Orient; in 1889, 378,634 barrels were sent to Hong Kong, and in 1899 over 1,000,000 barrels were sent. Germany is also becoming a good customer for flour, and we are now sending her 500,000 barrels against 13,000 barrels ten years ago. The Netherlands are also taking 1,000,000 barrels, an increase of 900,000 barrels in ten years. To the United Kingdom our exports of flour in 1889 were 5,271,244 barrels, and in 1899 they will exceed 10,000,000 barrels. That flour exports should have continued to increase in the face of the reduction of our exportation in other lines of breadstuffs is especially gratifying to those interested in seeing American labor participate as much as possible in the profits of American foreign trade.

THE HEAVENS IN AUGUST.

BY GARRETT P. SERVISS.

In August evenings one looks directly south to see the crossing place of the Zodiac and the Milky Way. The line of the former is indicated by the constellations Scorpio and Sagittarius. The red star Antares, with its third magnitude white attendants, one on the west and the other on the east, marks the heart of Scorpio; while Sagittarius, further to the left, is recognizable by the figure called the Milk Dipper, with its bowl upside down, in the streaming Galaxy. Falling from near the zenith, in immense luminous sheets, whose soft glow recalls the appearance of such a cataract as the Staubach when its descending clouds of water-dust are gleaming in the moonlight, the Milky Way justifies the rhetorical figure, often applied to it, "a river of stars." Its brightest portion runs from Aquila, whose chief star, Altair, has two attendants resembling in position those of Antares, down through the little constellation of Scutum Sobieskii, where it breaks into silvery flakes of wonderful beauty, and then descends to the southern horizon across the western part of Sagittarius, while a kind of setback from the main current overflows the eastern region of Scorpio, and the feet of Ophiuchus above. It is the California of the sky, packed with the riches that the star-gazer seeks with his telescope.

While the south glows with these splendors there is near the zenith a single star almost capable of matching alone the united beauty of Zodiac and Galaxy, the star Vega, or Alpha Lyræ. It, too, has a pair of attendants, but they are only of the fourth magnitude, and, instead of standing one on either side of their chief, they mark out with it the corners of a little triangle. The coronet of dazzling blue which surrounds Vega in the telescope is extremely beautiful.

Vega is demonstrably a far greater sun than ours—possibly a thousand times greater—and toward that wonder of the star depths the solar system is flying at the rate of at least 800,000 miles a day. If it should turn out that the solar motion is almost directly toward Vega, interesting experiences are doubtless in store for our descendants some hundreds of thousands of years hence. Our so steady seeming earth belongs to a family of incorrigible adventurers, and its changes of scene were by no means exhausted when the poles sweated with tropic heat, or when ice mountains glittered upon New England. More than once science has wondered whether the endless voyaging of the planet may not be concerned with some of these alternations of climate and temperature. Here is food for reflection as one gazes at Vega sparkling in the summer evening air, and remembers how we are speeding to meet, or to pass, it.

THE PLANETS.

Mercury, in Leo, is an evening star rapidly approach-

ing the sun, with which it is in inferior conjunction on the 19th. At midnight on the 21st Mercury and Venus will be in conjunction.

Venus, which during August crosses Cancer from west to east and passes into Leo, is a morning star, fast nearing the sun. Venus is in perihelion on the 20th. Judging by what is at present known of the position of its poles of rotation, Venus has no such alternation of seasons in each hemisphere as the earth experiences, but, on the contrary, enjoys practically unchanging climatic conditions over its entire surface. This fixedness of climate is emphasized by the comparative lack of eccentricity in the planet's orbit, its change of distance from the sun between aphelion and perihelion amounting to only 940,000 miles, as against 3,000,000 miles in the case of the earth.

Mars, in Virgo, remains an evening star throughout August, and in fact until the end of the year. But it is too near the sun and too far from the earth to present an interesting appearance.

Jupiter, also in Virgo, continues to be a conspicuous phenomenon in the early evening. Observers during the present year have noted many interesting details among its spots and belts. Not only do different spots move at different rates of speed, but the velocity of particular spots, or of the currents in which they are carried, varies apparently in accordance with some periodic law. Not many phenomena of Jupiter's satellites are conveniently visible in August on account of the early setting of the planet. On the 1st Satellite II. will disappear in eclipse at 7 h. 12 m. 18·75 s., and will reappear from eclipse at 9 h. 27 m. 37·9 s. On the 14th the shadow of Satellite I. will be seen on the planet as soon as the darkness of the sky is sufficient to render observations feasible, and will remain in sight until 9:27 P. M. Seventeen minutes before the shadow of I. passes off, Satellite III. will appear advancing upon the opposite edge of the disk.

Saturn, in Ophiuchus, is excellently placed for observation during the evenings of August. Between Scorpio and Sagittarius, it readily attracts the eye with its clear, steady light, exceeding the brightness of a first magnitude star. The rings are not quite so widely opened as in July, although the difference is slight. It is the north side of the rings and the northern hemisphere of the planet which are presented to view. Saturn's brightest satellite, Titan, can easily be seen with a small telescope, and is recognizable from its motion. Anyone may watch it making a complete revolution between the 5th and the 21st. On the first and again on the last of those dates it will be at its greatest western elongation from the planet. Its course lies from west through north, east and south. It reaches northern conjunction on the 9th, eastern elongation on the 13th, and southern conjunction on the 17th.

Uranus is in Scorpio and Neptune in Taurus.

THE MOON.

New moon occurs on the 6th, first quarter on the 14th, full moon on the 20th, and last quarter on the 27th. The moon is nearest the earth on the 20th and farthest from the earth on the 6th. The lunar conjunctions with the planets occur as follows: August 2, Neptune; 5th, Venus; 7th, Mercury; 10th, Mars; 13th, Jupiter; 15th, Uranus; 16th, Saturn.

METEORS.

The celebrated shower of the August meteors is due on the night of the 10th, their radiant point being in the constellation Perseus, which rises in the northeast. Mr. Denning has shown that these meteors continue to meet the earth for a month or more, beginning in July, but their maximum on August 10 is alone interesting to the casual observer. These meteors sometimes leave trails and exhibit fine colors.

REPORT OF THE COMMISSIONER OF PATENTS FOR THE FISCAL YEAR ENDING JUNE 30, 1899.

The following report of the Commissioner of Patents setting forth the condition of the Patent Office for the fiscal year ending June 30, 1899, has just been received.

DEPARTMENT OF THE INTERIOR.

UNITED STATES PATENT OFFICE.

WASHINGTON, D. C., July 15, 1899.

THE SECRETARY OF THE INTERIOR:

SIR: Complying with the request contained in your letter of June 15, 1899, I beg to submit herewith the following report of the business of the United States Patent Office for the fiscal year ended June 30, 1899:

APPLICATIONS AND CAVEATS RECEIVED.

Applications for letters patent	35,352
Applications for design patents	2,292
Applications for reissue patents	91
Applications for registration of trademarks	1,861
Applications for registration of labels	612
Applications for registration of prints	112
Caveats	1,610
Total	41,930

PATENTS GRANTED AND TRADEMARKS, LABELS, AND PRINTS REGISTERED.

Letters patent granted (including reissues and designs)	23,550
Trademarks registered	1,406
Labels registered	372
Prints registered	76
Total	25,404

PATENTS WITHHELD AND PATENTS EXPIRED.

Letters patent withheld for non-payment of final fees	4,021
Letters patent expired	16,670
Applications allowed awaiting payment of final fees	8,055

RECEIPTS AND EXPENDITURES.

Receipts from all sources	$1,209,554.88
Expenditures (including total in all appropriations)	1,148,663.48
Surplus	$60,891.40

APPLICATIONS AWAITING ACTION.

Number of applications awaiting action on the part of the office on July 1, 1899	2,989

COMPARATIVE STATEMENT.

	Receipts.	Expenditures.
June 30, 1890	$1,347,203 21	$1,081,173.56
June 30, 1891	1,302,794.59	1,145,502.90
June 30, 1892	1,268,727.35	1,114,134.23
June 30, 1893	1,288,809.07	1,111,444.22
June 30, 1894	1,183,523 18	1,053,962.38
June 30, 1895	1,195,557.07	1,038,166.08
June 30, 1896	1,307,090 30	1,097,368.85
June 30, 1897	1,343,779.44	1,088,473.16
June 30, 1898	1,253,948.44	1,092,449.83
June 30, 1899	1,209,554.88	1,148,683.48

APPLICATIONS FOR PATENTS INCLUDING REISSUES, DESIGNS, TRADEMARKS, LABELS, AND PRINTS.

June 30, 1890	43,810
June 30, 1891	43,616
June 30, 1892	43,544
June 30, 1893	43,589
June 30, 1894	39,206
June 30, 1895	41,014
June 30, 1896	45,645
June 30, 1897	47,747
June 30, 1898	44,216
June 30, 1899	40,320

APPLICATIONS AWAITING ACTION ON THE PART OF THE OFFICE.

June 30, 1890	6,585
June 30, 1891	8,911
June 30, 1892	9,447
June 30, 1893	8,283
June 30, 1894	7,076
June 30, 1895	4,927
June 30, 1896	8,943
June 20, 1897	12,241
June 30, 1898	12,187
June 30, 1899	2,989

Summarizing these tables, there were received in the last fiscal year 35,352 applications for mechanical patents, 2,292 applications for designs, 91 applications for reissues, 1,610 caveats, 1,861 applications for trademarks, 612 applications for labels, and 112 applications for prints. There were 23,550 patents granted, including reissues and designs; 1,406 trademarks, 372 labels, and 76 prints were registered. The number of patents that expired was 16,670. The number of allowed applications which were by operation of law forfeited for nonpayment of the final fees was 4,021. The total receipts of the office were $1,209,554.88; the total expenditures were $1,148,663.48, and the surplus of receipts over expenditures, being the amount turned into the Treasury, was $60,891.40.

CURRENT WORK.

On June 27, 1898, every examiner had his new work within one month from date of filing, and his amended work within fifteen days of date. This is the first time since December, 1889, when the present form of weekly reports was adopted, that such a report has or could have been made.

ORGANIZATION OF THE CLASSIFICATION DIVISION.

The most notable advance of the year in the work of the office has been the establishment of a classification division, and its entry upon a thorough revision and extension of the classification of patents and printed publications, the examination of which lies at the foundation of our patent system. The necessity for this work, after being repeatedly called to the attention of Congress, was finally recognized, and an Act entitled "An Act for Revising and Perfecting the Classification of Letters Patent and Printed Publications in the Patent Office," was passed by Congress, and received the approval of the President on June 10, 1898, and went into force at the commencement of the fiscal year. Before beginning the work of classification the principal examiners, and other members of the examining corps, were invited to give their views upon the subject, and after giving careful consideration to the same, an order establishing a classification division was made on November 17, 1898, and the division placed in charge of a principal examiner with the title of "Chief of the Classification Division."

As a preliminary step it was considered desirable to ascertain how much of the material was available, and to that end it was decided to rearrange the original drawings of all patents in numerical order and to prepare a list on which they could be checked. These drawings were heretofore arranged by sub-classes, and it was necessary to know the classification of a patent before it could be found, which often necessitated a long search. By the numerical arrangement it is possible to find it at once, and at the same time much storage space is saved. The arrangement of these drawings numerically was at once commenced, and as the first ten thousand patents had no numbers and were only identified by name and date, considerable additional labor was involved to find and properly arrange such earlier patents. The entire work of arranging the drawings of nearly eight hundred thousand patents and trademarks has been substantially completed.

While the arranging of the drawings was proceeding the work of classification has also been going on. This involves the careful consideration of each patent in order to place it in its proper class and sub-class. Many of these patents have to be read to be fully understood, and much care must be taken to select titles which will clearly indicate the contents of each sub-class and to preserve clear lines between them. Cross references are also necessary between sub-classes of the same class by reason of the presence of mixed matter in the same patent. A system of card index of sub-classes and other details have been perfected, which will make it possible to detect and remedy any losses. Arrangements have also been made for the preservation of the classification and for the prevention of unauthorized changes by retaining under the supervision of the classification division all patents hereafter granted.

Owing to the lack of space it has been deemed advisable to detail only a small force up to the present time, but while awaiting the additional space that will be available when the General Land Office removes from the Patent Office building, I have authorized the chief of the classification division to select one assistant examiner in each examining division to commence work on the classification of his own division, retaining his desk therein, but acting under the orders of the chief of the classification division.

It is already patent that the work of the classification division will prove a great benefit to the office, increasing the accuracy and rapidity of searches, and that the public will experience corresponding benefits. It will also produce a corps of experts in classification who will become more familiar with all classes of the office than would be possible were their services confined to a single division, and those who operate in a single division will become more thoroughly acquainted with other classes than they would in working solely in making examinations. During the present fiscal year I expect to see great advances made in the work of classification. The chief of the classification division deserves much credit for what has already been accomplished under his direction, especially in view of the limitations that have necessarily been placed upon him.

ROOM.

This one word expresses the crying need of this bureau. With adequate room whereby our records and stock can be made accessible and the clerical divisions suitably rearranged, our present force can accomplish much more work in a given time and fill all orders with business promptitude.

I earnestly beg that when the General Land Office vacates the Patent Office building you will assign rooms, so far as possible, sufficient for the needs of this bureau. In view of the fact that millions of dollars of property would be jeopardized by the destruction of our assignment records—many of the original assignments having been lost by their owners, who depend upon duly certified copies—and in view of the fact that many of our other records are largely of a nature that money could not replace, I believe a fireproof structure should be provided in which to store them. The American Society of Mechanical Engineers, representing the leading manufacturing engineering interests of the country, as well as other similar organizations, have forcefully urged the erection of such a bullding.

LEGISLATION.

Some general legislation increasing the powers of the Commissioner of Patents, acting under the direction of the Secretary of the Interior, would be beneficial. I refer among others to a readjustment of salaries and a reclassification of the clerical force; authority to dispose of models of expired patents; and the exchange or sale of books in the Scientific Library, not necessary for the use of the office, coupled with authority to replace them with modern scientific works. In submitting my estimates for the next fiscal year these and other matters requiring legislation will be referred to more in detail. Respectfully submitted,

C. H. DUELL, Commissioner.

NEW FEATURES IN THE SCIENTIFIC AMERICAN.

In the future issues of the SCIENTIFIC AMERICAN and the SUPPLEMENT, there will be a rearrangement of the class of reading matter which has appeared in these two publications under the generic term of "notes." The SCIENTIFIC AMERICAN will, in the future, contain each week the Engineering and Electrical Notes, which have formerly been published in the SUPPLEMENT, while the column of Miscellaneous Notes and Receipts will hereafter make its weekly appearance in the SUPPLEMENT. The page containing valuable Trade Suggestions from American Consuls in all parts of the world, which has proved to be of such widespread interest to our readers, will continue to form an important feature of the SUPPLEMENT. The publication of a page of Engineering, Electrical, and Science Notes in the SCIENTIFIC AMERICAN will provide its readers with a digest of the general technical news of the week, in which the many items which do not call for an extended treatment will be condensed into brief paragraphs which will be by no means the least readable of the paper.