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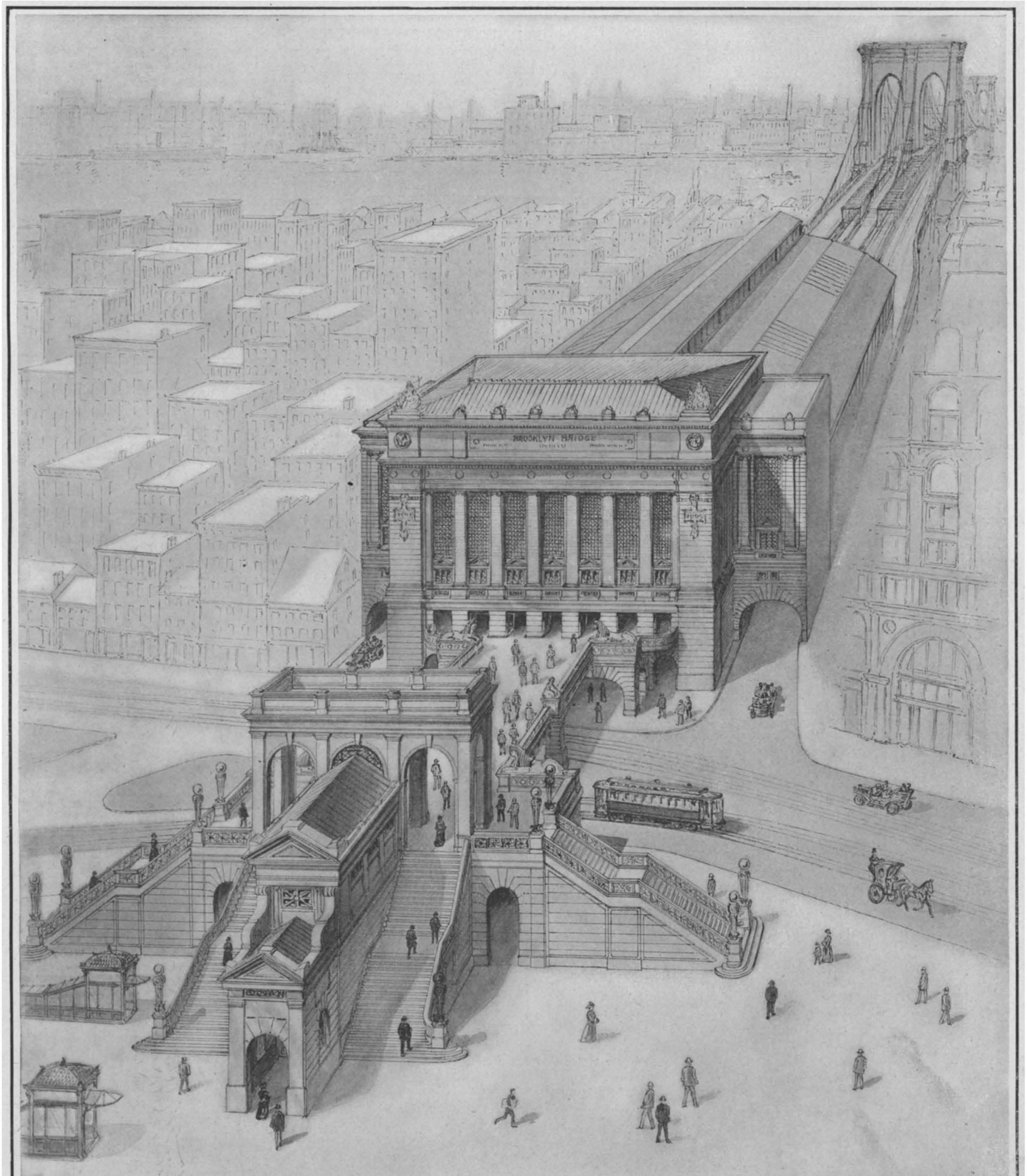

The Present Station and Temporary Extension Across Park Row Will Ultimately be Removed and the Above Classic Structure Will be Built in Its Place.

THE NEW TERMINAL STATION AND APPROACHES OF THE BROOKLYN BRIDGE.—[See page 94.]

SCIENTIFIC AMERICAN

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NEW YORK, SATURDAY, FEBRUARY 8, 1908.

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.

THE HUDSON RIVER PIERHEAD LINE SHOULD BE EXTENDED.

The port of New York labors under a serious disadvantage because of the very high rental charged by the city for piers used by the various shipping lines. This is one of the causes why other North Atlantic ports have gained at the expense of New York; for we understand that in these ports the piers for ocean steamers are offered either without cost or at a nominal charge. The enormous outlay by the city for its latest piers, known as the Chelsea improvement, was due primarily to the obstruction of the engineers of the War Department, who refused to allow the new 800-foot piers to be extended beyond the pierhead line, and by their refusal made it necessary to dig out the shore front to the necessary extent. The work on these piers, up to date, has cost the enormous sum of $12,500,000, which was the sum expended for the property and improvements up to December 31, 1906, and does not include the cost of the construction of pier sheds and bulkhead buildings.

Now, in view of the fact that the center of business in New York is steadily moving farther uptown, the question of increased pier facilities to keep pace with this movement becomes of prime importance; and, during the past five years, the matter of the extension of the pierhead line to provide room for piers of the greater length necessitated by modern shipping, has been repeatedly taken up with the War Department. The Department's engineers have opposed any extension of the line, on the ground that it would unduly contract the fairway of the river. Now, while we do not dispute the wisdom of the War Department in safeguarding the natural waterways of the country, we think that in particular cases, such as this, a principle, good in itself, may be pushed too far. Too much praise cannot be given to the army engineers for the jealous way in which they have conserved for the use of the nation fairways which, but for their guardian care, would have been ruined in the interests of private ventures. At the same time, we believe that a matter of the importance of the improvement of the facilities at the port of New York should be made a question of judicious compromise. The width of the Hudson River between the pierhead lines on either shore is approximately 2,800 feet between Twenty-third and Thirtieth Streets, and 3,000 feet between Thirtieth and Fiftieth Streets. The pierhead line at present is 530 feet outshore at Twenty-third Street; and to accommodate piers 800 feet in length, the pierhead line would have to be extended about 100 feet riverward between Thirtieth and Fiftieth Streets, and from 100 to 287 feet between Thirtieth and Twenty-third Streets. Now, in view of the great width of the Hudson River, these encroachments would be comparatively insignificant. There would certainly still be left abundance of room for the handling of the river traffic, even when ocean liners of the greatest length were entering or leaving their piers. As matters now stand, even the new 800-foot berths are equaled in length by the largest ocean liners, and further progress in size must await the construction of longer piers. To follow the suggestion of the War Department, and dig away the shore line of Manhattan, would involve the destruction of the present fine marginal thoroughfare, which is so necessary to the handling of the heavy traffic of the river front.

PROGRESS ON THE NEW YORK BARGE CANAL—AND A SUGGESTION.

There is cold comfort for the people of this State in the report of Mr. Stevens, the Superintendent of Public Works, recently made to the Legislature; for it is announced that the rate of progress is so slow that the enterprise will be obsolete before its completion, and that the only scheme which will meet the demands of future transportation is a federal deep waterway from the Lakes to the Hudson River.

The 1,000-ton barge canal is to cost a little over $100,000,000, and at present the work under contract aggregates, in amount, $22,342,277. These contracts call for the practical completion of the canal for a distance of 131.29 miles, the erection of twenty-six bridges, and the construction of twenty-four locks and fourteen dams. All of this work was under contract prior to January 1, 1907; yet only a very small portion of it has been done, and the rate of progress, from the very start, has been small. Moreover, the work under contract amounts in dollars and cents to but little more than twenty per cent of the estimated cost of the canal, and the amount actually done reaches only twenty per cent of the amount under contract, or four per cent of the whole work.

After demonstrating that the final completion of this improvement seems, at the present rate of progress, to be indefinitely postponed, Mr. Stevens says that although the barge canal may be suited to compete with the present type of Canadian canals, the Canadian government has foreseen the need of a different type, and has undertaken to supply it in what is known as the Ottawa-Georgian Bay route. Surveys have been completed and plans and estimates made of the cost for a 21-foot ship canal, connecting Georgian Bay with the St. Lawrence River by way of Ottawa and Mattewa Rivers, and the Canadian Parliament is expected to make an appropriation for the construction of this canal during its present session. The Ottawa-Georgian Bay canal is planned to provide the shortest outlet by water for the grain, forest and mining products of the great Northwest; and it is pertinent to ask whether, with that route for shipment once opened, commerce can be changed so as to take the route through the lower lakes and across the State of New York, and particularly such commerce as is bound for European ports. Mr. Stevens points out that the simplicity of this route for a Canadian ship canal, and the enthusiasm always shown by the government in matters intending to enhance the glory of the Dominion, threaten, if they do not fully insure, the completion of this waterway before our own barge canal has been completed.

It is a well-recognized fact that commerce, once diverted to a certain route, is very difficult to regain. Moreover, when, in the indefinite future, we have completed our barge canal, what prospects of successful competition would a 12-foot barge canal have against a ship canal 21 feet in depth? The solution of the present problem, as suggested by the Superintendent of Public Works, is that the assistance of the federal government should be solicited for the construction of the 21-foot ship canal from Lake Erie to the Hudson River, careful surveys and estimates of which were made by the Board of Engineers on Deep Waterways, and submitted in the year 1900. The estimate of cost was $198,000,000, of which $42,500,000 was to be spent between Lake Erie and Lake Ontario, while $155,500,000 was to be spent in connecting Lake Ontario with the Hudson River by way of Oswego and the Mohawk River route. The route from the Hudson River to the westerly end of Oneida Lake was practically that which is being followed by the barge canal, and the route from that point to Oswego ran parallel to the Oswego River. Such a canal, instead of accommodating barges of 1,000 tons burden, would accommodate craft of a carrying capacity of 8,400 tons. It is suggested that the Legislature memorialize Congress to join with New York in constructing that portion of the barge canal route from the Hudson River by way of the Mohawk River, Oneida Lake, and Oswego River, as a ship canal of the type contemplated in the government surveys of 1900. It is estimated that the cost to the State, if its completion could be consummated, would not be greater than will be the cost of completing the barge canal. The benefits resulting from the substitution of a ship for a barge canal would be immediate and cumulative.

Now, here is a suggestion which is born of a broad and statesmanlike view of the whole situation. The question of the utility of any waterway from the Lakes to New York city is closely bound up with that of the action taken by the Canadian government in providing an opposition route. Were our barge canal completed to-day and in operation, it would, no doubt, bring to the State and to New York city certain benefits to secure which it was planned and authorized; for its direct competitor would be the existing Canadian canals from the Lakes to the sea, whose capacity is not so much the greater as to give them any overwhelming advantage. But to proceed with the construction of a barge canal, when our competitors are likely to complete a ship canal within the near future, would be to invite very certain disappointment and failure. We consider that the suggestion is worthy of wide debate throughout the State of New York, and of most careful consideration on the part of our Legislature; and this particularly in view of the fact that the cost to the State, if the completion of a 21-foot ship canal could be consummated, would not be greater than the cost of completing the lesser waterway.

THE RECENT CRITICISMS OF OUR NAVY.

Among the many letters to the Editor, thanking him for the recent *exposé* of the baseless attack on the ships of the United States navy, we quote the following from one of the most distinguished members of the House of Representatives, a member of the Committee on Naval Affairs:

"I cannot refrain from congratulating you upon your reply, in your issue of January 25, to the Reuterdahl attack on our navy. The attacks upon armor placement, freeboard, and turret construction are most unwarranted, and have been discussed by naval men of most competent attainments, for years. Condemning our present construction, taking examples of ships built several years ago, is most unfair and unpatriotic. One would not care for such an article written by so incompetent a critic, were it not for the damaging influence such a criticism may have, not so much here at home as in the foreign countries, where the articles will probably be copied and circulated, and where it is desirable that the strength and formidable character of our navy should be fully appreciated.

"Again congratulating you upon this reply you have made," etc.

A lawyer writes as follows from one of our Western States:

"When McClure's came out with its scream, I only replied, 'Wait until the Scientific American gets a crack at this article.' Reading it was one of the joys of my life. You are all right—the *figures* tell the story. Through your columns I have kept close account of our navy for years. The family interest ran so high, that my nephew has become a second-class man at the Academy. Your article ought to be in the hands of every patriotic citizen.

"I thank you also for the astronomical articles."

THE WORLD'S PRODUCTION OF CEREALS.

The commercial museum at Philadelphia has recently made diagrams representing the manner in which the world's production of cereals is distributed among the different countries.

M. H. Mallet, in the Bulletin of the Society of Civil Engineers, gives an explanation of these diagrams.

Wheat holds first place among the cereals, rising above the others both in its quantity and in its value. If one takes the least number of its production for the last five years, one finds an entire quantity of 3,160 million bushels of wheat, corresponding to a weight of 86 million tons. Three countries alone produce one-half of this enormous figure—the United States, 660 million bushels; European Russia, 541 million, and France 328 million. The other half is produced by the other countries of the world, in the following proportions: India, 286 million bushels; Italy, 159; Germany, 128; Hungary, 120; Spain, 115. Certain countries, because of their small population, and consequently their small interior consumption, export great amounts; thus, the Argentine produces 101 million bushels, Canada 91 million, Asiatic Russia 90 million, Roumania 75 million, Australia 54 million.

After wheat comes maize; its production reaches 73½ million tons, representing 2,896 million bushels. Three-quarters of this quantity are produced by the United States. England, which only produces 112 million bushels, exports, however, more maize than the United States. It is, indeed, the only true cereal that the old world takes from the new. It is cultivated in China, in Italy, in India, in Roumania, in Africa, and in other warm countries.

Oats go ahead of all the other cereals in volume, but not in weight, because of their low specific weight. The total production is 3,371 million bushels, giving a weight of only 49 million tons. The United States produces 871 million bushels, Russia 825, and these two figures represent more than half of the world's production. Germany figures with 449 million bushels, France with 268, Canada with 204, United Kingdom with 187, and Austria-Hungary with 196 million.

As to rye, Russia produces 890 million bushels, or more than one-half the amount produced by the rest of the world. Germany produces 372 million bushels, or more than one-fourth of the world's production.

Barley is cultivated extensively in all the countries where the vine cannot be grown, because this cereal is largely employed in the manufacture of beer. Russia produces 297 million bushels of it, Germany 145, United States 114, and Japan 80.

Rice probably comes immediately after wheat in importance. No statistics are available with regard to its production in China. The best authorities, though, estimate the number at 245 million tons, a number higher than the 217 million tons at which the production of India is placed.

In general, incorrect ideas are held upon the consumption of rice in China. The missionary Huc reports that in the provinces of the North, rice is not any more employed as a food than in France; one scarcely finds it except upon the tables of the rich; but in the South it is the only nourishment of millions of people.

Millet is largely cultivated in India, in China, in Russia, in Africa, in Japan, and in Italy. A variety known under the name of kaffir corn is grown on a large scale in Kansas. India produces 542 million bushels; China a great quantity, but probably less than India; European Russia 78 million; Asiatic Russia 15 million; Japan 12, and the United States 5.

It can be seen from that which goes before, that the United States outstrips by a goodly margin all other countries in its production of cereals. This production is, indeed, 92 million tons. The production of India, if millet be included, probably reaches 45 million. If the figures for the grains other than rice, produced in China, were available, this country would perhaps be second to the United States.

Europe, with the exception of Russia, with a population of almost 300 million, is outclassed by the United States in surface cultivated and in the production of cereals; but she always comes out ahead of the United States in the total value of the products of her general cultivation.

THE MAKING OF AN ELECTRICAL ENGINEER.

BY GEORGE FREDERIC STRATTON.

In the great shops of a well known electrical company are some three hundred young men, clad in workmen's garments, assembling small apparatus and testing dynamos, transformers, railway motors, and lighting appliances of every description.

These men have come from universities, colleges, and technical schools, not only in this country, but in all quarters of the civilized world. And they are supplementing the theories upon which they have spent years of study with the admirable practice to be obtained in the finely-equipped shops and the variety of apparatus manufactured.

This company has always had an eye to the future. Its excellent apprentice system is devised with a view to producing a company of expert workmen, from which may be drawn the future foremen, superintendents, and executive heads of departments. Its student' course is to provide for its future need of engineers on all classes of apparatus and equipment; to take charge of foreign and domestic installations of great power and lighting plants; to become managers of new shops, designers of new machinery, or commercial managers and assistants.

The qualifications necessary for a man entering on this student course are that he should have graduated from some college or technical school. Graduates from several of the correspondence schools (approved by the company) are also admitted.

The man who enters, however, is not estimated according to his college attainments. All start on the same basis and at the same nominal salary. The estimation and advancement come upon a demonstration of the quality of a man's work in the shops; upon his steadiness and reliability; his quickness in seeing errors or defects; his aptitude at grasping problems and solving them.

The course is for a period of four years, but no written agreement to this effect is required by the company. And it must be understood that the four years consist of fifty-two weeks each, excepting possibly two weeks for vacation each summer. In fact, the student is subject to exactly the same discipline and shop routine as the ordinary workman. His hours are the same—from 7 A. M. to 6 P. M.

There is no strictly defined routine of practice on this course. The general principle is to give the young man the opportunity to work some time in each department, and so familiarize himself with every type of apparatus manufactured. He usually commences by assembling small motors and becoming familiar with every detail of the machine. He then works for a period at testing generators, transformers, arc lamps, meters, etc., respectively, thus becoming acquainted with the nature and use of testing and measuring instruments, and also with the wonderful labor-saving devices and the accuracy of machine tools with which the shops abound.

He sees the methods of the great steel and iron foundries, and observes the materials used in building up the great turbo-generators. He is expected to acquaint himself with the methods of constructing and winding armatures and field coils; the various kinds of insulators; and the details and uses of switches, switchboards, meters, and controllers.

The work is by no means a sinecure. At much of it dirt, grease, and real labor are encountered by these students as by any mechanic in the shops. On transformer tests and tests of special apparatus, the work necessarily continues, frequently, for as long as thirty-six hours at a stretch; and it speaks well for these men that such work is rarely shirked. The dropping of one of these students for inefficiency or inattention is of the rarest occurrence.

In the course of from two to three years—it all depends upon the man's brightness—he will find his shop work more or less frequently broken by calls to go outside; to report on disaster to some outside plant; to examine, and probably adjust, machines which are working improperly; or to direct a crew of workmen installing new machinery.

He will also now come more in contact with the prominent engineers, and, if his choice so lies, may be taken into some special department.

This specializing is encouraged. Electrical problems have become so complex and diverse, that the man who achieves the greatest amount of usefulness and success is, undoubtedly, the one who devotes his energies and abilities to some particular line; and ample opportunity is afforded to students in this course to confine their attention to any one department for which they show unusual ability or aptitude.

In the engineers' departments he will have the opportunity of confining himself altogether to the manufacturing and designing details, or he can branch off onto the commercial side, with a view to qualifying himself for work in some one of the company's many district or foreign offices. The salesman of electrical apparatus is much more than an ordinary commercial agent. He is a consulting engineer. He must be thoroughly conversant with the construction and assembling of machines; with their capacities under greatly varying conditions; must have aptitude for understanding and explaining peculiar conditions, with a view to the designing of special apparatus to meet them. Many of the students are in special training for this department, while others are devoting themselves to the acquirement of a thorough knowledge of electrical practice.

Many high authorities are insistent upon the value of some commercial training for every engineer.

Dr. Louis Bell, in a recent interview, said:

"Sometimes—nay, often—it is a greater problem for an engineer to keep the cost of a plant or some of the apparatus within a given appropriation that it is to solve the engineering difficulties. And that is where a young engineer should be carefully trained, commercially, so that he will always avoid the risk of seriously injuring his newly-acquired reputation by designing something in which the demand of solidity and efficiency is sacrificed to that of cost. He should learn to say 'No!' when the insidious suggestion is made to cut down weight here or power there."

The advantage of this practical training—this acquired familiarity with the actual conditions of working apparatus as supplementary to the preliminary theoretical training—are incalculable. The student who is thoughtful, attentive, and ambitious, acquires by this method the qualities which must be combined in order to make the thorough engineer. Nerve and resourcefulness with machinery in times of emergency—presence of mind, tact, and ability to handle men; business knowledge and executive capacity—all this is requisite; and practice—and practice alone—can give it.

In addition to this practice, the embryo engineers have ample opportunity of keeping abreast of the times on theoretical lines, and in touch with the rapid advancements and changes in electrical science. A special engineering organization or club is designed for this purpose. Meetings are held monthly, at which lectures and addresses upon technical subjects are delivered by speakers of undoubted qualification, followed by discussions on the subject. This society also arranges and carries out visits to other plants of unusual interest, where the installation and operation of power for generating purposes, and of special apparatus, may be fully inspected and discussed.

Mr. H. W. Buck, in an article in the Scientific American says:

"In a stationary condition of art, a man with practical experience only may become very familiar with all the existing types of apparatus and, knowing their applications, may qualify, to an extent, as an engineer. But the extremely rapid growth of electric practice makes rapid change in the construction and operation of electrical machinery. The man of practice only is apt to fall behind; while the man with a knowledge of the theories and the formulas—with a mind trained to study and deductions—follows up the changes without difficulty, and is frequently one of the men to initiate such changes."

The opportunities ahead for these students are most promising. In the far Indies graduates of this training are harnessing the sacred streams and generating and conveying power and light hundreds of miles, over a country and against difficulties unknown here, and unforeseen there, until met and conquered.

Up toward the North Pole, installing arc lights to run through a six months' night; in distant Japan, operating railways for the gentle Oriental; stringing the cañons of the Rockies with transmission lines; putting the collar on the mighty Niagara and bringing a half million horse-power into productive subjection—everywhere you find them, meeting and battling with problems and difficulties, overcoming them, and in thus overcoming them, becoming stronger and more invincible themselves.

That's where these young men are going from the student course. All of them will become useful; many of them will acquire some degree of eminence; perhaps one here or there will rise to international fame—an Edison, a Thomson, or a Steinmetz.

In the electrical field the pace is swift—the marvelous of to-day is the commonplace of to-morrow. Peculiar characteristics or abilities in certain lines will find their opportunity in this industry, always provided they are coupled with the qualities which are requisite to success anywhere—vigor, pluck, patience, and good sense. A good general education, supplemented by a good technical education, and followed by the practice obtained among the machinery and apparatus of a great manufacturing corporation, comprises the nursery and training ground from which many of the future giants of electrical science and achievement will undoubtedly emerge.

SCIENCE NOTES.

A report was recently spread that the island of Laysan, in the Pacific, had disappeared from sight. This report was made on the authority of the captain of a schooner, who cruised for some days in what he believed to be the vicinity of the island, but was unable to find it. Later reports show that his reckoning must have been wrong, for several days after its supposed disappearance the United States government tug "Iroquois" touched at the island, on its way from Guam to Honolulu.

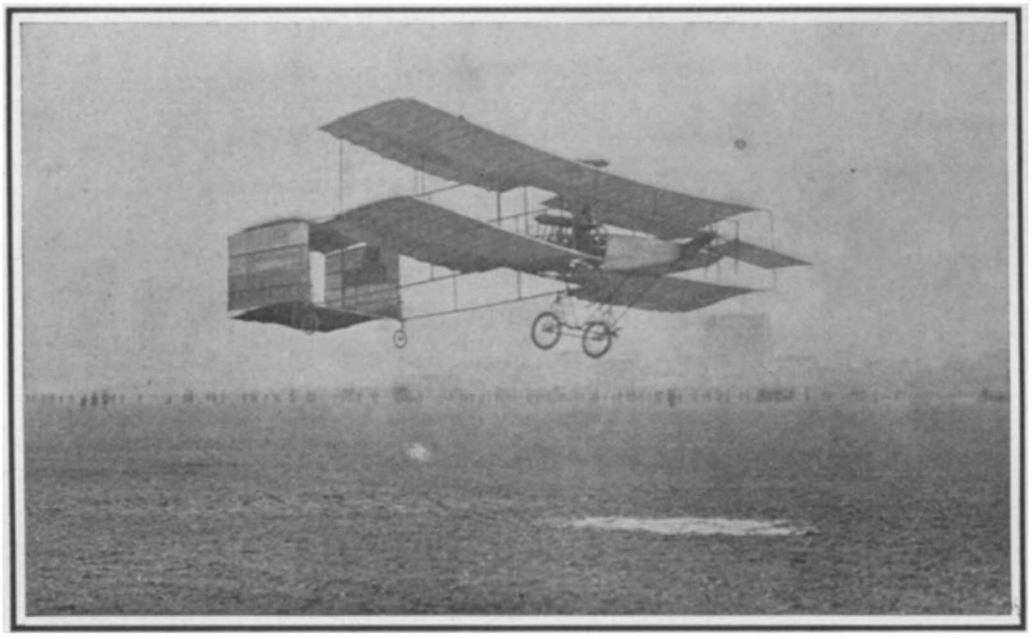
An experiment of some interest was carried out at Paris not long since upon a new method of preserving meat. By the present process the meat is kept in a special refrigerating room in which the desired degree of cold is produced by means of compressed air. A company has now been formed at Paris in order to work the process on a large scale. To produce the cooling effect, compressed air is allowed to expand suddenly by means of an apparatus which distributes the cooled air throughout the refrigerating chamber. It was desired to give a conclusive test of the system in the presence of experts, and accordingly the company fitted up an experimental refrigerating room in the basement of a building located in the center of town. The meat which was placed under test consisted of poultry and quarters of pork, and this could be kept for ten days without any difficulty. During the test, the meat was examined each day by experts in order to observe its condition, and at the end of the ten days the commission found that the samples were in a good state of preservation. The poultry was not wet nor was it frozen by this process, and it appeared to be the same as on the first day. The refrigerating machine is operated by an electric motor of small size which is coupled to it, and this machine is placed on the other side of the wall outside the cooling room. The compressed air is allowed to expand from the outside by this means into the chamber so as to produce the cooling. Refrigerator cars are to be built by the company, and they will have a special thermometer placed at the outside so as to see the temperature without opening the door. It is found that the cooling is well kept up and there is but little loss, so that the machine is only worked when the temperature rises. During the ten days' test it was required to work the machine for only three and one-half hours per day, and the standard temperature was kept a little above the freezing point. The cost was 40 cents a day, but can be lowered.

THE CURRENT SUPPLEMENT.

Despite the widespread advantages that have accrued to Egypt by the construction of the huge barrages at Assouan and Asyut, the Egyptian government has been so taxed by the poor floods of the river during recent years that a third barrage, similar to those already in existence, is now in course of construction, and will soon be completed. This barrage is located at Isna, and is described and illustrated in the opening article of the current Supplement, No. 1675. A good electrical article is that on the general cost of direct-current and single-phase alternating-current systems. Everyone is aware that theoretically there is still great room for improvement in the internal-combustion engine. The high temperatures which have been generated have been one reason why a certain amount of heat has not been converted into useful work. In the engine described in the current Supplement, a plan seems to have been hit upon for overcoming these difficulties. One of the English railways has recently introduced a new type of dynamometer car, which is described and illustrated. The manufacture of Bessemer steel rails is discussed.

THE PRIZE-WINNING CIRCULAR FLIGHT OF THE FARMAN AEROPLANE.

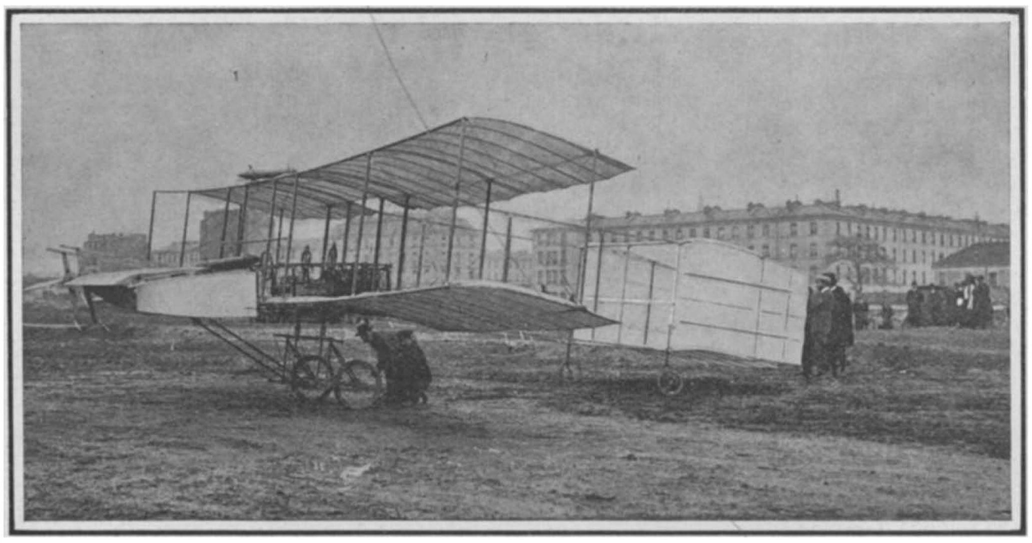
After but three months of active experimentation, Henry Farman, an Englishman residing in Paris, succeeded in winning, on January 13 last, the Deutsch-Archdeacon prize of $10,000 for a circular flight of one kilometer (0.621 mile) by an aeroplane or other heavier-than-air type of flying machine. Twice before, two days previously, he had accomplished this feat without touching the ground, but this was not done under the observation of the donors of the prize and the proper officials of the Aero Club of France.



Three-Quarter Front View of the Aeroplane in Flight.

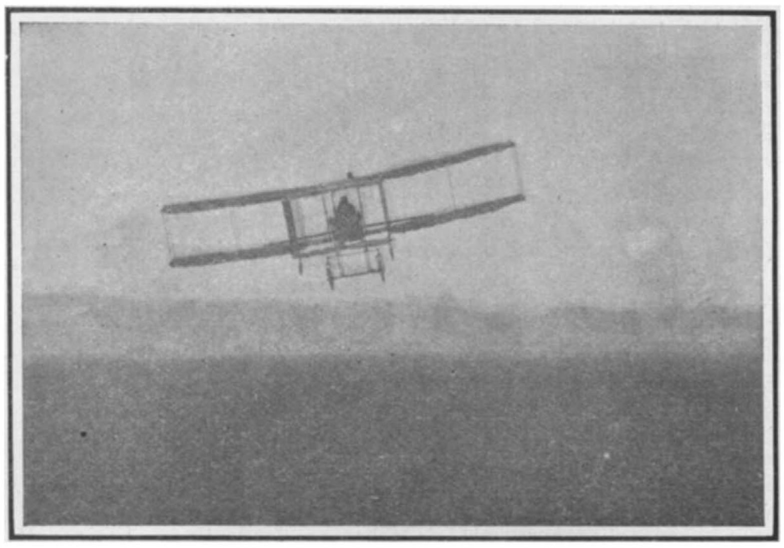
Note the notches cut in rear edges of the upper and lower planes at their centers for the purpose of allowing the propeller on the rear end of the motor crankshaft to turn.

The photographs reproduced herewith give an excellent idea of the appearance of the machine when making the prize flight. As can be seen from these pictures, it consists of two main planes, 12 meters (39.37 feet) long by 2 meters (6.56 feet) wide, and placed one above the other at a distance apart of 2 meters. At a distance of 4½ meters (14¾ feet) behind these planes are placed two other superposed planes, some 10 feet in length by 2 meters (6.56 feet) in width, i. e., in the fore-and-aft direction. These two latter planes serve as a balancing tail, and carry but little weight. They are connected together at each end by a pivoted vertical rudder, the two rudders being made to work in unison. The 8-cylinder, 50 horse-power gasoline motor is located at the rear part of the lower forward plane, half way between its ends, and it carries upon the rear end of its crankshaft a two-bladed propeller, 2.1 meters (6.88 feet) in diameter by 1.1 meters (3.6 feet) in pitch. A seat for the operator is provided just in front of the motor, while a single-surface horizontal rudder is mounted upon the front end of a quadrangular, tapered body, which extends out in front of the lower plane at a distance of 5 or 6 feet. The rudder which was first employed was a double one, but this was modified and changed to a single surface, placed a little higher than before, which was found to operate better. The rudder is in two halves, each half being on the outside of two stout, upwardly curved wooden supports. It is pivoted about 1/3 the distance back from its forward edge, and is operated by means of two lever arms set at right angles to its frame at the pivot point and connected by rods to the steering column in such a way that by rocking the latter in a vertical plane, this rudder is operated.



The Aeroplane Just Before Its Flight, Showing the Remodeled Rear Part.

The horizontal rudder, the gasoline and water tanks, the steering wheel, and the engine are all plainly to be seen in this illustration.



View of Aeroplane Making the Turn.

The considerable angle with the horizontal made by the machine in turning is apparent in this picture, as is also the slight dihedral angle of the planes.

The forward pair of planes are mounted on a tubular framework carried on two pneumatic-tired wheels; while the rear pair of planes are supported on two very small wheels of a similar type. Both the forward and the rear pairs of planes are connected by wooden posts, while the two sets of planes are connected by four horizontal rods of wood, strengthened by four vertical posts. The forward pair of planes are slightly lower at their center points than at their ends, so that they form a slight dihedral angle which, in combination with the low center of gravity obtained by placing motor and operator on the lower plane, is used to assure the transverse stability of the aeroplane. The total surface is about 650 square feet, of which 516.67 are furnished by the main planes. The weight is 530 kilogrammes (1,166 pounds). As the forward planes support practically all the weight these surfaces are loaded to over 2 pounds per square foot.

As has already been pointed out in our columns, Farman's aeroplane is by no means as efficient as that of the Wright brothers. He has accomplished by mere power what they accomplished, after many experiments in gliding flight, by skill and by the construction and proper utilization of correct-shaped surfaces. Farman's machine, as he has modified it from time to time, has come to resemble that of the Wrights more and more, until at the present time its chief difference lies in the use of small following planes for the purpose of steadying the main planes. As the center of pressure of these planes appears to be back of a point halfway between the front and rear edges when the machine is in flight, the aeroplane would dive to the ground were it not for the downward pressure upon the top of the rear surfaces and the upward pressure upon the horizontal rudder.

In thus keeping the machine on a fairly level keel in the fore-and-aft direction, the tail and rudder absorb a very considerable amount of power, while the angle of attack of the main surfaces is probably not the most efficient one, and the surfaces themselves doubtless have not the very best shape, although Farman, like the Wright brothers, claims to have constructed them after making numerous experiments with models.

A description of the manner in which Farman built, tested, and improved his aeroplane until he finally achieved the result of flight in a closed circle is interesting. After first experimenting with models, he had the Voisin brothers construct a full-sized machine fitted with a 50-horse-power motor and weighing complete about 1,100 pounds. He expected to fly at once, but he soon found that the machine did not have sufficient power to leave the ground. After effecting modifications in the tail, he at length managed to make a few short leaps, of 50 yards or so. After a month or more of experimenting, changing the position of the steadying planes, trying new propellers, etc., he finally succeeded in making a true soaring flight of several hundred yards. From this time on, having once acquired the knack of getting up in the air, he made many flights of varying lengths and heights, but all in a straight line. He next began to attempt a circular flight, and he found that it was necessary to ride the aeroplane in much the same manner as a bicyclist rides a bicycle. In making a turn, one has to incline the body and the machine toward the inside of the circle. He points out that the aviator not only has to steer to the right and to the left, but that he also has to maintain the fore-and-aft equilibrium of the machine and counteract its tendency to dive downward at any angle while at the same time tipping to one side. Besides all this, he is obliged to control the powerful 8-cylinder motor. The accomplishment of

(*Continued on page 94.*)

The End of the Flight. The Aeroplane Is Descending On a Perfectly Even Keel Just Before Crossing the Line.

FLIGHT OF THE FARMAN AEROPLANE FOR THE $10,000 DEUTSCH-ARCHDEACON PRIZE.

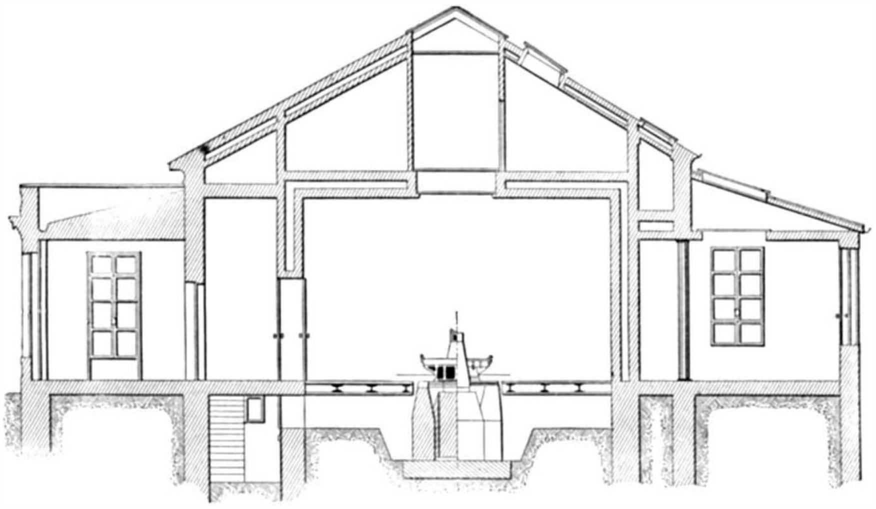
THE INTERNATIONAL BUREAU OF WEIGHTS AND MEASURES.

BY HERBERT T. WADE.

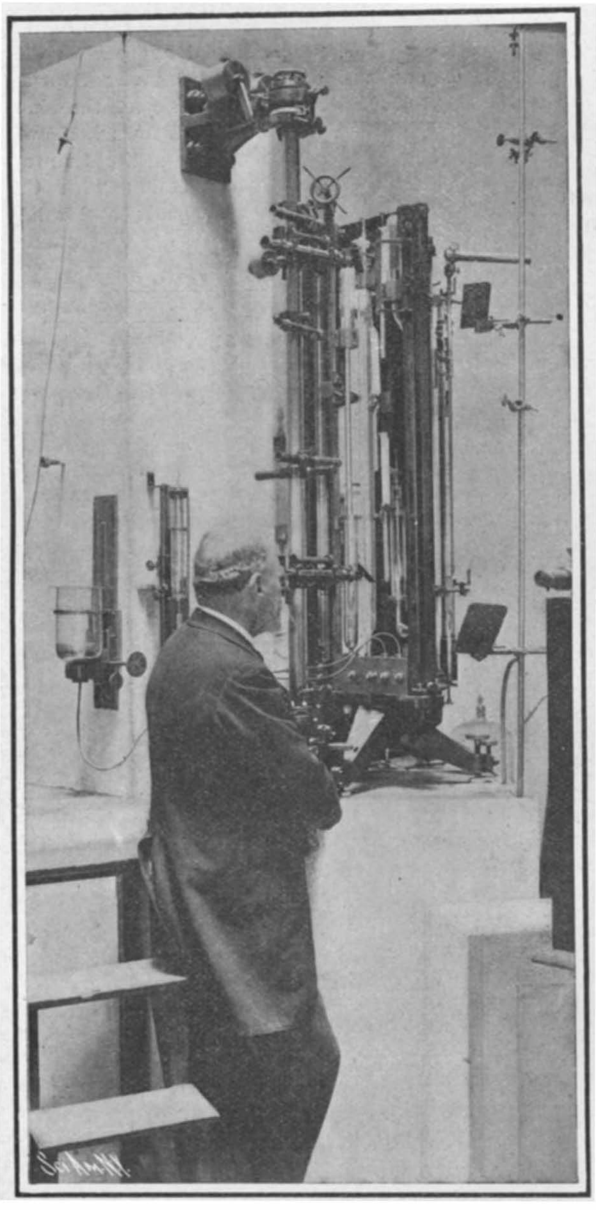
We described last week the method by which standard measures of length are prepared and tested in France. The International Bureau of Weights and Measures, in which the work is done, is worthy of notice. For more than thirty years the Bureau has been situated near Sèvres in the environs of Paris, on ground made absolutely neutral by international treaty. This treaty was signed in 1875 by the delegates of seventeen nations interested in the construction of a new meter and kilogramme to replace those determined on in 1799.

At the outset it may not be amiss to explain the importance of this Bureau, not only to science, but to ordinary commerce and industry, which at first thought hardly would seem to be concerned with the minute measurements of the physicist. This perhaps will be more apparent if we consider for a moment the analogous condition of a nation's currency, which must be absolutely uniform and unvarying. While a uniform currency can be secured through a national mint, it would be next to impossible for each nation to construct and supply to its citizens weights and measures for every-day use, so that makers and users of weights and measures must be provided with some means for comparison with secondary or other standards, which bear some fixed relation with the national standards, just as the coinage must be referred to certain definite standards of weight. Now, if the national standards of one country vary materially from those of another, or there is not sufficient opportunity for government regulation and comparison, there will be a lack of uniformity in weights and measures, such as existed to a marked degree in Europe at the beginning of the nineteenth century, when over 300 different pound standards were in use. This of course interfered seriously with commerce, and largely led to the adoption of the metric system in the interest of harmony, and this in turn brought about the necessity of redetermining or improving the metric standards. As a direct result followed the institution of the Bureau and the construction of the international prototype meter and kilogramme.

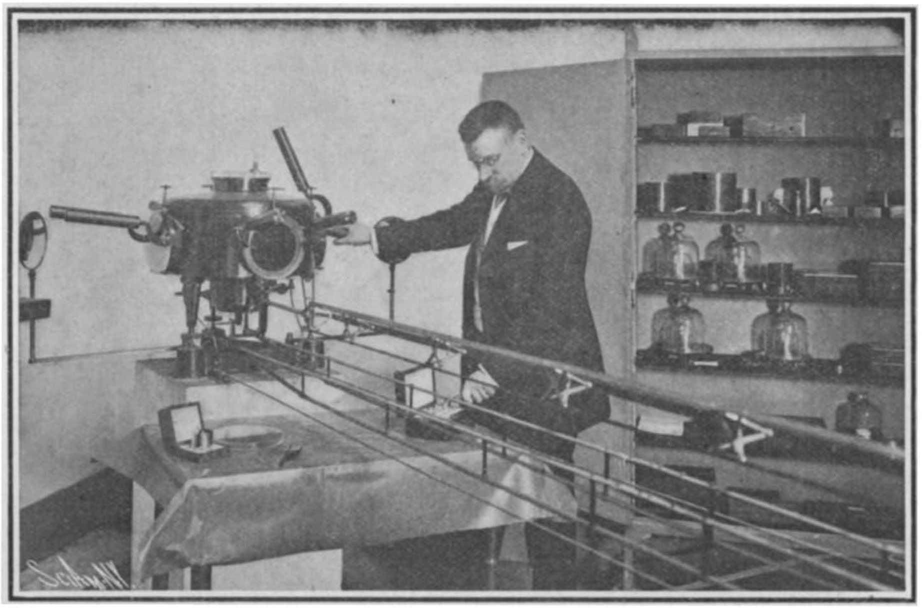
The construction and comparison of standards involves the most delicate operations of modern experimental science, and requires great manipulative skill as well as knowledge of practical physics. The present staff of the Bureau is headed by M. J. René Benoit director and M. Charles Eduard Guillaume



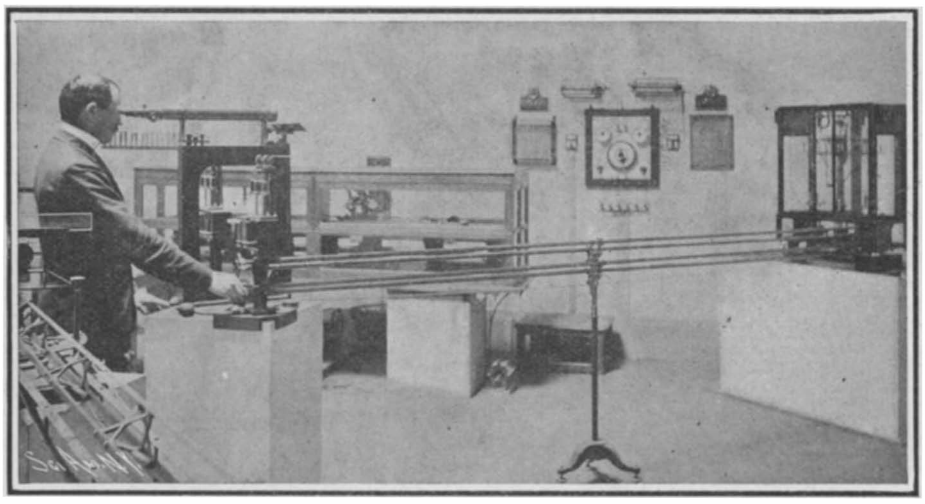
Laboratory of the International Bureau of Weights and Measures. Section Showing General Construction. The Method of Mounting the Instruments is Shown by the Large Comparator in the Center.



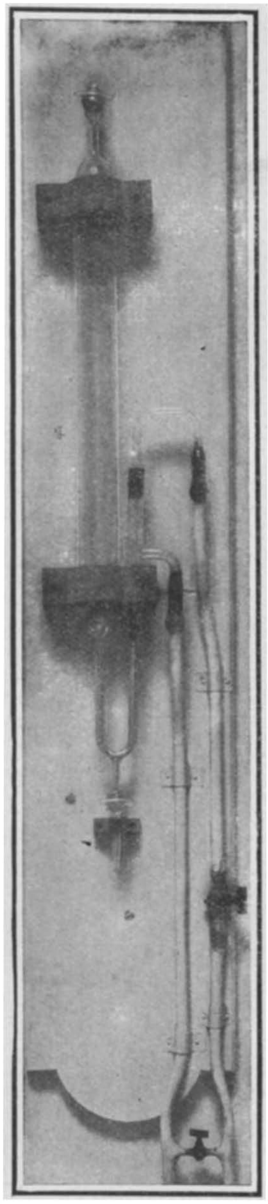
Standard Normal Barometer and Manometer. M. René Benoit is Making an Observation.



Bunge Balance for Making Weighings in Vacuum.



Balance for Comparing Standard Kilogrammes.



Temperature Regulating Device.

THE INTERNATIONAL BUREAU OF WEIGHTS AND MEASURES.

assistant director, both of these gentlemen being widely known for their researches and thorough knowledge of all matters connected with metrology. The buildings of the Bureau are typical of the triumph of peace, as the Pavillon Breteuil, where its offices are located, not only was once a favorite resort of Napoleon I., but suffered in the Franco-Prussian war. The Pavillon was turned over to the International Committee by the French government and was thoroughly repaired, while near by was erected a modern and specially equipped laboratory. The illustrations show some of the more important instruments of this laboratory. In regard to the building itself, in the first place, there must be absolute stability and freedom from vibration or other disturbance for the instruments, and to secure this there are independent mountings on masonry piers, with individual foundations that are independent of each other as well as of the structural walls. This is made clear in the cross section of the building, which shows the mounting of a large comparator for comparing standards of length on an independent concrete base. The floor is supported so that a minimum of vibration caused by walking is communicated to the main structure, and floor and walls of course are quite clear of the pillars supporting the instruments. The laboratories are in the center of the building, surrounded by a corridor on all sides and with an attic above, so that they never receive direct sunlight, while the doors and walls are made double, the latter being filled with material that does not conduct heat. The heating and ventilating system is so arranged that a constant temperature is maintained, and often the heat from the observer's body is the most important cause of disturbance. The maintenance of an exact temperature in winter within the laboratories, where accurate comparisons are made, is accomplished by a thermo-regulator acting on a gas stove. This device, which is shown in the accompanying illustration, consists of a large glass bulb containing gasoline, which terminates in one arm of a U-tube containing mercury. As the liquid air expands with an increase in temperature, the mercury rises in the opposite arm of the tube, and thus cuts off the main gas supply, though a small cock is always open, and permits a small amount to pass, sufficient to keep the flame alive in the stove. This regulator can maintain the temperature of the room constant to within 1/10 of a degree Centigrade, so long as the outside temperature is less than that for which it is regulated.

In most of the work done at the Bureau, the measurement of the pressure and temperature of the air and other gases must be carried out with high precision. The standards represent the given unit only at some specified temperature and pressure, at which measurements and comparisons must be made, and to which all measurements must be reduced. Now, as all temperatures, whether measured by mercurial or other thermometers, must be reduced to terms of the hydrogen gas thermometer, it is necessary to have some device to measure accurately the pressure of the gas. We have for this purpose the standard mercurial normal barometer and manometer, and this instrument is illustrated, with M. Benoit, the director, engaged in making a measurement. Mounted on its pillar, this barometer is a complicated piece of apparatus, and to secure the highest precision, the tubes containing the mercury are made rather large, and there is an elaborate system of reading telescopes and scales, forming what is termed by the physicist a cathetometer. The director is looking through the telescope in order to fix the lower surface of the mercury, and the adjustment of the cross hairs at this point is made with great accuracy by a system of reflectors. A modification of this instrument is used to measure the pressure of the hydrogen gas in the air thermometer, which is the standard now adopted not only in connection with the standards, but in all exact temperature measurements. Here at the Bureau the relation of the gas thermometer to the mercurial, platinum resistance, and other thermometers has been most carefully studied, so that now temperature measurements can be made with the greatest accuracy.

In the same room with the standard barometer are the balances of precision used in comparing the standards of mass, or kilogramme and other weights. As shown in the illustration, the observer is at a distance of about 15 feet from the balance, and looking through a telescope notes the deflection of its beam as indicated by a mirror and scale. By means of a system of rods and cranks, he is able completely to control the mechanism without approaching the apparatus. The balance shown in the illustration is of the Ruprecht type, used in comparing the standard kilogramme. In this, after the two standard weights are placed in the scale pans, the beam can be set in motion or brought to rest, and the weights interchanged in the two scale pans by the mechanism referred to without the case being approached or opened by the observer. The Bunge balance, also illustrated, combines all the essentials just mentioned, but in addition permits the weighing to be done in a vacuum. The cabinet behind the observer, it will be noticed, contains various standards, and one of the original kilogrammes of platinum-iridium is to be seen on the table in front of the balance. The sensitiveness of these balances is something marvelous, a difference of a milligramme showing a movement of from 25 to 50 divisions on the scale.

In connection with the study of standards, many important physical determinations and researches must be made, and for these the Bureau has appropriate laboratories with special instruments and equipment for chemical, optical, and electrical work and for the general study of the properties of various materials.

NEW TERMINAL STATION AND APPROACHES OF THE BROOKLYN BRIDGE.

At last, after a quarter of a century of service, the Brooklyn Bridge is to be provided with a terminal station and approaches worthy of the importance and dignity of that structure The present station is in every way inadequate, both in its appearance and in its accommodation, to form a fitting entrance to this, the most famous bridge in the world. The overcrowding at the Manhattan terminal has long been the most serious of the many cases of congestion of traffic in Manhattan Island. Fully a decade ago, the conditions were described in the columns of this journal as "intolerable." What they are to-day passes description; and that the accidents are not more frequent, is due to the wonderful self-repression and patience, in the face of enormous inconveniences, of the many millions that pass to and fro through the station.

The decidedly ugly building which now disfigures the bridge entrance is to be entirely removed, and in its place is to be erected a much larger and more dignified structure, whose architectural features, as shown in our front-page engraving, have been so judiciously treated, that the station with its approaches will form a decided addition to the architectural features of City Hall Park; while the whole scheme has been laid out on such a spacious scale, that the days of excessive overcrowding must soon become a thing of the past. In addition to serving its purpose as a station, the new terminal building will form an appropriate annex to the municipal office building, twenty stories high, which the city will ultimately erect above the new Subway station adjoining the bridge entrance to the north. The design of the new bridge station, which will be about the height of the present terminal, has been treated in the Grecian style. The façade, whose front will be flush with the building line of the World building, will be formed of six massive columns with glass between, and at each corner of the coping line, above the masses of masonry which flank the central glass-lighted portion of the building, will be symbolic groups of statuary. The approach to the station from City Hall Park will be by way of an esplanade 40 feet in width and of richly ornamented design, which will extend across Park Row and Center Street into City Hall Park, where access to the esplanade will be had by means of four broad stairways; one to the north, another to the south, and two with an escalator between them to the east of the structure. The escalator will be inclosed, as shown in the engraving. All four stairways lead up to an impressive peristyle, which marks the termination of the esplanade. At each end will be massive figures of the Sphinx, and the treatment of the electric light standards, the balustrades, and other features of the design admitting of decorative work, has been done with a simple dignity that harmonizes well with the general treatment of the whole work.

The massive steel bridge which has recently been thrown across Park Row, and the rearrangement of traffic at the present terminal, must not be confused with the permanent improvements referred to above. The recently-completed structure is of a temporary character only, and is designed to offer immediate relief until the new bridge and approaches are completed. The temporary extension of the bridge terminal was made to provide additional platform space and increase the switching facilities. With its opening a couple of weeks ago, cable-car service during the rush hours was discontinued, and through elevated trains are now operated from distant points on the Brooklyn Rapid Transit system during all hours of the day and night. Although the inauguration of this improvement was attended with much confusion, it is confidently expected that ultimately the capacity of the bridge will be increased, and the congestion not a little relieved, particularly in view of the fact that the recent opening of the Subway to Brooklyn has diverted a large amount of travel from the bridge.

The new station will be considerably larger than the old. In the first place, it will be widened to occupy the whole of the available space from building line to building line; and it will be lengthened by extending it eastwardly over the present viaduct, which is being widened to accommodate it. There will be three floors, as in the present station. The ground floor, or surface, now occupied by the surface car loops, will be cleared of these, leaving an absolutely free passage for pedestrians. The eight loops will be transferred to the second, or mezzanine floor, as it will be called. The third floor will be given over entirely to the elevated service. By this arrangement there will be a complete separation of the three classes of traffic—foot passenger, surface car, and elevated. The passengers who wish to use the surface cars will pass through on the ground floor below the station, and ascend by the particular stairway which serves the line on which they wish to travel. Each loop will have its own stairway from the ground floor, and each stairway will carry a sign designating the lines which may be reached on the floor above. In this way the crossing and recrossing of the tracks, which is such a source of confusion and danger, will be entirely eliminated, and, as the mezzanine platforms will be very spacious, the present congestion will be entirely relieved.

As soon as the extension of the tracks and platforms of the new station has been completed, the temporary extension across Park Row will be taken down, and the new approaches built in its place. Passengers desiring to take the elevated trains will pass along a platform on the mezzanine floor, which will be raised above the platform of the trolley loops, and from this platform another set of stairways and escalators will lead to the elevated lines on the floor above. These escalators will also carry signs, which will enable the passengers to go direct to the platforms from which their particular trains are starting.

At the present time the work of widening the roadways of the bridge is nearing completion. This widening is done to enable the Subway cars which will cross the bridge to descend into a tunnel, which will connect the bridge with the Subway terminal station and the Subway loop. When the roadways have been widened, the trolley tracks will be moved out to permit the laying of another track on each side of the bridge to connect with the Subway. The advantages of the scheme of tracks and connections as outlined above are that if the Brooklyn Rapid Transit Company does not wish to operate the Subway loop connecting the bridges, it still can operate its elevated trains to the Park Row terminal. Moreover, in that case the company which operates the Subway loop will be independent of the Brooklyn Rapid Transit Company. The passengers who use the Subway loop will not be required to use the bridge terminal station, but can take their cars from the big Subway terminal station below the Staats Zeitung building site.

The Subway terminal station will extend for a distance of three blocks, and it will contain three loading and two unloading platforms, each 450 feet in length. The trains from the bridge will cross under William Street and Park Row, where they will enter the station. Access to the station will be amply provided for. There will be five stairways where Park Row and Center Street form a triangle; three for the loading platforms, and two from the unloading platforms, the flow of incoming and outgoing passengers being maintained in opposite directions. At the mid-length of the station there will be another series of entrances leading from Duane, Center, and Reade Streets, and at the extreme northerly end of the terminal there will be another series of exits and entrances. The center loading platform will be 40 feet wide. On either side of this will be two unloading platforms; while on each extreme side of the station there will be another loading platform.

A four-track system will extend from this station, through Center Street and the Bowery, to Delancey Street. There will be stations at Leonard and Franklin Streets, at Howard and Grand Streets, and a large station, built on the general lines of the Park Row station, at the Bowery and Delancey Street. This station, which will be at the entrance of the approach to the Williamsburg Bridge, will cover nearly three city blocks, and the same system of separate loading and unloading platforms and complete separation of incoming and outgoing traffic, that has been planned for the Park Row Subway station, will also be used here.

Important improvements, designed to remove the present surface car congestion at the entrance to the bridge, are being carried out on the Brooklyn side, the main feature of which is the erection of an incline from Washington Street to the bridge yards, a short distance this side of Concord Street, and beyond the elevated spur which connects the Brooklyn elevated system on Adams Street with the bridge. By means of this elevated construction it is confidently expected that the long waits of surface cars at the Brooklyn end of the bridge will be eliminated.

The public has but little idea of the magnitude of the improvements of which the new bridge terminal forms an integral part; for the total cost of all this work will be about $40,000,000. The Manhattan Bridge with the cost of the land and approaches will call for an expenditure of $25,000,000. The Subway loop will cost $10,000,000; the remodeling of the Manhattan terminal, that is to say, all that work shown in our engraving, will cost $3,000,000; the Subway station in Delancey Street in connection with the Williamsburg Bridge will cost $1,500,000; and other items will bring the total up to the $40,000,000 named above.

THE PRIZE-WINNING CIRCULAR FLIGHT OF THE FARMAN AEROPLANE.

(*Continued from page 92.*)

a circular flight in an aeroplane is, therefore, quite difficult, and can only be attained after considerable training.

As to the type of aeroplane to be used in the immediate future, Farman believes this will be a combination of the double and single surface, following-plane machines, such as used by himself and Bleriot. Accordingly, his new aeroplane will have three pairs of superposed wings in front and two following pairs at the rear. The spread of the forward wings will be 7 meters (22.96 feet), while that of the rear wings will be somewhat less. The total supporting surface will be 45 square meters (484.36 square feet). The wings will be attached to a quadrangular body 14 meters (45.93 feet) long and mounted on three wheels. The 50-horse-power motor at the front end of this body will carry a 2½ meter (8.2 foot) propeller directly on its crankshaft. One pair of the forward planes will be hinged and used as a horizontal rudder.

On January 13, the day on which Farman made his flight for the prize, the weather was fair and the air was calm. At 9:30 A. M., Farman and the Voisin brothers, after a minute final examination of the aeroplane, ran it out of its shed and tried the motor, which was found to operate perfectly. The aeroplane was then taken to the starting point at one end of the Parade Ground at Issy-les-Moulineaux. Two poles bearing flags of the Aero Club of France were located at a distance of 50 meters apart, while the turning post was located on the perpendicular to the line connecting these posts, at a distance of 500 meters away. Various officials were located at the starting and turning points, while other members of the Aero Club followed the aeroplane in an automobile. At about 10:15 the motor was started, and the aeroplane was released. After a run of several hundred feet, it rose in the air, and crossed the starting line at a height of about 12 feet. It flew straight for the turning post at a speed of fully 30 miles an hour, rising meanwhile to a height of 20 to 25 feet; and, turning about the post at right angles some 300 feet away, it flew a considerable distance—fully 1,000 feet—parallel to the starting line, after which, another right-angled turn was made, and a long straight flight continued back to the goal. The total distance actually covered is estimated to have been between 1,300 and 1,500 meters (4,265 and 4,921 feet), which would bring the average speed up to as high as 28½ miles an hour. The flight lasted 1 minute and 28 seconds. In finishing, the machine crossed the line at about the same height as before, and landed about 100 feet beyond. Farman was given a great ovation, and was heartily cheered by the onlookers. Not content with having so easily won the prize, he made another circular flight before housing the machine in its shed and going back by automobile to Paris. At a banquet of the Aero Club a few days later, he received the prize, in addition to a number of other commemorative medals.

Correspondence.

The Recent Criticisms of Our Navy.

To the Editor of the SCIENTIFIC AMERICAN:

While the subject of our navy is being so exhaustively discussed in your paper, permit me to give you a few of my own ideas on that subject, taking as a basis your treatment of the article, "The Needs of Our Navy," which recently appeared in McClure's Magazine. As a scientific journal, yours is naturally the one to speak with authority on the subjects discussed in that article; but it seems to me that what you have said concerning it has not been altogether without bias, even though you have not suffered it to influence your scientific stand in regard to the matter. To be plain, it seems to me that while you freely join in criticism of the navy on most of the points in dispute, yet you revile Mr. Reuterdahl for bringing them so pointedly before the people.

The five great charges made against the navy in the article are as follows: 1. Faulty distribution of armor. 2. Low freeboard as a distinguishing feature of our ships. 3. Open turret communication with magazine. 4. Archaic system of selecting men to command in our fleets. 5. Lack of sufficient battle practice.

Now, in regard to the last four of these charges, what have you to say? Only this: that they *are* faults—serious faults—faults that are found to a far greater extent in our navy than in the British navy or the French navy. The only ground on which you impeach Mr. Reuterdahl is that it is not the fault of our constructors, but of the line officers, that the American navy is in the condition that it is. I would like to ask what difference it makes to the American people whose fault it is, so long as it is a fact that it is true. The American people have furnished several hundred million dollars in the past ten years for the construction of battleships, and now we are told by even so reputable a journal as yours that the men to whom we have trusted the expenditure of this money have made inexcusable blunders in their designs of ships; that while engaged in a childish pursuit of the will-o'-the-wisps of heavy armor and armament, they have in reality left our ships with both inefficient armor protection and inefficient offensive power. You have admitted these facts reluctantly, but still you have admitted them.

All the points in dispute being allowed by you except that regarding the distribution of armor, I will say a few words on that subject. On the one hand we have the French system, which has come to be adopted in its essential features by Great Britain, and the American system. The essential point of the French system is heavy armor all around the ship both above and below the waterline. All French warships have this high continuous belt of heavy armor. The American system is to have a narrow belt of heavy armor amidships with lighter armor at the ends, and a complicated system of secondary or casement armor, extending up the side of the ship amidships. Incidentally, it may be stated that the French system has stood up under actual test better than the American. In the battle off Port Arthur in the Russian war, the "Czarovitch," a French-built ship, astonished naval experts by enduring a pounding from Togo's guns that would have sunk any ship in the Japanese navy. In fact, one of the Japanese ships did come near sinking in the same fight. It was the French system of armor distribution that saved the "Czarovitch."

Compare our ships with French ships of the same date; the "Illinois" with the "Jena." The "Illinois" has soft ends, the "Jena" has not. The magazines of the "Illinois" have very little protection; those of the "Jena" are well protected. Compare the "Maine" with the "Suffren." The "Maine" has a soft end; the "Suffren" has not. The "Maine" has weak magazine protection; the magazines of the "Suffren" are taken care of by the high continuous belt of heavy armor. Compare the "Virginia" with the "Patrie." The magazines of the "Virginia" are still without protection, and the ends are protected only by 4-inch armor. Other defects are low freeboard, the mixture of three calibers of guns in her main battery, and the superimposing of 8-inch turrets on the 12-inch turrets. The "Patrie," on the other hand, is for its size (which is the same as that of the "Virginia") a thoroughly up-to-date fighting machine. Compare the "Connecticut" with the "Danton." The "Connecticut" has a low freeboard, three calibers of guns in her main battery, and only four inches of armor at her ends. The "Danton's" armor and armament are such that she could dispute matters with even the "Dreadnought" with good chances of success.

Whether the French have made a mistake in carrying the "Danton" plan of armament into their new 18,350-ton ships or not, I am not prepared to say. But in my opinion their armor protection, consisting of a waterline belt 10½ inches thick amidships and 8 inches thick at the ends, is unquestionably superior to that of our new 20,000-ton ships. The French ships are to be somewhat faster than ours also, which is a point decidedly in their favor. I do not want to disparage our ships, and I will readily admit that the six 12's of our ships would probably be superior to the twelve 9.8's of the French ships; but at the same time I do not think that, considering their size, our ships are as powerful as they should be. I will give my reasons.

They have one great defect in that a great extent of their waterline is protected only by armor which a 6-inch shell would pierce at long range, and this armor rises so slightly above the waterline that if the ship should go into action in any degree overloaded, her ends would be practically unprotected.

It was with profound regret that I first saw a plan of our new ships. I had expected a ship patterned after the "Dreadnought" in its armor, excelling the "Dreadnought" in number of guns and speed. But incredible to say, the American navy still clung to its casement armor. It is true that the radical fault of armor distribution was partially covered up by increasing the thickness of the first stratum of casement armor to ten inches; but in order that this fault might be thus partially covered up, the battery and engine power of the ships were sacrificed to an unprecedented extent. They carry no more guns than the "Dreadnought," their speed is not so great, and their armor protection is not so good; while the "Dreadnought" is more than two thousand tons smaller. With displacement enough to give their ships twelve 12's and twenty-three knots speed, our constructors frittered it away on casement armor in order that they might mount a puny battery of 5-inch guns behind 5-inch casement armor; and the result is that their ships are inferior to foreign ships of the same displacement in armament and speed, and not superior to them in armor. And further, the American navy with its usual pig-headed independence has refused to have anything to do with either the wire-bound system of constructing guns, or the Parsons turbine, whereby it will come to pass that our ships going into commission three years from to-day will be inferior in speed, and worse still in gun power to every first-class foreign ship afloat. What awful folly! Do not our constructors know that the Japanese won over the Russians in ships far inferior to the Russians' in armor protection, but at the same time superior to them in speed and gun power? Do they not know that in a war with Britain or France, our fleet would be equally unable to catch the enemy if it should whip them or unable to get away from them if they should whip it? Do they not know that as long as an enemy has faster ships than ours, they have all the advantage of a victory without the risk of a battle? That they can destroy our commerce, attack our coasts, plunder our colonies, all without risk, even though our fleet is superior in actual fighting power to theirs? What more could they do if we did not have any fleet at all?

And in actual battle, what immeasurable advantages are with the swifter ship! She fights when she pleases, how she pleases, where she pleases, how long she pleases. If she is whipped herself she runs away, if she whips the other ship she sinks it. What would have happened to the "Rossia" and "Gromobia" if they had been slower than the Japanese cruisers "Tokiwa" and "Asama"? They would be at the bottom of the ocean now with their sister ship. What ships have we that could catch the British "Invincibles" or the French "Ernest Renans"? With their large fuel capacity these ships, operating from bases in the West Indies, would have our whole Atlantic and Gulf seaboards at their mercy.

American battleships ought to have high speed. It is vital. They must have it if they are to keep the sea in war, and not be destroyed. If in the Russian war the Russian fleet had been as much superior in speed to the Japanese as the Japanese were to them, Russia would never have lost Manchuria. If ten years ago the United States navy had commenced to construct 21-knot battleships, to-day she would be unquestionably the second naval power in the world.

In conclusion, I will give a description of what our 20,000-ton battleships should have been, designed at the time they were. They should have carried twelve wire-bound 12.6's mounted preferably in four three-gun turrets arranged like the turrets in the "South Carolina." While the volume of fire from guns mounted in three-gun turrets might not be quite as great as it would be if they were mounted in two-gun turrets, the guns would remain in good condition longer, which would be the next best thing, and the accuracy of fire would be unmarred by hurried firing. It would be a very difficult feat to mount twelve heavy guns so that they could be fired on either broadside, in any other way.

Their armor should consist of a belt 8 inches thick amidships, and 7 inches thick at the ends. This belt would begin eight feet under water, would rise vertically five feet, then be reduced to five inches in thickness, given a slope backward of 50 degrees from the perpendicular, and carried up four and one-half feet above the waterline, at which height an armored deck two inches thick would be constructed across the ship. Another armor belt four inches thick would begin three feet under water and rise four and one-half feet above it. The present protective deck would be placed lower down in the ship.

The coal bunkers would be enlarged and rearranged. The superstructure amidships would be cut out. The funnels would be lowered by a third. The secondary battery would consist of 4-inch guns instead of 5-inch ones. A British type of tripod mast would be used. And the ships should have twenty-five knots speed. I venture to say that, constructed as I have outlined, these ships would be useful members of the American fleet when the ones that are constructing will have been relegated to the scrap department or been sent by an enemy's guns to the bottom of the sea.

However, in view of the fact that American genius for invention is to have no part in the construction of our ships, I would seriously suggest to the American people, as the simplest way out of the difficulty, that they petition Congress to have all our future ships constructed by British shipbuilders as exact duplicates of the latest British ship out. EUGENE VAN BRIMMER.

Delaware, Ohio.

[We publish the above curious misinterpretation of our articles refuting the attacks on our navy, for what it may be worth. When our correspondent speaks of prejudice against Mr. Reuterdahl, he cannot surely himself have read our editorial of January 18, in which we say, "When Mr. Reuterdahl states that he is highly appreciative of the American navy, we believe him." We did not "impeach" Mr. Reuterdahl. We simply showed in a dispassionate array of facts that the great majority of his statements are either contrary to fact or greatly exaggerated. Our criticisms were confined to the material, that is, guns, armor, etc., of the navy; it does not come within the province of this journal to discuss the question of the "selecting of men to command our fleets," or the "lack of sufficient battle practice." On only *two* out of the many alleged defects in material do we agree with Mr. Reuterdahl, namely, the dangers of the open-turret hoists, and the lack of sufficient destroyers. All of the other charges of submerged armor, low freeboard, low guns, large gun ports, unprotected crews, etc., we have not only not "admitted reluctantly," but have proved to be baseless. The best answer to our correspondent's comparison of French with American ships is to point to what happened in the battle of Tshushima, where the Russian ships belonged to the French school of design, and the Japanese to the school to which the American ships belong. Not a single Japanese vessel was sunk; whereas the four distinctly French-type battleships "Borodino," "Suvaroff," "Alexander," and "Osliabia" were speedily sunk by gun fire, or so badly crippled as to be an easy prey to the torpedo.

We have no space to take up our correspondent's criticisms seriatim; the points raised have already been attended to in our reply to Mr. Reuterdahl. But we will add, just here, the following dispatch from Berlin to the Staats-Zeitung, as showing that one great naval power, at least, is convinced of the excellence of our ships. The dispatch is as follows:

"Berlin, January 30, 1908.—The military editor o the Norddeutsche Allgemeine Zeitung, the official organ of the government, refutes at some length the statements made in Mr. Reuterdahl's article on the defects of the American navy. The expert who wrote this reply warmly defends the American navy, and proves, point by point, that the American critic has argued from false premises and figures to an entirely wrong conclusion. He proves that the navy of the United States is composed of most excellent material, and is in no way inferior to that of any of the great naval powers. This refutation of the sensational attack of Reuterdahl has attracted all the more attention, because it may be assumed with some reason that its publication in an official organ carries with it the faith of the German government in the American navy."—ED.]

Redwood Canyon, in Marin County, Cal., Presented to the Nation.

Redwood Canyon, an area of 295 acres comprising several fine groves of redwoods, situated near Mill Valley, Marin County, California, has been presented by its owner, William Kent, to the nation, and has been accepted by the federal government as a national park. This was done at the suggestion of a member of the United States Forestry Department, in order to preserve the canyon from a water company, which proposed to strip it of its beauty and convert it into a reservoir. A condemnation suit to compel Mr. Kent to sell his property had already been begun, when he deeded the land to the United States and begged that the gift be accepted. The owner retains some adjacent ridges covered with brush and will use them to protect the canyon from destruction by fire.

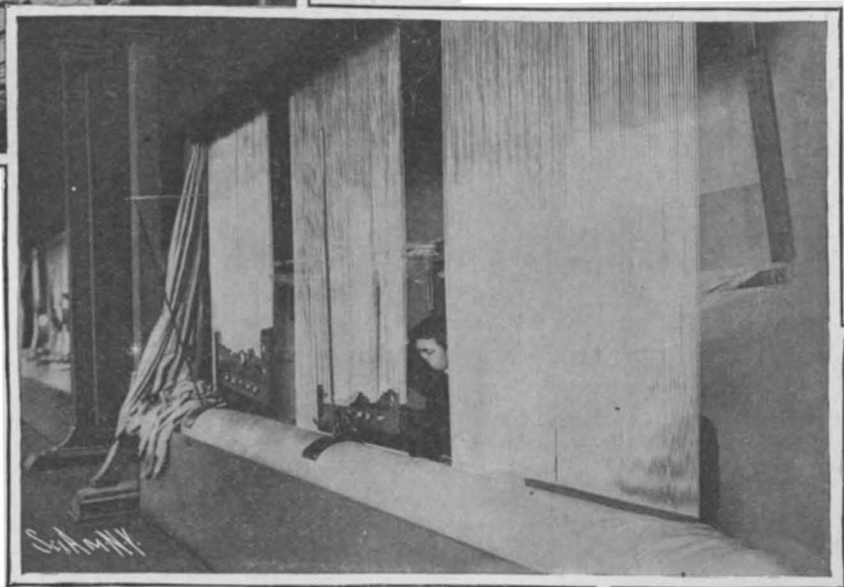
Deposits of bitumen are said to extend all along the coast of Venezuela from the Gulf of Paria to Colombia in the form of superficial lakes, states a contemporary.

GOBELIN TAPESTRY WORKS.

BY OUR PARIS CORRESPONDENT.

Tapestry weaving has been an active industry in the region of Paris from very early times. Francis I. established the first royal tapestry establishment at the Chateau of Fontainebleau in 1530; his predecessors had obtained their tapestries from private works. This factory turned out some remarkable work, but lasted for only thirty years. In 1550 Henri II. founded the Trinité factory at Paris, and this continued to flourish down to 1635. Henri IV. decided to found an important tapestry establishment in the city and it was begun at the Louvre palace. Afterward we find it transferred to its present situation, where Jehan Gobelin had already founded a dye works in the middle of the fifteenth century upon the small stream of the Bièvre, the waters of which were supposed to have a special value for dyeing, although this has been since disproved, and the fame of the Gobelin dyes was due only to the skill of the workmen. But no weaving was done here until Henri IV. transferred the royal weaving factories to this locality, and placed the whole under the direction of Marc de Comans and De la Planche, when it was first known as the Gobelin tapestry works. It was during the reign of Louis XIV. that the establishment enjoyed its greatest prosperity. At this time it was much enlarged and was placed under the direction of the painter Lebrun; his cartoons were largely followed in making the great pieces of tapestry which have since become famous. Without attempting to follow the further history of the establishment, which covers such a long period, we will give a short account of the various parts of it, and point out some of the main processes which are used.

The Piecing Room Where the Weaves Are Finished or Repaired.



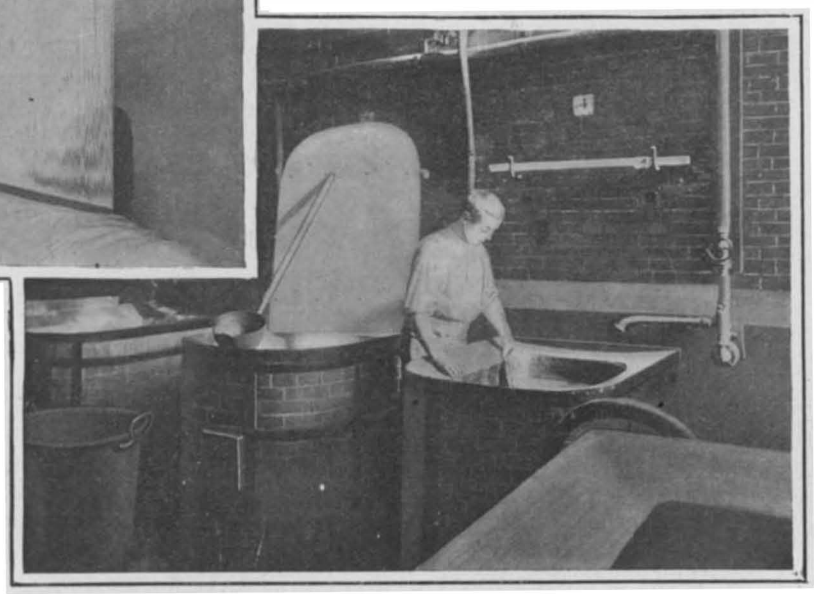
Weaving Three Pieces of Tapestry on the Same Loom.

The warp or foundation of the Gobelin tapestry is formed of a series of stout woolen threads which are stretched upon the loom, and are well fixed in place. The weaver then applies the woof, which consists of colored threads forming the pattern. Two kinds of tapestry were formerly made. In the *haute lisse* tapestry the warp was stretched vertically upon the loom, while in the *basse lisse* it was placed horizontally. At present only the *haute lisse* is made at the Gobelin works. Some of the looms for this kind of tapestry date from the time of Louis XIV., but have been somewhat improved in more recent times. As will be observed in the accompanying engravings, this type of loom consists of two horizontal cylinders placed about ten feet apart and held in two uprights forming a frame. The cylinders are mounted at the ends in trunnions which work in wooden sockets so that the cylinders can turn freely. The bearing slides up and down in a groove in the frame, and the roller is turned about by means of a lever. As to length, the looms vary from 12 to 23 feet according to the size of the tapestry which is to be woven. Sometimes several pieces of narrow tapestry can be woven upon a single loom of the larger type.

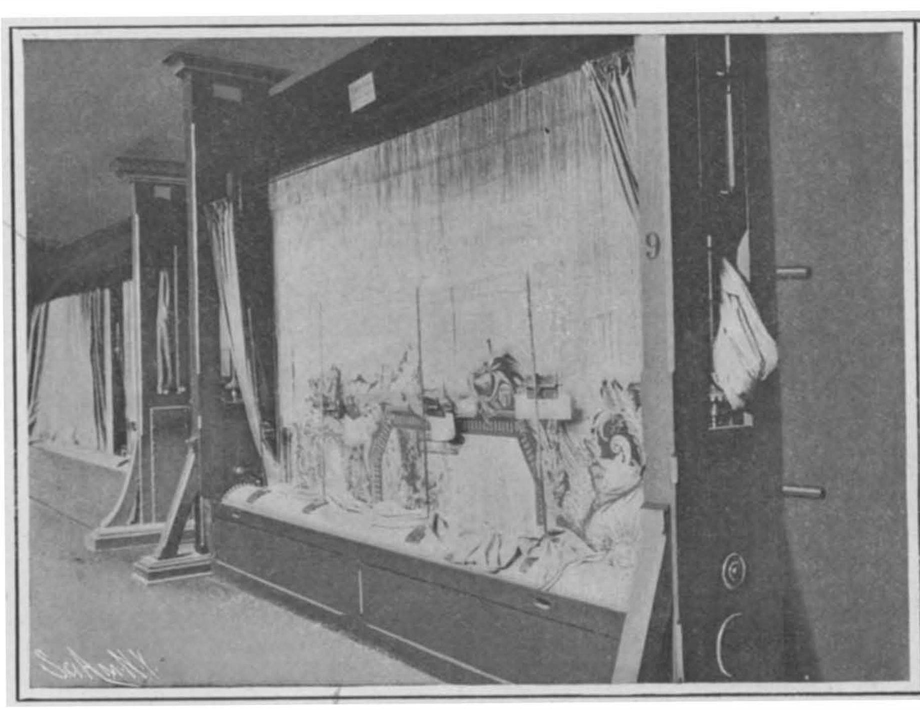
When mounting the work upon the loom, the weaver first sets up the warp of vertical threads, and each thread is given an extra length of about five feet in excess of the desired length of the tapestry. The threads are stretched on the rollers, putting the extra length on the upper roller. The threads of the warp are equally spaced, the standard spacing allowing about twenty-five threads to the inch. The tension upon each of the threads is about 7 pounds, which holds them well in place. When the warp has been laid out, the weaver passes a one-inch glass tube between the threads so as to separate the uneven-numbered threads on the outside and the even threads on the inside. The rod is placed about two feet above the working point. To carry out the weaving process, the weaver takes his place at the back of the loom, with the original design in colors placed behind him. He repeats the design by making a tracing in ink upon the threads of the warp, but this is only to give him the principal points of the design, and the weaver must be a veritable artist in order to copy faithfully the painted cartoon upon the canvas. He is provided with a great number of spools or shuttles, each containing a different colored thread. As the work progresses, the finished part of the tapestry is rolled upon the lower cylinder. One of our engravings shows two weavers working side by side upon the same loom upon different pieces of tapestry. In weaving the larger pieces the worker is almost entirely concealed from view.

In all the tapestry of the ancient period the warp consists of woolen threads, and this seems to be the best, for other kinds of thread have been tried without much success. Cotton thread was substituted in 1850 for the wool, as it was claimed to be cheaper and less liable to attack by insects, but in 1890 the use of wool was resumed, as the advantages claimed for cotton were not substantiated in practice, and the economy was very small. Silk has also been used, but without any advantage.

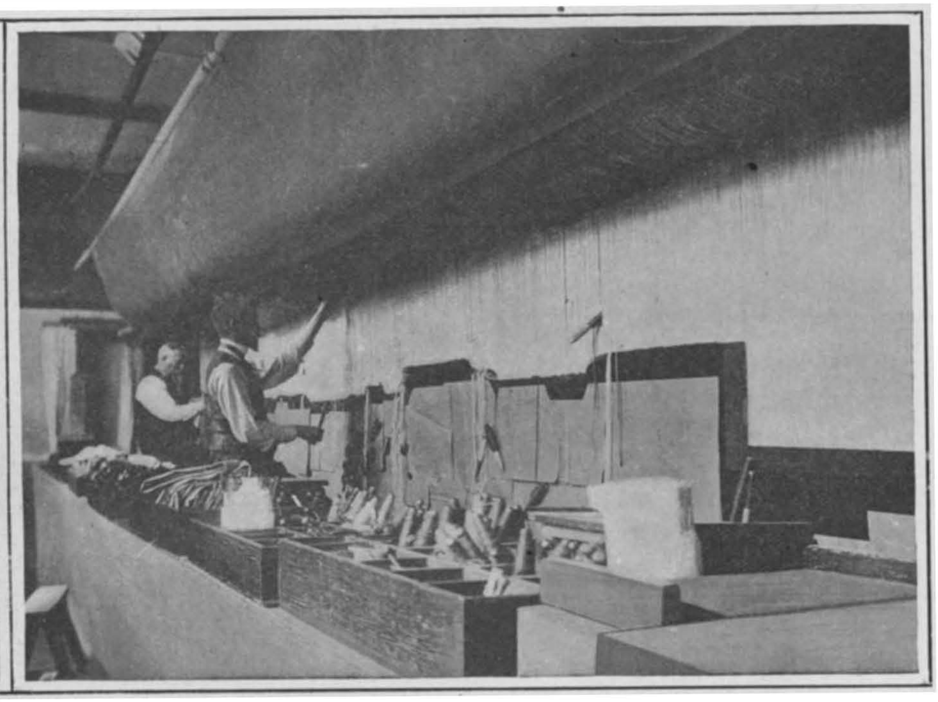
The dyeing of the threads is one of the most important operations, and this has always been carried out under the direction of a chief dyer who stood at the head of his profession. In ancient times the water of the Bièvre was said to have a special efficacy in dyeing, but chemical analysis showed this to be a fallacy, and as far back as the last century the Seine water was used, as the water of the Bièvre became fouled by the different factories along its course. In 1665 one of the famous master-dyers was Van Kerchoven, and the secrets of the trade were handed down in this family from father to son for nearly a century. After that came other dyers, who were not as successful. The famous chemist Chevreul took charge of the dyeing factory in 1824, and was the first to establish a standard system of color-shades. This he carried out by making a disk or circle containing seventy-two principal colors in a series. Then he added one-tenth of black, so as to darken each of the colors, and placed the latter shades in a second circle. Adding two-tenths of black gave a third circle, and so on down to nine-tenths of black. He thus had 720 color elements. Then each element was divided into twenty tones ranging from light to dark, giving in all 14,400 color divisions. Adding to these twenty tones for the gray, he had a



The Dye Vats Where the Wool or Silk is Colored.



Haute Lisse Weaving; the Workmen Stand Behind the Loom.



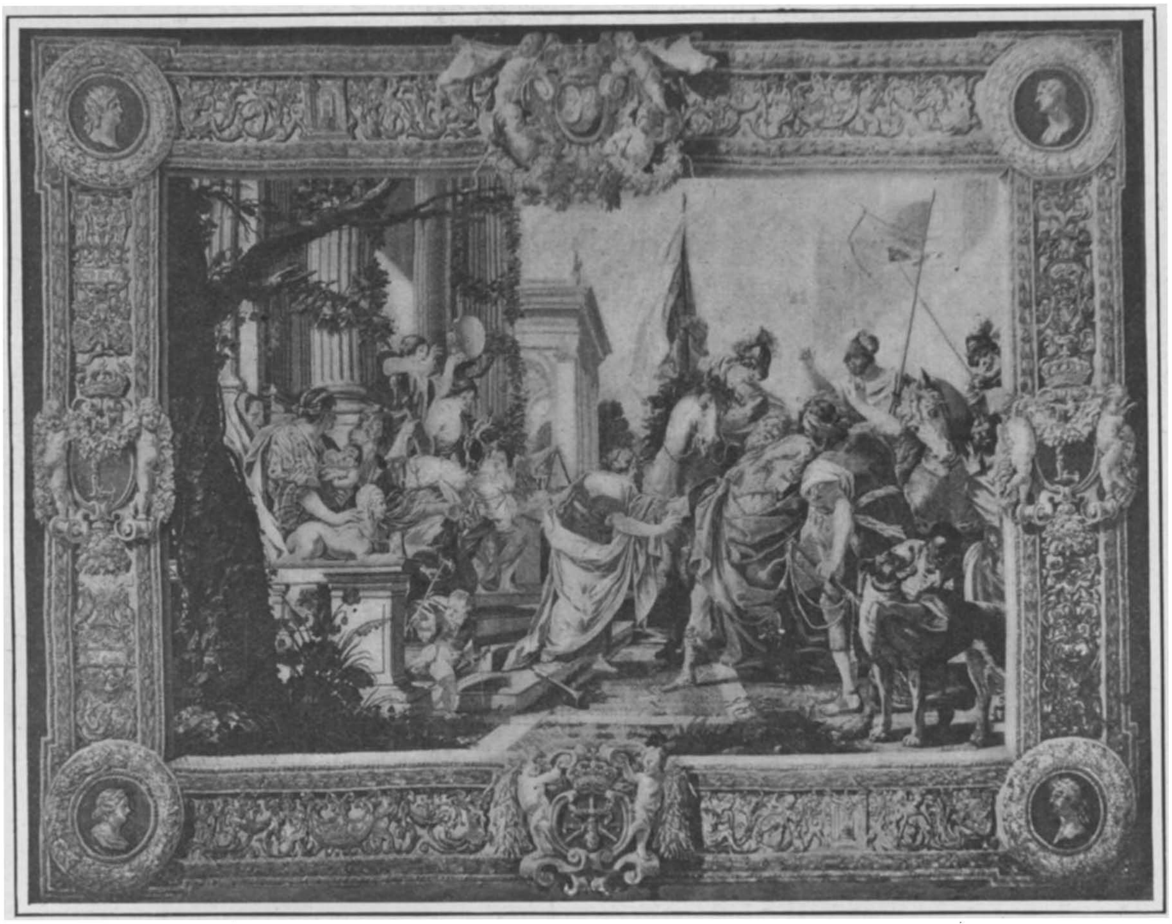
A Loom for Savonnerie Velvet Carpet.

THE GOBELIN TAPESTRY WORKS.

total of 14,420 shades. The dyeing establishment was reorganized in 1890, and the formulæ and processes for the different colors were kept recorded in a special register, along with samples of the wool or silk. In former times the silk which came from the Lyons factories was dyed in those establishments, but later on it was decided to dye the silk as well as the wool at the Gobelin works. In the register are kept account of the laboratory experiments and of all the manipulations.

In the storehouses are kept a large number of spools of dyed threads, and three divisions are used for the storehouses, the detail supply, the general stock, and the old or disused stock. When the design of the tapestry has been chosen, the choice of the colored threads is commenced in the detail room, and here are ranged a series of spools which have been already used for other tapestries and hold part of their thread. In this stock are kept some 34,500 spools of colored wools and 5,600 of silks, but some of these are duplicates. If the desired color is not found among the spools, the second stock is resorted to. In it the colors are kept in the dark and are classed according to Chevreul's system. The stock contains about 11,000 shades of wool and 7,500 of silk which come directly from the dye shop, and in this case there are no duplicates. Should this desired color not be found in any of the stocks, the color is dyed upon the wool according to a given sample, and an excess of the thread is provided, so as to leave a part for the storehouse. One of the illustrations herewith shows the *rentraiture* or piecing room, which is one of the important parts of the factory. Here are filled up the gaps which are left in a new piece when several weavers work upon it at the same time, or else the borders, which have been woven separately, are added to a tapestry. Repairs to old pieces of tapestry are numerous, seeing that many of them date from an ancient period and have suffered more or less damage. All this work requires great skill. To repair an old piece, a new part of the warp has to be formed, then the woof is put in with the needle. Where the gap is too large, an extra piece is woven on the loom, and is then joined on in the piecing room. In this part of the shop are kept the stored pieces of tapestry, old pieces are cleaned and renewed, etc.

The Savonnerie velvet carpets are also woven at the Gobelin works. It was as early as 1626 that the Savonnerie establishment, then a separate factory, was founded during the reign of Marie de Medicis, under Simon Lourdet. Since 1826 these famous carpets have been produced at the Gobelin works. But they are now exclusively used for wall hangings. One of the engravings shows the method of weaving, which differs much from the tapestry process. Here the workman is placed in front of the loom and has the colored design suspended above him.



A Beautiful Example of Ancient Tapestry, Depicting Jephtha's Daughter.

THE GOBELIN TAPESTRY WORKS.

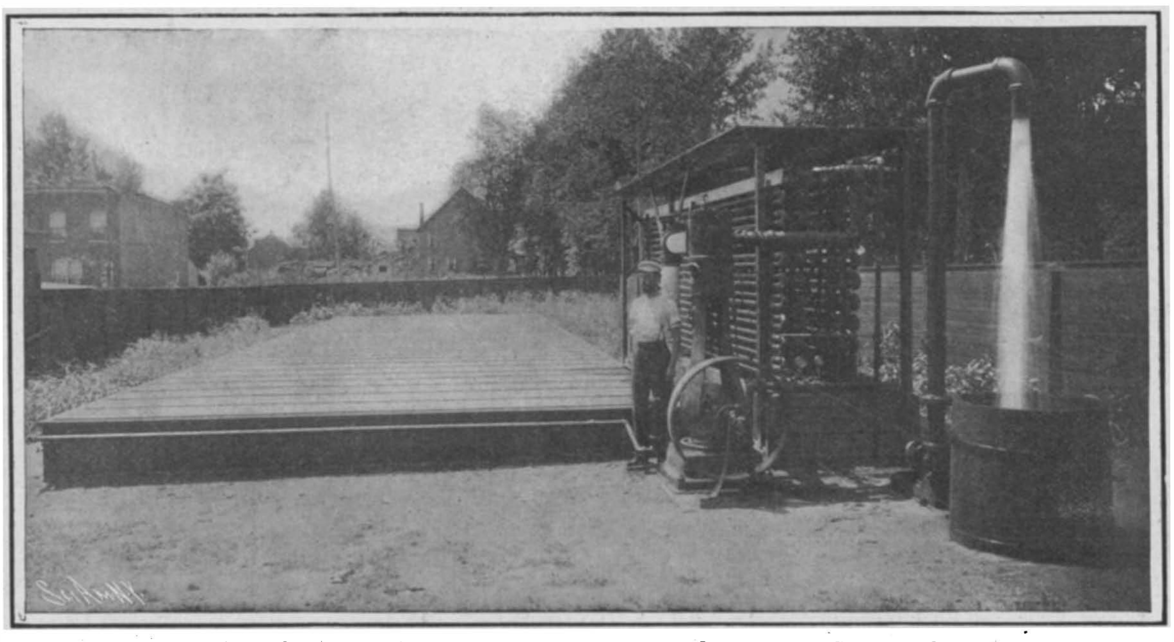
A NEW SOLAR POWER PLANT.

BY FRANK C. PERKINS.

The problem of utilizing the sun's heat as a source of power is one which has allured and baffled many inventors. The efforts have usually been in the direction of collecting and concentrating the heat by means of reflecting mirrors; and the results have proved too heavy in first cost and in maintenance to be of commercial use. This new method makes no attempt to concentrate the rays of heat; it acts on the principle of the forcing frame of the gardener; absorbing the direct rays of the sun and minimizing the loss from radiation. The apparatus consists of a shallow flat box, covered with two layers of window glass separated by a space of about one inch. Coils of piping, painted black, are laid in this box and through them water or some other fluid runs. The light-rays of the sun pass through the glass without interference, and are converted to heat, which, owing to the jacketing of the double glass and air space, escapes by radiation or induction very slowly, and generates a heat which converts the water in the pipes into steam. The steam is used in the engine, which is of the ordinary steam-driven type, and the exhaust is condensed and returned, forming an endless cycle.

The "hot box" or generator shown in this illustration is an experimental one installed at Tacona, Pa. With a glass area of 1,080 square feet it generated during the summer months a peak load of 3½ horsepower. Ether was used in the boiler and a pressure of 90 pounds was shown. With water the highest pressure obtained was 15 pounds; but it is expected that water will prove satisfactory in tropical countries. The cost of installation was about $1,500, and the upkeep is very moderate. A more powerful plant will shortly be erected in Florida, and submitted to a severe test under commercial conditions.

This power plant possesses the advantage of simplicity of construction; and its maintenance will be a fraction of that of a steam boiler. The fuel, of course, will cost nothing, and wages will be very little. The inventor, Mr. Frank Shuman, has organized a company to exploit the engine. If the results which are foreshadowed by the experimental plant are confirmed by more extended trial, one of the most perplexing problems of tropical countries will have been solved.



The Rays of the Sun, Striking Through Glass, Fall on Blackened Iron Pipes and Raise the Water in Them to Steam.

A NEW SOLAR POWER PLANT.

Spark-Producing Metals.

BY LEO SILBERSTEIN-GILBERT.

Auer von Welsbach has discovered that certain alloys of iron with cerium, lanthanum, and other metals of the rare earths produce showers of exceedingly bright sparks when they are scratched with a file or a knife blade. By employing large pieces of steel and of the alloy and applying strong pressure, it is possible to produce apparent flames as large as a man's hand, of intense brilliancy but accompanied by very little smoke and heat. The sparks possess remarkable igniting power and never fail to kindle tinder, inflammable gases, and wicks saturated with alcohol. They are equally efficient in the ignition of the explosives used in blasting and in gunnery.

These new alloys, therefore, present two very valuable properties—great luminosity and certainty of ignition—in a surprisingly simple form. They may be employed, for example, to light incandescent gas lamps at a distance by friction with a steel moved by an electro-magnet, and in time fuses operated by clockwork. For the ignition of explosives they possess the peculiar advantage of not being explosives themselves. Hence they should be safer than the fulminates and other igniters and primers now in use, as they are free from the danger of spontaneous or accidental explosion.

These "pyrophorus alloys," as they are called by their discoverer, promise also to be useful as illuminants in special cases. In buoys, for example, they might be arranged in combination with parabolic mirrors to emit flashes under the impulsion of the waves. They would be useful also in military signaling, from captive balloons or otherwise, and particularly valuable in flashlight photography, because of their freedom from smoke and odor.

The character of the light varies with the composition of the alloy, and special alloys are made for different purposes. Most of these alloys contain more than one earth metal in addition to iron. For example, the alloy called "lanthan," which gives an intense light, contains lanthanum and cerium, and the igniting compound "erdmetall" contains several metals of the rare earths. The last-named alloy evolves a slight odor of garlic, which makes it offensive in closed rooms, but the alloy "cer," containing only cerium and iron, also ignites very readily and is entirely odorless.

In general, the brightness of the sparks and the ease with which they are produced increase with the proportion of iron up to 30 per cent, and then decrease. Alloys containing 30 per cent of iron emit showers of very bright sparks at the lightest touch with the steel. The iron may be replaced in part, though not entirely, by nickel, cobalt, or manganese.

These remarkable alloys are made at Treibach in Austria, and cost $6 or $7 per pound, and a little of them goes a long way. A friend of the writer has carried a piece of the cerium-iron alloy in his pocket and given frequent exhibitions of its properties for a year, and there is no apparent reason why he should not continue to do so for many years longer.—Condensed from the New Yorker Staats-Zeitung.

By rubbing metals with salt before applying mercury, says the Engineer, the ancients obtained a reaction similar to that for which copper sulphate is used. The chlorine released from the salt formed a silver chloride easily attacked by mercury.

Fog Dispersion Again.

An Italian engineer has offered to secure immunity for London from the dense fogs which occasionally envelop her and paralyze her traffic, and as he asks for financial aid to demonstrate his theories, the London County Council has declined his offer. Writing of this fog problem, Consul-General Wynne of London says: "In replying to the report which made light of the theory that fogs could be driven away by the discharge of cannon, a civil and electric engineer informs the writer that the inventor of the fog dispeller has never claimed to be able to displace the atmosphere in order to prevent the fog from forming or to drive it away when once formed. His theory is quite different and the work to do very simple. He states that in order to prevent the phenomenon from taking place it suffices to destroy the atmospheric equilibrium which exists at the moment when the fog forms and which lasts as long as the fog lasts. The inventor states that the tranquillity of the atmosphere is the sole cause of fog; his purpose is to produce a movement in the air molecules. This movement is easily obtained by means of vibrations of the atmosphere. In order to produce molecular movement in 100 tons of metal it is not in the least necessary to displace the mass of metal—it is sufficient to strike it with a hammer to put the molecules of the entire mass in vibration."

The inventor quotes the case of hail in France, where a discharge at the right moment has often dispersed a gathering storm. According to a recently-issued report of the District Viticulture Society of Lyons, France, it appears that in the ten years preceding the use of protection against hail the losses amounted to about $2,600,000. In the six following years they amounted only to $200,000, and it is here stated that "all the slight failures sustained were invariably due to the relaxation of discipline on the part of the firers, who allowed themselves to be taken unawares."

Rutile—A Material for Aeroplanes.

A discovery of rutile is reported by Consul F. W. Goding, from Queensland, Australia. Hitherto rutile has had no commercial value, but it is now used in the construction of aeroplanes. The advent of flying machines driven by gasoline motors that run at very high speed has proved that bearings and axles of ordinary metals submitted to speeds of 2,500 to 3,000 R. P. M. wear so rapidly and heat so quickly that the necessity has arisen for some metal to stand the strain and velocity without wearing or heating, and this has been found in the metal titanium, of which rutile is the purest ore.

Rutile is a titanium dioxide, containing from 70 to 98 per cent of titanic acid, chiefly depending on the quantity of iron present. Pure rutile contains 98 per cent of titanic acid and 2 per cent of iron, when the mineral is a crystalline substance resembling sealing wax. The examples found in Queensland contain 70 per cent and resemble wolfram, having a lustrous fracture and being uneven in the grain. The specific gravity of rutile is 4.2; it cannot be scratched with a knife, but can be marked with a quartz crystal. The mineral occurs with wolfram and tin, running in veins through quartz and quartzite from a mere streak to large bunches, and is worth four times the price of wolfram at the present time.

Dr. Asa Williams Wilkinson.

Dr. Asa Williams Wilkinson, who died in New York on January 25, aged 75 years, is best known for his practical work in the improvement of illuminating gas. After a wide medical experience, most of it in New York city, Dr. Wilkinson in 1868 became interested in the manufacture of oxygen gas, and made improvements in the carbureting of street gas, enabling it to be burned in conjunction with the oxygen fed by a separate pipe to the burner tip. The white flame thus produced made this the most brilliant light invented up to that time and in public use. Later he conducted the chemical engineering of water gas manufacture, which was introduced into this country by the Municipal Gas Light Company.

In 1880 he became chemist of the Mutual Gas Light Company. From that time on he was actively engaged in the improvement of illuminating gas. He introduced the manufacturing of wood gas and the carbureting of the same by the use of gasoline, a petroleum product at that time a drug on the market.

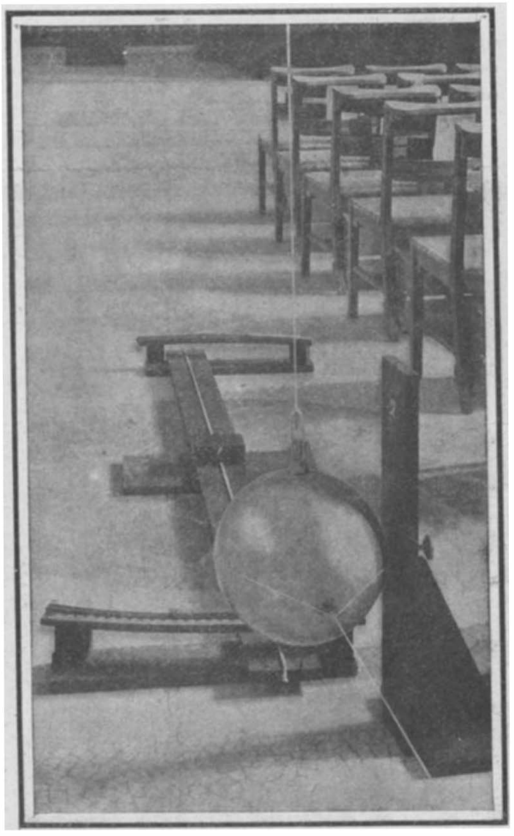
The Revised Specifications for the War Department's Military Airship.

The speed required of this two-man dirigible is 20 miles an hour, and no airship that makes less than 16 miles per hour will be accepted. The chief change in the specification is the requirement that the bidder shall furnish the material for the balloon envelope. The material must have a minimum breaking strength of 62½ pounds per inch width, and must require no varnish. The envelope is limited in length to 120 feet.

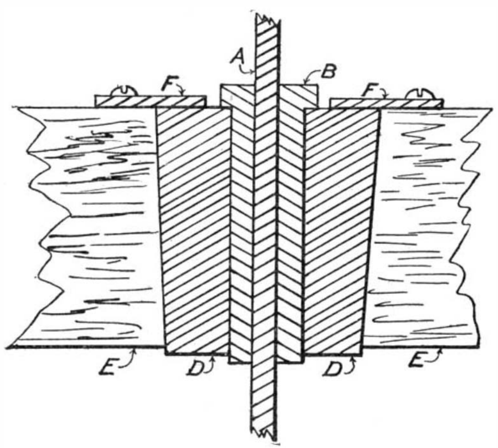
FOUCAULT'S PENDULUM EXPERIMENT REPEATED AT COLUMBIA UNIVERSITY.

BY DR. CHARLES FORBES, COLUMBIA UNIVERSITY.

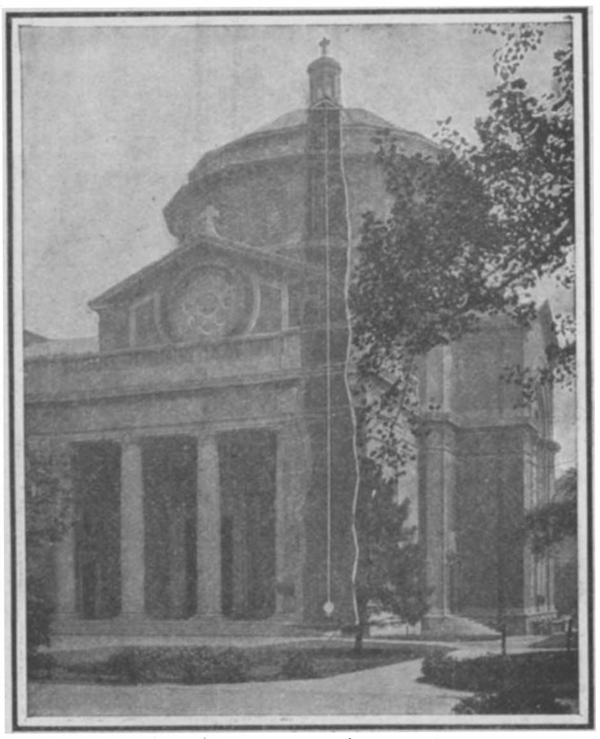
We owe to the ingenuity of Foucault, a French physicist, an experiment which renders the earth's rotation visible. This experiment was first performed by him in Paris in 1851. A pendulum was suspended from the dome of the Pantheon, and a fine point at the bottom of the weight was adjusted to trace marks in a ring of sand at each vibration. The marks thus made showed that the plane of oscillation varied with regard to the building, or, in other words, that the building was skewing around under the pendulum.



The Pendulum is Started by Burning the String in the Foreground.



Enlarged View Showing How the Wire is Attached to the Truss.



The 91-Foot Pendulum Suspended in St. Paul's Chapel.

FOUCAULT'S PENDULUM EXPERIMENT REPEATED AT COLUMBIA UNIVERSITY.

St. Paul's Chapel at Columbia University affords a most excellent place for the repetition of the same experiment, which was performed there on January 3, since which time there have been several repetitions with most satisfactory results. The apparatus for the experiment was prepared by the writer, and it embodies some novel features, which render the experiment a quantitative one; as performed by Foucault, it was somewhat qualitative.

The details of the apparatus are as follows: The weight is a hollow iron ball filled with lead, weighing 200 pounds, and suspended by a No. 13 steel wire from a truss across the opening of the dome of the chapel, as pictured in one of the illustrations. The breaking strength of the wire is 1,090 pounds. The wire is therefore strong enough to prevent longitudinal vibrations. The novel way in which the supporting wire is secured to the truss contributes materially to the success of the experiment. The details of the arrangement are shown in the line cut. At *A* is represented the wire passing through a brass sleeve *B*, which in turn passes through a rubber stopper *D*. The latter is fitted into a hole in the center of the crosspiece *E* of the truss. The stopper is kept from working upward by an annular brass plate *F*, which overlaps it and is fastened by screws to the crosspiece *E*. The wire is continued upward about one foot, and secured to the top of the truss. In this arrangement there is a distribution of the bending of the wire at the upper end, and thus the tendency to break by the swinging of the pendulum is greatly lessened. This symmetrical arrangement also allows the ball to swing freely in any direction. At a distance of 91 feet from the supported end of the wire, and 6 inches from the floor, the ball is secured. On the floor under the ball rests the recording apparatus. This consists of a board 228 centimeters (89.76 inches) in length, centered to a pivot directly under the ball. At its ends there are two arcs graduated in centimeters, each centimeter (0.39 inch) representing one-half a degree. On the board is a block with printer's ink on its upper surface. This serves at each vibration to ink a brush projecting downward from the under side of the ball. The ball is drawn to one side by a string looped around its equator and tied to a rigid support. At starting to swing, the ball should have no lateral vibration. To prevent this, an upright support at the right of the ball has a screw passing through it, the point of which just touches the side of the ball. This is gradually screwed backward until the ball hangs freely. It will now be perfectly quiet, and ready to be released on its journey, which is accomplished by burning the retaining string just back of the knot. The recording apparatus is so adjusted that the line on the floor will lie in the plane of the swinging pendulum. The inked brush will now begin to make its record on the graduated arcs at the ends of the recording device.

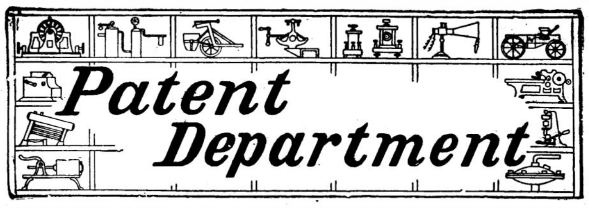
The fundamental principle involved in the performance of the experiment was described in the last issue of the Scientific American. The pendulum when set to vibrating keeps its plane of vibration constantly in the same direction with regard to space. The experiment is most easily understood if it is supposed to take place at one of the earth's poles, say the north pole. Here to an observer the earth would revolve horizontally from west to east. If at the pole the pendulum is set to vibrating in any direction with regard to space, a line drawn on the earth under the ball will rotate around the pole counter-clockwise, and complete its rotation under the plane of the swinging pendulum in 24 hours less 4 minutes (the sidereal day). The movement would therefore be about 15 deg. per hour. The desirability of position for the performance of the experiment diminishes as the equator is approached, at which place the experiment is inoperative.

The rule for determining the time of the complete rotation of the ground line is this: Divide 24 hours, or to be more exact, 23 hours and 56 minutes, by the sine of the angle of latitude where the experiment is being performed. For the latitude of New York city the time would be 36¾ hours. To get the distance the line moves per hour, divide 360 deg. by the time of the rotation of the ground line. For New York city it would be 9.8 deg.

On Monday, February 3, the writer repeated the experiment before the Department of Physics and officers of the university. The recorded movement, as in previous demonstrations, accorded very satisfactorily with the theoretical.

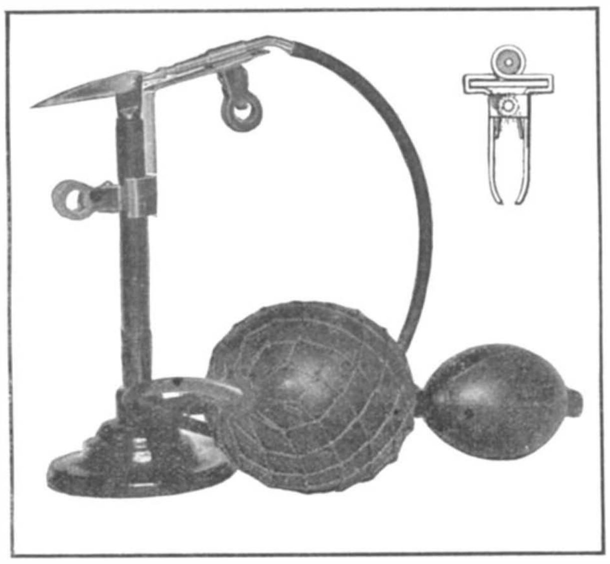
On the 7th, Dr. Mitchell of the Department of Astronomy gave a public demonstration of the experiment, and on the 12th Prof. Jacoby of the same department will repeat the demonstration.

To raise a heavy door slightly on its hinges, when about to lubricate them, place an ax on the ground with its edge toward the door, and open the latter so as to force it up the thickness of the ax for about a quarter of an inch. The ax will hold the door with the pintles exposed while the lubricant is applied.



A CONVENIENT BLOWPIPE.

Although particularly adapted for mineral analysis, the blowpipe attachment illustrated in the accompanying engraving will be of great value for all delicate

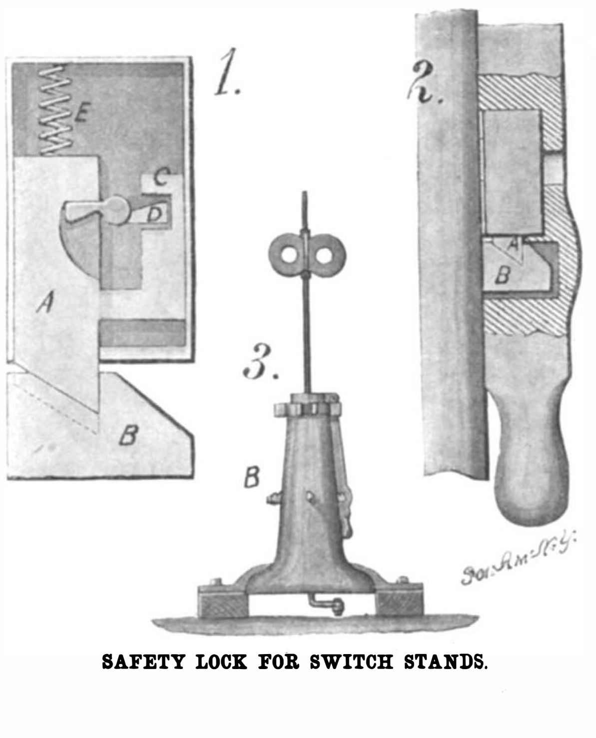


A CONVENIENT BLOWPIPE.

work which demands a small, intense flame of constant character for a considerable period of time. The device is adapted to be applied to a Bunsen burner, and does away with the inconvenient though customary method of supplying air from the lungs. It comprises a carrier, which is attached to the Bunsen burner by means of a spring clamp. The carrier is formed with a slide, that projects outwardly at an upward incline from the top of the carrier. On this slide the blast tube is secured by means of a spring clamp. The details of this clamp are shown in the small line drawing. It will be evident that by pressing together the thumb pieces of the clamp, the jaws of the clamp will open, permitting the device to be adjusted along the slide. The clamp which holds the carrier on the Bunsen burner is of similar construction, and may be released by pressing together the thumb pieces. In this way a double adjustment of the blast tube is provided. Normally, the blast nozzle is set to rest in a notch in the Bunsen burner, as shown in the engraving. When not in use, the blast tube may be lowered out of the way of the flame, permitting the latter to be used for other purposes. At the rear end of the blast tube a cap is provided, in the end wall of which is a minute opening to admit the air. Fitted to the cap is a tube, which communicates with a flexible storage bulb, and beyond this with a feed bulb. By pressing the feed bulb the storage bulb is filled with air, and a fine stream of air is caused to issue from the blast nozzle. The inventor of this blowpipe is Mr. Walter M. Bradley, 1346 Chapel Street, New Haven, Conn.

SAFETY LOCK FOR SWITCH STANDS.

Many serious railroad accidents have been caused by the failure to close a switch, either through forgetfulness on the part of a switchman or brakeman, or because of a careless infraction of the company's rules to accommodate a following train. In order to avoid such dangers, and make it possible to discover the guilty man, a recent invention provides a lock for the switch lever, which will catch and hold the key when the lever is unlocked from the stand. The brakeman is thus unable to withdraw his key from the lock until the switch lever is again locked fast to the stand. The details of this lock are shown in the accompanying engraving. The bolt *A* is arranged to engage one of a series of notched lugs *B* on the switch stand. The bolt is formed with an extension plate *C* at one side, which fits closely against the inner side of the casing, and overlies the keyhole *D*. This extension plate is formed with a notch, which clears the keyhole *D* when the bolt engages the lug *B*; but when the bolt is unlocked, a spring *E* serves to force it to the position shown by dotted lines, in Fig. 1, and the extension plate *C* will drop and cover the keyhole *D*, to prevent withdrawal of the key. The brakeman will not be liable to forget the open switch as long as his key is held in the switch lock. On the other hand, if he attempts to violate orders, and leave the switch, he cannot carry his key with him, and hence it will not be possible for him to make the errors that are now so costly to the railroad. A patent on this improved lock has been secured by Messrs. Richard F. Jacob and B. B. Hollomon, 548 Lauderdale Street, Selma, Ala.



SAFETY LOCK FOR SWITCH STANDS.

BASKET HOLDER FOR FRUIT PICKERS.

To enable fruit pickers to use both hands freely while carrying the baskets which they are filling, Mr. George S. Paine, of Winslow, Me., has invented a basket holder, which easily may be secured in operative position by means of an adjustable strap passed around the waist. The holder consists of a trough-shaped member of sheet metal, which securely binds the basket in place. It is particularly designed to hold a pair of small baskets or boxes of the type in which berries are usually sold, but it will be evident that the holder could also be adapted to carrying baskets of other types. As shown in the accompanying illustration, the sheet metal trough *A* is provided with an offset at one side, and an outwardly inclined wall *B*. At the opposite side the trough is made fast to a block which is curved to fit the body. Secured to this block is a metal band provided with buttons at each end, to which a strap may be secured. This strap is provided with a number of buttonholes, so that it may be adjusted to the size of waist of the person on whom the holder is mounted. When placing the baskets in the trough *A*, they will rest on the offset at the forward side thereof, and the extensions *B* will press against them and bind them in place. The baskets will thus securely be retained against accidental displacement as the operator moves from place to place.

Obviously the use of this holder will effect a considerable economy; for, with both hands free, the operator will be able to pick a much larger quantity of fruit in a given time.

A NOVEL OBSERVATION SWING.

One of the latest amusement devices for recreation parks and the like is a rocking wheel, which swings the passengers back and forth over a large convex arc, rather than a concave arc, as in the ordinary swing. A pair of rockers are provided of the type shown at *A* in the engraving, and suspended between these rockers is the passenger car *B*. Grooved tracks *C* are provided, in which the rockers travel. The peripheries of the rockers are also grooved to receive cables *D*, which are fastened to the rockers above the car, and passing around the rockers extend to opposite ends of the track. These cables serve to hold the rockers in the tracks. To balance the weight of car and passengers a counterweight *E* is secured to the rockers. This weight may be raised or lowered by means of rack and pinion gear operated by a crank *F*. A catch *G* holds the crank *F* against accidental turning. When the weight has been adjusted to the proper position, it is made fast by operating the clutch *H*. Near the upper end of the rockers is a pin *I*, adapted to be engaged by a hook *J* extending from a weighing scale. When the swing is in the dotted position, the passengers enter the car, and the operator noting the scale adjusts the weight *D* to balance the car and its occupants. This done, the lever *L* is operated to withdraw the hook *J* against the tension of the spring *K*, and release the rockers. The latter will then rock back and forth, and if undisturbed will finally come to rest in the position illustrated by full lines. In order to continue the rocking motion indefinitely, and make sure that the device will return to the starting position, a pushing crank *M* is provided which may be operated by the lever *N* to push the rockers at the end of each oscillation.

The inventor of this observation swing is Mr. Winfield S. Rich, of 440A St. Marks Avenue, Brooklyn, N. Y.

Fence Posts Made Durable.

Fence posts of many kinds of cheap woods which ordinarily would soon decay if set in the ground can be made to last for twenty years by a simple treatment with creosote. Most of the so-called "inferior" woods are well adapted to the treatment, and this is especially true of cottonwood, aspen, willow, sycamore, lowgrade pines, and some of the gums. When properly treated, these woods outlast untreated cedar and oak,

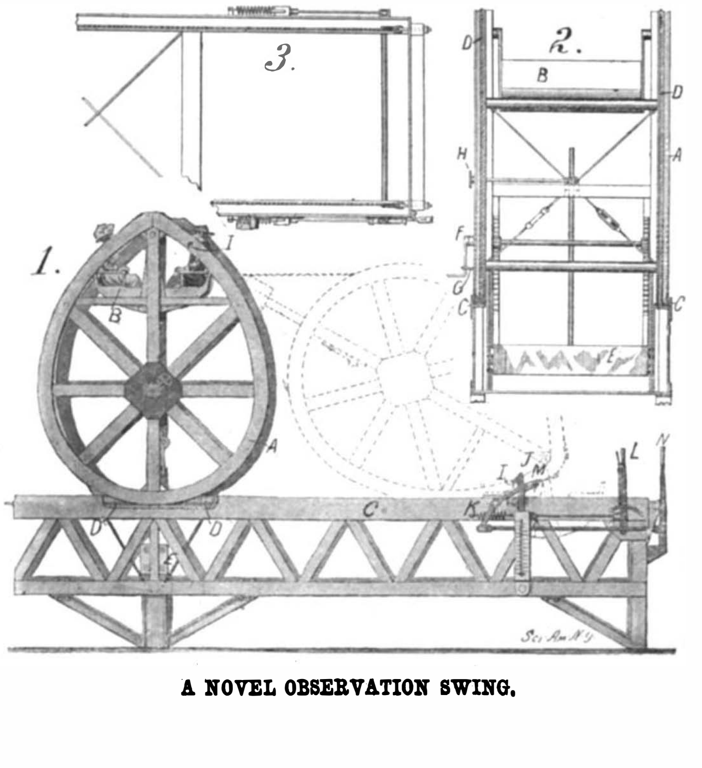
BASKET HOLDER FOR FRUIT PICKERS.

which are becoming too scarce and too much in demand for other uses to allow of their meeting the demand for fence posts.

Impregnation with creosote has been greatly cheapened by the introduction of the "open tank," which can be installed at a cost of from $30 to $45, or much less if an old boiler is used. A tank with a bottom 12 square feet in area will suffice for treating 40 or 50 6-inch posts a day, or double this number when two runs per day can be made. The absorption of creosote per post is about as follows: Eucalyptus, one-tenth gallon; willow, two-tenths gallon; sassafras, ash, hickory, red oak, water oak, elm, and maple, four-tenths gallon; Douglas fir, quaking aspen, and black walnut, six-tenths gallon; sycamore, cottonwood, and lodgepole pine, seven-tenths gallon. The price of creosote is about 10 cents per gallon in the East and Middle West, 16 cents per gallon on the Pacific coast, and 27 cents per gallon in the Rocky Mountain States. The cost of treating a post will therefore vary from 4 to 15 cents. Properly treated, it should give service for at least twenty years.

Experiments of the Forest Service show that with preservative treatment the durability of lodgepole pine in Idaho is increased sixteen years. The cost of creosote is there relatively high, yet by treating posts there is a saving, with interest at 6 per cent, of 2 cents per post yearly. More important than the saving, however, is the fact that through preservative treatment other woods are fitted to take the place of cedar, of which the supply is rapidly becoming exhausted. A detailed description of experiments in preserving fence posts, together with practical suggestions for treating them on a commercial scale, are contained in Circular 117 of the Forest Service. This publication can be obtained upon application to the Forester at Washington.

Subjected to the action of liquid air, lead becomes elastic and can be made to rebound or serve as a spiral spring during the continuance of this low temperature.



A NOVEL OBSERVATION SWING.

RECENTLY PATENTED INVENTIONS

Electrical Devices.

TROLLEY-REPLACER.—G. Q. Seaman, New York, N. Y. The replacer is such as used in connection with the trolley poles of electric cars for replacing the trolley upon the trolley wire when it becomes accidentally displaced. While the invention concerns itself especially with the replacer, the construction is such as will operate automatically to depress the pole when it becomes displaced; in this way preventing injury to the guy wires or supports.

TRANSFORMER EMPLOYED IN HIGH-FREQUENCY-CURRENT CIRCUITS.—G. E. Gaiffe, 9 Rue Méchain, Paris, France. This invention consists essentially in the employment, with the object of damping the oscillations of high frequency which tend to traverse the transformer, of resistances either alone or in conjunction with capacities connected to the extremities of the secondary of the transformer.

Of General Interest.

FLY-ESCAPE.—G. W. Stein, Washington, D. C. The improvement pertains to a fly escape and also to a combined sash bolt or lock and fly escape, and the object is to provide a simple means for allowing flies to freely escape from the interior of a room, store, or dwelling, but which will not allow ingress of flies to the interior of the rooms, stores, or dwellings.

SIGN-ILLUMINATING DEVICE.—W. H. Nicolay, New York, N. Y. The primary object of this inventor is the provision of means adapted to enable a sign to be illuminated evenly on both sides by a series of lamps, and to enable the lamps to illuminate with a minimum amount of power the front of a store and the sidewalk connected therewith.

PHOTOGRAPHIC-PRINT BOX. — M. H. Havenhill and E. A. Jenkinson, Jacksonville, Ill. The print box is more especially designed for use in separately storing exposed and non-exposed photographic sheets, the arrangement being such that the exposed sheets or prints are returned to a compartment separate from the one containing the non-exposed sheets, to avoid confusion of the exposed and non-exposed sheets.

GATE.—F. E. Nelson and G. W. Tribbey, Marshfield, Ore. The gate being closed, a pull on the rope lifts the weight and swings a bar into position. This bar movement oscillates a rod and swings a lug in position with the lower end of the rear upright of the gate directly in front of the rod, which tends to push the lower end of the gate away from the gate post, and elevate the unattached end of the gate, so that the latch is released from the catch. Continuation of shaft rotation opens the gate. Means lower the gates' free end to engage the latch with the catch, and to limit swinging movement after closing of the gate.

Machines and Mechanical Devices.

BOTTLE-WASHING MACHINE. — J. W. Greer, Mount Pleasant, Texas. The more particular object of this invention is the provision of a machine containing a revoluble drum provided with bottle holders. The holders being filled with water, power is turned on by manipulating a lever to shift the belt. This causes the drum to turn. The rotation washes bottles and removes labels. The operator stops the machine by removing a belt to a loose pulley and at the same time applies the brake by depressing the treadle-plate with his foot.

CASH-REGISTER.—F. Degenhardt and R. Degenhardt, New York, N. Y. The object in this case is to provide means capable of being attached to a cash register and adapted to record the time within which individual deposits are made therein. By means of the construction the amount of the sales, or deposits made in the register are also recorded on the tape marked with the sub-divisions of the time.

CENTRIFUGAL MILL.—H. Besser, Alpena, Mich. The more particular object in this instance is to produce a mill in which the movable grinding members are controlled either wholly or in part by the action of centrifugal force, and thus caused to press upon the stationary grinding member or members with a degree of force inherently related to the speed of rotation.

SPOOLING-MACHINE. — F. L. Atherton, Paterson, N. J. The object of this patentee is to provide a spooling machine, arranged to automatically stop each spool when filled, independently of the other spools, and to permit the convenient and quick adjustment of the bearings to insure proper alinement and to accommodate spools and reels of various length.

WATER-ELEVATOR.—W. G. Dougherty, Pocatello, Idaho. In operation when the apparatus is located and suitably anchored in a stream of flowing water the water will turn the drive wheels which by the belt gearing will operate to turn the elevator, the water acting with force upon the concave paddle blades and the connections from the drive shaft to the upper and lower ends of the elevator will operate to equalize the strain on the apparatus and thus increase the power and improve the running of the apparatus.

ANTIFRICTION-BEARING.—H. R. Plimpton, 2d, Newton Center, Mass. The object here is to so construct the device that all contracting surfaces will have rolling rather than sliding or rubbing engagements with each other. To accomplish this, rotatable spacing members are provided adapted to be moved by centrifugal force to such positions that they serve to hold the load-supporting balls at equal distances from each other and rotate by contact therewith, the outward movement of said members serving not only to separate them from engagement with their raceway but also to effect a finer adjustment of the balls.

Prime Movers and Their Accessories.

GAS-ENGINE COOLER.—F. L. Orr, Thurman, Iowa. The invention is mainly designed as a cooling attachment to the form of engine starter described in the Letters Patent formerly granted to Mr. Orr, but is equally adapted for use with other forms of engine starters employing expanded or stored hot gases as the boosting motive power, and therefore this inventor does not confine himself in its use to any particular form of explosive or hot-air engine.

ENGINE-VALVE.—B. Hanson, Schroyer, Kan. In this patent the invention pertains to valves, and more particularly to those for steam engines, and has for its object to provide a valve of oscillatory type, which may be easily applied to an engine and which may be operated to admit steam to the valve ports of the cylinder alternately.

ROTARY ENGINE.—E. E. Lord, Springvale, Maine. This invention has reference to rotary engines, and the object of the inventor is to produce an engine of this class which is simple in construction and which will use the steam economically. A further object is to construct the engine so that it can operate without the use of a special valve mechanism.

INTERNAL-COMBUSTION ENGINE.—F. C. Gordon, Asotin, Wash. The intention in this case is to improve a two-cycle internal combustion engine, in which one or more cylinders are employed and in each of which opposed pistons operate, driving two crank shafts having connection with each other to maintain them in fixed relation, and it involves features concerned with vaporizers of the liquid fuel and supply of the combustible mixture to the cylinders, the ignition of the charge and the regulation of governing of the engine.

CARBURETER.—E. Gundelach, New York, N. Y. The object of the inventor is to provide a carbureter arranged to insure an intimate mixture of the air and gas, to force the explosive mixture thus formed into the working chamber of the motor under pressure, with a view to forcibly drive out the residue matter left by a previous explosion, and to fill the working chamber with an efficient fuel charge even when running the motor at high speed.

PISTON.—P. A. Wille, New York, N. Y. The invention relates to improvements in pistons adapted for use in engines, pumps, and the like, and especially adaptable in connection with cylinders which have become worn or irregular through use. Particularly in internal combustion engines the cylinder often becomes gouged or worn out at one side thereof, due to thrust of piston, and the cylindrical packing rings no longer fit the wall of the cylinder, thus permitting escape of gases to the rear of the piston.

Railways and Their Accessories.

AUTOMATIC PRESSURE RETAINING AND GRADUATING RELEASE DEVICE FOR AIRBRAKES.—E. B. Hillman and L. E. Roberts, Chico, Cal. More particularly the invention relates to means whereby the pressure within the brake cylinder may be automatically retained until the brake pipe and auxiliary cylinder have been recharged to the desired pressure after the brakes have been set. Brakes may be applied instantly after having been released, and the second application of the brakes secured with as fully as great a pressure as was employed in the last preceding application of the brakes.

MAIL-BAG CATCHING AND DELIVERING APPARATUS.—J. B. Dawson, Pioneer, Mont. The station agent applies the bag to the arms of the station crane, hangs the bag on the upper and then raises the lower arm and hooks the bag thereon to receive it from a train. A clerk takes the sack to the car door and hooks its top on the extension carrying the fastening and the lower end of the sack to bail fastenings and holds the bag to be engaged by a fork as the car passes the crane when the mail is exchanged. The car hook takes the sack from the crane after the hook has taken the bag from the car.

COMBINATION STOCK-CAR.—T. M. Crepar, Jamestown, N. D. One purpose of the invention is to provide the car with permanent deck fixtures, that are entirely out of the way when the car is in use with a single deck, and to provide means at such time for storing the extra deck material at the roof section of the car out of the way and in an order corresponding to that which the material is laid in building an upper deck.

Note.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

Notes and Queries.

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.
References to former articles or answers should give date of paper and page or number of question.
Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.
Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.
Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.
Scientific American Supplements referred to may be had at the office. Price 10 cents each.
Books referred to promptly supplied on receipt of price.
Minerals sent for examination should be distinctly marked or labeled.

(10668) A. L. H. asks: A claims that a tub containing two-thirds of water and weighing 62½ pounds will weigh, if a fish weighing 4 pounds is put in, 66½ pounds. B claims that putting in the fish does not change the weight at all. He claims that the fish's bladder supports him, as it contains air. A claims that if the tub was full of water and the fish put in same, it would displace its weight in water. Which is correct? A. If a fish weighing 4½ pounds is put into a tub of water and no water overflows, the weight of the tub is increased by 4½ pounds. The weight of the fish is supported by the water, and the water in turn is supported by the tub, so that the tub would press upon scales more when the fish is put into it. If the tub were even full, then a weight of water equal to that displaced by the fish would overflow, since as you say the fish in the water weighs just as much as the water it displaces. Its air bladder enables it to adjust its volume, so that its weight is usually the same as that of the displaced water. Fishes may be seen to sink in water. In this case the fish is compressing its air bladder, and thus it displaces a weight of water less than its own weight, and it sinks. Should it expand its air bladder, it would rise to the surface by that means. A is right, B is not right. The law known as Archimedes's Principle covers this case.

(10669) A. H. D. asks for a formula for insulating varnish. A. Put 1 ounce shellac into a wide-mouthed 8-ounce phial containing 5 ounces of well-rectified wood naphtha. Close the bottle with a cork, and let it stand in a warm place until perfectly dissolved. Shake the mixture frequently and pass the fluid through a paper filter; add rectified naphtha to the solution from time to time in such quantities as will enable it to percolate freely through the filter. Change the filter when necessary.

(10670) A. C. N. asks how to amalgamate zincs. A. This is accomplished in several ways. 1. By dipping the zinc in dilute sulphuric acid and then dipping the end of it into a small quantity of mercury, after rubbing the surface with a brush. 2. Dissolve 1 pound of mercury in 5 pounds of nitro-muriatic acid (nitric acid 1 part, muriatic acid 3 parts), heat the solution gently to hasten the action. When a complete solution of the mercury is effected, add 5 pounds more of nitro-muriatic acid. The solution should be applied with a brush, as immersing the zinc in it is wasteful. 3. To the bichromate solution commonly used in batteries, add to every pint of solution 1 drachm of bisulphate of mercury or a similar amount of nitrate of mercury (mercury dissolved in nitric acid). By employing this method, the amalgamation of the zincs is maintained continuously after the first amalgamation, which must be accomplished by method 1 or 2. 4. In the Bunsen, Grove, or Fuller battery the amalgamation may be accomplished by placing a small quantity of mercury in the cells containing the zincs. 5. Place a little mercury in a saucer with some dilute sulphuric acid. Dip the zincs into dilute acid. Then with a little strip of zinc or galvanized iron touch the mercury under the acid and rub it on the zinc. This will transfer a little to the surface, and a few minutes' rubbing will make the zincs as bright as silver. A very small globule of mercury is enough for a single plate.

(10671) H. C. A. says: How large a dynamo is necessary to charge storage batteries such as those used in automobiles? Can you give me a few hints on how to charge them? A. We should advise you to write to the makers of the storage battery you wish to charge, and learn from them what current is necessary to do the work. They will very willingly assist you in getting the right dynamo. We cannot tell anything about the matter without knowing more about it. A storage battery is charged by connecting its positive pole to the positive pole of the current, and thus sending the charging current through the battery in the opposite direction to that of the current which the battery sends out. The quantity of current to be used for charging is determined by the size and number of the plates in the battery. This is also a matter to be decided by the firm making the battery.

NEW BOOKS, ETC.

Practical Dairy Bacteriology. By Dr. H. W. Conn of Wesleyan University. A complete exposition of important facts concerning the relation of bacteria to various problems related to milk. A book for the class-room, laboratory, factory, and farm. Equally useful to the teacher, student, factoryman, and practical dairyman. New York: Published by Orange Judd Company. Fully illustrated with 83 original pictures; 340 pages; cloth; 5½ x 8 inches. Price, $1.25.

The development of dairy bacteriology has been very rapid in the last ten years. Beginning first as a subject of scientific interest only, the study of the bacteria in milk has proved to be of vital importance, not alone to the dairyman, but to all persons who have an interest in public health problems. In the last few years there has developed in our large cities a keen interest in the bacteria of the city milk supply. To-day there is no more important subject affecting the milk producer, distributer, or consumer than their relations to the bacteria of milk, and public health officials are also recognizing the subject as one of which they must take cognizance. All dairy students to-day must learn the facts which are known, and no dairy course is complete without a full consideration of this subject.

This book is designed to meet this growing demand. It consists of two parts. The first is a general discussion of all phases of bacteria associated with milk products and their relation to public problems. The second is an outline of a series of experiments for students, so designed that one who has been through them will not only have a practical knowledge of bacteria and bacteriological methods, but will be able to carry out all the work of bacteriological analysis of milk products that may be needed either in a dairy, a creamery, or a sanitary laboratory. The book is thus especially adapted to meet the needs of students in dairying, or any to whom a practical knowledge of bacteriological methods as relating to milk is of value. The book is strictly up to date and contains the most recently determined facts in the newest methods. It represents the rounding out of the experience of Dr. Conn.

Insects Injurious to Vegetables. By F. H. Chittenden. New York: Orange Judd Company. 12mo.; cloth; 262 pages. Price, $1.50.

This book embodies the life work of Dr. Chittenden, the world's greatest authority on insects injurious to vegetables. The insects are discussed and illustrated under the various crops they attack. It is easy, therefore, for anybody to identify the creature being dealt with, find the remedy and apply it.

A Pocket Book of Electric Lighting and Heating. Comprising useful formulæ, tables, data, and particulars of apparatus and appliances for the use of contral station engineers, contractors, and engineers in charge. By Sydney F. Walker. New York: The Norman W. Henley Publishing Company. 16mo.; pocket size; leather bound; 438 pages; 272 illustrations. Price, $3.

In preparing this pocket book the aim has been to present in a handy form information that may be required in an emergency by central station engineers, contracting engineers and their assistants, and engineers-in-charge, in performance of their daily duty. During the work of preparation, practical utility was kept in view in the selection of subjects to be treated, and no pains were spared in the choice of such subjects as the practical engineer might desire. In obtaining material from the best sources, including much information as to sizes, weights, efficiencies, dimensions, etc., of the apparatus and appliances selected, excellent results have been obtained.

The Ziegler Polar Expedition. 1903-1905. Anthony Fiala, Commander. Scientific results obtained under the direction of William J. Peters, representative of National Geographic Society, in charge of scientific work. Edited by John A. Fleming. Washington, D. C.: Published under the auspices of the National Geographic Society by the Estate of William Ziegler.

Through the courtesy of the estate of the late William Ziegler, Esq., we have received the published records of the scientific results obtained by the Ziegler polar expedition of 1903-1905, which was commanded by Anthony Fiala. The mass of observations made by the five scientists of the expedition shows what little regard they had for their own personal welfare and comfort. Especially is this realized when one knows that to reach a certain instrument house where a watcher was always stationed, the relief was forced to follow a guide rope through blinding, driving snow, in the face of a cutting wind. Upon arriving at the destination, the imprisoned worker within had to be dug out before he could be released.

Little or no mineralogical, zoological, or similar work was done, owing to the impossibility of transporting collections. Some coal was discovered, a lignite of poor quality, which however burned readily; as well as some brown coal. A pair of Spitzbergen ptarmigen were shot in the summer of 1904. They are a rare bird, not often seen in collections. Colored sketches of the aurora borealis were also secured. They were made in the open at a temperature of from 30 deg. to 50 deg. Fahr. below zero.

The main body of the contents of the book is made up of magnetic, tidal, astronomic, and similar tabulated readings.

CHAPTERS ON PAPER HANGING. By Clayton Beadle. London and New York: D. Van Nostrand Company. 4 vols. 16mo.; clot... Sold separately at $2 per vol.

Four volumes of reprints. Vol. I. contains ten lectures on paper making, delivered before a London educational institute in 1902; Vol. II. gives the examination questions set during a number of years by the City and Guilds of London Institute, with answers and comments. Vols. III. and IV. are the outcome of a sort of correspondence school conducted through the columns of Paper and Pulp. The author asked questions which were generously responded to by workingmen in paper mills. These answers, and the author's comments on them, form the basis of two very practical volumes.

SANITATION IN PUBLIC BUILDINGS. By William Paul Gerhard. New York: John Wiley & Sons. 12mo.; cloth; 262 pages. Price, $1.50 net.

The sanitation of hospitals, theaters, churches, schools, markets, and abattoirs is a large subject to be dealt with in one little book of about 250 pages. The author, however—who is well known by a number of books on similar subjects—has packed much practical information into his limited space. The book is not one merely for sanitary engineers, but will prove useful reading to all who have any intelligent connection with the classes of buildings considered.

THE CHEMISTRY OF GAS MANUFACTURE. A Practical Manual for the Use of Gas Engineers, Gas Managers, and Students. By Harold M. Royle. With colored plate and numerous illustrations. New York: Norman W. Henley Publishing Company. 8vo.; cloth; 328 pages. Price, $4.50.

The author, who is a chemist at an English gas works, has succeeded in his endeavor to write a practical manual. He does not trench on the actual manufacture of gas, but confines himself to certain aspects of its chemistry, and handles a wide subject in a compact manner. The volume will be a useful addition to the bookshelf of the works manager or advanced student.

THE PROELL STEAM CALCULATOR. Adapted for Steam Calculations for Turbines and Piston Engines. Pamphlet with plates. London: John J. Griffin & Sons, Ltd. Price, $2.

A graphic treatment of the properties of steam by a set of twenty curves plotted to rectilinear co-ordinates in the usual manner.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Issued for the Week Ending January 28, 1908.

AND EACH BEARING THAT DATE

[See note at end of list about copies of these patents.]

RUBBER STAMP MAKING.—THIS article describes a simple method of making rubber stamps with inexpensive apparatus. A thoroughly practical article written by an amateur who has had experience in rubber stamp making. One illustration. Contained in SUPPLEMENT **1110**. Price 10 cents. For sale by Munn & Co. and all newsdealers.

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Remedy for dyspepsia, headache, and nausea, F. Fuller 67,354
Remedy for laxative and blood purifying purposes, Iron-ox Remedy Co.......... 67,357
Remedy for purifying the blood, P. L. Cusachs, Limited 67,363
Rubber erasers, J. Lehmann.......... 67,380
Rugs, woven, Kilmarnock Textile Manufacturing Co. 67,297
Salt, blue, and ammonia, table, Drake & Co. 67,291
Shirts, dress and negligee, J. Lauer........ 67,236
Shoes, children's leather and canvas, Lamkin & Foster.......... 67,379
Shoes, leather, R. P. Smith & Sons Co., 67,383 to 67,386
Skirt and trousers hanger, Frear Novelty Co. 67,241
Soap, T. Metzger.......... 67,248
Soap, toilet, Remmers Soap Co.......... 67,299
Stoves, certain, Duparquet, Huot & Moneuse Co. 67,332
Tablets, laxative, F. W. Sultan.......... 67,367
Tobacco, cigars, and cigarettes, Globe Tobacco Co. 67,246
Tonics, stock, Stock Food Company of America 67,366
Treatises on medicines and supplements thereto, Physicians Publishing Co.......... 67,340
Typewriting machines, Elliott-Fisher Co.... 67,245
Umbrellas and parasols, Kraut & Finver Bros. 67,298
Underwear, ribbed, Southdown Knitting Co., 67,302, 67,303
Waters and carbonated beverages, mineral, Borello Bros. 67,326
Whisky, A. Hill.......... 67,268
Whisky, Golden Hill Distilling Co.......... 67,311
Whisky, Live Oak Distilling Co.......... 67,319
Yeast, C. B. Blackwell.......... 67,307
Yeast and certain cereal foods, Fischer Bros. 67,310

LABELS.

"Alma," for cigars, Moehle Lithographic Co. 14,012
"El Stilo," for cigars, Moehle Lithographic Co. 14,008
"El Vincero," for cigars, Moehle Lithographic Co. 14,010
"Henry Draper," for cigars, Moehle Lithographic Co. 14,009
"Eyelets," for metal specialties, Edwin B. Stimpson Co. 14,019
"Indian Tonic Bitters," for a medical compound, J. C. Veader.......... 14,016
"J. Clavel Company," for cordials, J. Clavel Wine and Cordial Co..........14,014, 14,015
"John Torrey," for cigars, Moehl Lithographic Co. 14,013
"Rover," for cigars, Moehle Lithographic Co. 14,011
"Steel Gray Enameled Ware," for enameled ware, Republic Metalware Co.......... 14,018
"Woodruff Celebrated Sticking Plaster," for sticking plaster, B. A. Perry.......... 14,017

PRINTS.

"By the yard or buy the garment," for linings, A. G. Hyde & Sons.......... 2,207
"Dr. Stork," for malt elixir, Peter Hand Brewing Company.......... 2,206

A printed copy of the specification and drawing of any patent in the foregoing list, or any patent in print issued since 1863, will be furnished from this office for 10 cents, provided the name and number of the patent desired and the date be given. Address Munn & Co., 361 Broadway, New York.

Canadian patents may now be obtained by the inventors for any of the inventions named in the foregoing list. For terms and further particulars address Munn & Co., 361 Broadway, New York.