

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	1,148,663.48

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 30, 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 non-payment 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 building.

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.

**Calcium.**

M. Moissan, of the University of Paris, who has been successful in the extraction of the rare metals in the electrolytic furnace, has recently undertaken a series of experiments with the metal calcium, which, although abundantly distributed in nature in the state of carbonate, sulphate, etc., has not up to the present time been prepared in any considerable quantity in the pure state. It will be remembered that at the commencement of the century Sir Humphry Davy was the first to establish the existence in lime of a metallic body, and by decomposing it by an electric current in the presence of mercury he obtained an amalgam of the metal calcium. Later on, in 1855, Matthiessen electrolyzed a mixture of chloride of calcium and chloride of strontium, and thus obtained small globules of calcium having a yellow color. A few years later Jobin prepared the metal by a purely chemical process, causing the metal sodium to react upon iodide of calcium in fusion contained in an iron crucible; however, the quantity of metal obtained was small, 300 grammes of iodide giving but 6 to 8 grammes of calcium globules. After other experiments, scarcely more advantageous, M. Moissan has been the first to obtain a relatively considerable weight of the metal. He employs two methods; in the first, which is purely chemical, he utilizes the property which calcium possesses of dissolving in liquid sodium at a dull red heat. In an iron crucible of one liter capacity are placed 600 grammes of anhydrous iodide of calcium, together with 240 grammes of sodium. The whole is heated to dull redness, at which temperature the sodium unites with the iodine of the iodide of calcium, and the calcium set free dissolves in liquid sodium, which is in excess. Upon cooling it crystallizes in the middle of the mass of sodium, and by proper separation one may obtain brilliant hexagonal crystals of pure calcium. The amount of the latter is equal to 50 per cent of the theoretical weight contained in the iodide, and 40 grammes have been obtained at a single operation.

The second process employed by M. Moissan consists in the electrolysis of iodide of calcium in fusion at a dull red heat. A cylinder of pure nickel is used for the negative electrode, and for the positive a rod of graphite. The calcium thus prepared has been examined as to its physical and chemical properties. Among its physical properties may be mentioned the following: it may be melted in vacuo at a temperature of 760° C. and then appears as a brilliant liquid. After cooling, the metal is rather soft and may be cut with a knife. It may be broken by striking it, and the fracture presents a crystalline structure. Its surface, when it has not been attacked by gases, is of a clear white color, approaching that of silver. Its density is 1.85.

As to its chemical properties, calcium when brought to redness unites with hydrogen, forming a crystalline hydride; it combines with chlorine at 400° C., and with bromine and iodine at a dull red heat. In oxygen the metal, when raised to 300° C., gives a brilliant combustion. It decomposes water at the ordinary temperature, and also decomposes sulphurous acid gas with incandescence. When heated in carbonic acid gas, it becomes covered with a deposit of carbon. Calcium combines with sulphur at 400° C., and burns with incandescence in the vapor of phosphorus. It unites with carbon in the state of lamp black below redness, and produces calcium carbide. Calcium when cold does not unite with nitrogen, but when heated in that gas it absorbs it slowly, and the metal, at first brilliant, assumes a yellow color. This explains why the alloys of calcium, which up to this time were regarded as the pure metal, were all more or less yellow, this color being due to the nitride. The latter compound is obtained in transparent crystals of a yellow-brown color, melting at 1200° C.

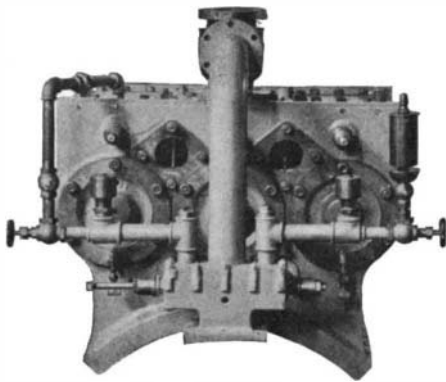
SOME Greek divers have recently discovered a treasure-ship which was sunk near Chios, where,

in 1770, the Turkish fleet was totally destroyed and the Russian flagship was sunk. The latter was found thirty fathoms deep, and over \$60,000 in gold and silver has been obtained from the hold of the flagship.

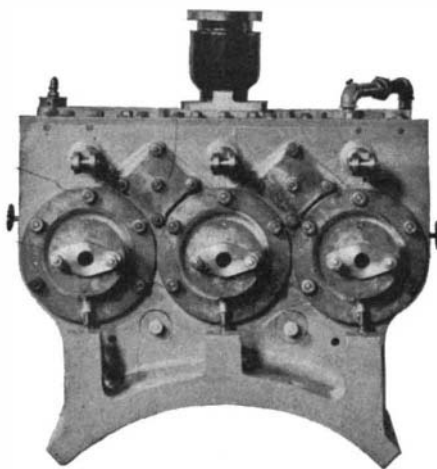
**A HUGE OVERLAND TRACTION ENGINE.**

One of the largest traction engines ever built was recently completed by the O. S. Kelly Company, of Springfield, Ohio, and shipped to Cuba, where it has been used with considerable success on one of the largest sugar plantations.

The engine is essentially a triple-cylinder geared loco-



FRONT VIEW OF CYLINDERS.



REAR VIEW OF CYLINDERS.

motive with enormous drive wheels, especially adapted to the roads over which they are to travel. The three cylinders with their valve-chests form a single large casting placed on the forward end of the boiler. Steam passes directly from the boiler to the central steam-chest and thence to the outside chests. The engine has a three-throw crank-shaft with cranks 120 degrees apart, fitted with three pairs of eccentrics. As the point of cut-off is carried late enough always to insure admission of steam to two pistons, heavy loads are easily started. The boilers are of the locomotive type with grate surfaces varying from 9 to 12 square feet. The boiler pressure is 180 pounds per square inch. The engine gives a continuous tractive force of 12,000 pounds at

the wheel rim, moving at a rate of 330 feet per minute; the horse power developed is therefore 120.

The drive-wheels are eight feet in diameter and are built up from center castings to which side sheets are riveted. The steel plate tires are provided with cleats four inches wide and two inches thick, extending completely across the face at such an angle and distance apart as to insure the complete bedding of one cleat on each wheel before the preceding cleat has left the ground. The front wheels are five feet in diameter, and are similarly constructed. Steering is effected by the usual hand-wheel, worm, and shaft, fitted with chains secured to the front axle.

By the use of steam traction-engines pulling wagons adapted to the kind of freight which they are to contain, not only may large loads be readily transported, but an economy is effected even in countries where beasts of burden are cheap and easily obtained. With a grade not exceeding five per cent, a load of thirty tons exclusive of engines and wagons can be hauled thirty miles per day. Over dry, natural soil, even 112 tons have been hauled. The engines are adapted to haul freight from plantations and from mines so remote from railways that the transportation of low-grade ores becomes unprofitable.

**Hardening Articles of Plaster of Paris.**

A German patent has been granted for the treatment of articles of plaster of Paris with an aqueous solution of ammonium borate, for the purpose of hardening them and rendering them insoluble in water. A simple and efficient process for accomplishing this object would be highly desirable, as it would serve to greatly prolong the life of plaster casts, which being quite soft and not entirely insoluble, sooner or later become superficially defaced, and washing specially wears down the outlines of the object.

The process above referred to is said to give results decidedly superior to anything that has heretofore been proposed. The hardening liquid may either be mingled with the plaster in the act of moulding or may be applied on the surface of the finished casts with a brush.

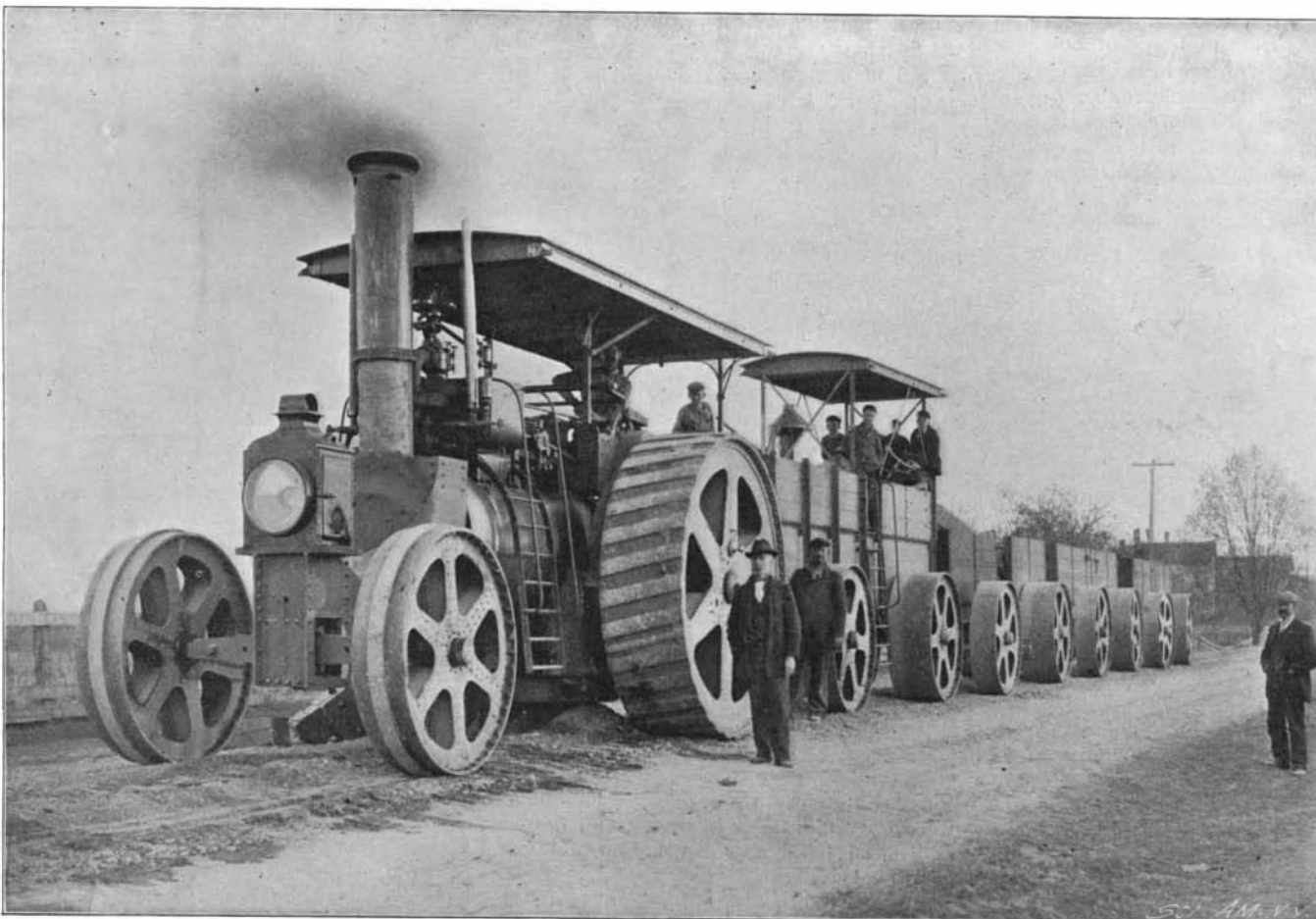
The solution is prepared by dissolving boracic acid in warm water and adding thereto sufficient ammonia to form the borate which remains in the solution.

The manner of using the solution is thus described: The saturation of the gypsum or painting of the plaster of Paris is carried out in the cold. The objects are subsequently rinsed off and dried. The surface becomes very hard after two days and insoluble in water, while the induration in the interior advances more slowly. By means of the fluid described, gypsum floors can be hardened and rendered more durable and impervious to the influence of the weather. Saturating with ammonium borate is said to be especially useful on exterior walls of buildings, barracks, etc.; on the latter, because experiments have proved an anti-septic action of the liquid.—Journal of Franklin Institute.

**A Southern Exposition.**

A Southern Exposition will be held in the Grand Central Palace, New York city, October 31 to November 25, 1899. Its aim will be to display the commercial

resources of the Southern States and to show the use which has been made of them. It is believed that the exposition will be of vast benefit in attracting capital to the Southern States, where there are great opportunities for investment. The present is a particularly auspicious time for the display of Southern products in the North, owing to the new era of good feeling, and a warm reception is assured to the Southern visitors. The mineral wealth of the South will be suitably illustrated, and also its industries. Col. John J. Garnett is the Director of the Exposition, and the advisory committee includes prominent men.



THE TRACTION ENGINE AND ITS LOAD UNDER WAY.