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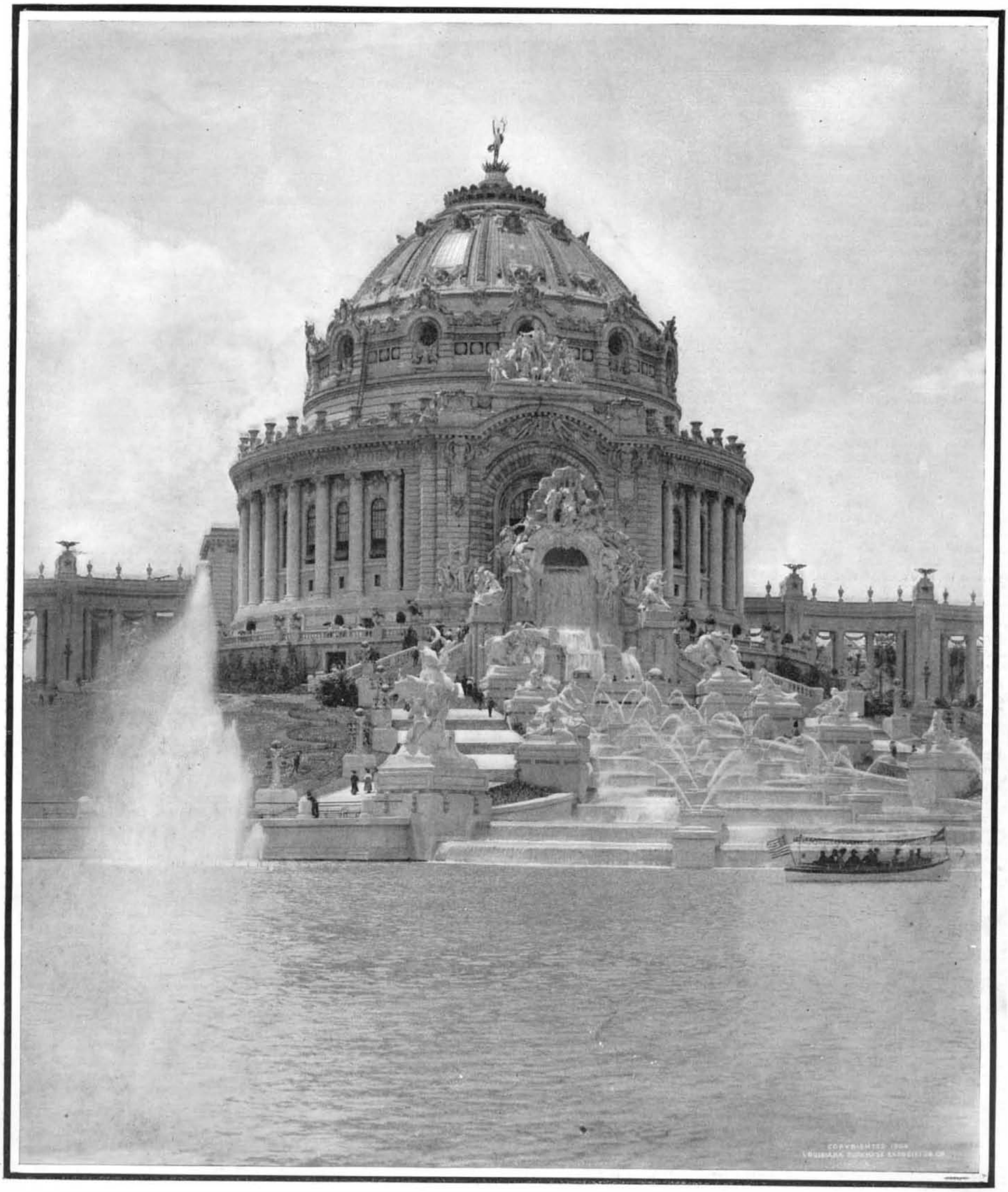

THE FESTIVAL HALL, THE CENTRAL AND DOMINATING STRUCTURE OF THE LOUISIANA PURCHASE EXPOSITION.—[See page 46.]

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NEW YORK, SATURDAY, JULY 16, 1904.

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.

HOW LONG MUST WE SUFFER? OUR ENGINEERING DEPARTMENT AT PRESENT THE CREATURE OF PARTY POLITICS.

Every evening between half past five and half past six o'clock the Brooklyn Bridge on the Manhattan side of the East River presents a scene which mere words describe but feebly. In that brief hour, tens of thousands of men and women who live in Brooklyn and work in New York city pour out of the downtown office buildings, rush for the trolley and elevated cars that circle in cramped loops around the Manhattan terminal, and literally fight for a place to sit, often for a place to stand. Men and women struggle in this throng, so utterly regardless of the common courtesies of life, that even injuries are sustained by those who are least able to wage this evening strife. Long ago the conditions became so shocking that policemen were stationed at the tracks to preserve something like order, and to restrain the over-energetic from worming themselves through the car windows in an ambitious attempt to outdo those who fought their way through the end gates.

This state of affairs has prevailed for years. Finally, the cry for better transportation facilities aroused even the sluggish municipal officials, and induced them to divert their attention for a time from the less onerous exigencies of politics to the city's immediate needs. Several bridges were authorized. One of these, the Williamsburg Bridge, is completed. For the time being it is of little or no value in relieving the congestion in City Hall Park, because the railway companies have not as yet laid the tracks for which ample roadways have been reserved. Two bridges are still in course of construction. When they will be completed, no one can foretell.

With thousands of Brooklyn residents clamoring for better means of reaching their homes, one would suppose that the municipality would make a determined effort to meet the situation. Officials to whom the construction and care of bridges are intrusted have not been idle; but their activity has been expended very largely in drawing plans for imposing structures, in discarding them, and in providing others to take the place of those discarded. The Bridge Department of one administration seems to exert its utmost endeavors to undo the work of previous office holders, and to substitute its own ideas of what the city wants, regardless of the disgraceful scenes that occur daily before their very eyes at the Brooklyn Bridge. What may be regarded as a typical instance of the delays by which the patience of New Yorkers has been taxed for years is offered by the history of the Manhattan Bridge—a history which is anything but diverting, and in which politics, personal spite, useless engineering debates have played their part.

We first heard of the Manhattan Bridge about six years ago. On November 30, 1898, resolutions were passed by the Board of Aldermen, authorizing the preparation of plans for the structure. That was the first step. An ordinary business man would be justified in assuming that these plans were adopted after reasonable consideration, and that the necessary money was appropriated without unnecessary delay to carry them into effect. Unfortunately, however, New York city is administered on political, and not business principles. It was not until January 1, 1900, that the construction of the bridge was authorized. For some inexplicable reason the aldermen saw fit to appropriate, not a lump sum for the building of the structure, but to set apart a small amount for the construction of certain parts—an amount which the engineers in the Department of Bridges considered absurdly inadequate, even for the particular purpose for which it was intended.

This method of procedure was not without its effect on the Department of Bridges. In the summer of 1899 following the resolution authorizing the preparation of drawings, the drafting force of the Department began its work. In the summer of 1900 plans for one tower and its foundation had been completed, and the drawings for the other parts had been developed to a degree rendered necessary in preparing the tower plans. In the inscrutable wisdom of the Board of Aldermen, only money enough for the building of a single tower had been appropriated at first. That money not being immediately available, the contract for the single tower in question was not let until the spring of 1901.

Three years had elapsed, and not a spadeful of earth had been turned.

Meanwhile the drawings for the Manhattan tower had been prepared. In printed form they were ready for bidding contractors by January 1, 1902. Then came a turn in the tide of political affairs. When the Reform administration came into power, every Tammany man was swept out of office. The Commissionership of Bridges was wisely intrusted to an eminent engineer of international reputation, undoubtedly to the Department's benefit. The new incumbent objected to the plans of the Manhattan Bridge, because he considered the structure which they represented entirely inadequate. New plans were prepared. For the wire cable suspension bridge that had been proposed, he substituted an eye-bar cable structure. The newly-proposed plans, however, aroused such a storm of criticism that the mayor of the city deemed it advisable to submit them to a board of experts for approval. That board, composed of men who stand in the front rank of their profession, gave their unqualified approval to the eye-bar design. After this delay, the substituted plans for the bridge were completed in a general way by the summer of 1903, and duly approved by the Municipal Art Commission.

Five years had elapsed. The foundations of the towers loomed up on the shores of the East River—all that had been done.

The elections of 1903 brought defeat to the Reform administration. Following the usual American practice, the change of administration again resulted in turning out the department engineers. A new Commissioner and a new engineering force began the administration of the Department of Bridges. Eye-bar cable designs, which had cost so much time and trouble to prepare, and over which so much ink had been spilled in alternate disparagement and approval, were thrown aside. The old wire cable design was dug up; its architectural faults were remedied so far as possible; the whole entailing an expenditure of $75,000 to $100,000 in the preparation of new drawings and loss of time that cannot be measured in money.

Six years have passed; and still, all that the city can show in actual work completed is the foundations on the shores of the East River.

Those who know something of the leisurely delivery of the wire cable used in the construction of the Williamsburg Bridge, place the date of completion of the Manhattan bridge at 1909. Meanwhile the Williamsburg Bridge is still trackless; and crowds still struggle for a chance to ride home across the old Brooklyn Bridge every night.

Where is this hopelessly unbusinesslike and impractical method of constructing the engineering works of a large city to bring us? How long will it take to build the Manhattan Bridge, if each new Commissioner is to discard his predecessor's plans and substitute others for them? If it has taken six years to build the tower foundations, how long will it take to build a whole bridge?

One conclusion must inevitably be drawn from the history of the unfortunate Manhattan Bridge, and that lesson is this: Municipal engineering should be free from every political influence. Is it advisable to change the engineering force of the Department of Bridges with each election? No well-conducted manufacturing company would dream of placing the management of its affairs every two years in the hands of a new man, just after the old had succeeded in mastering the intricacies of his business, and become of some value to his employers. And yet this is the very proceeding which is adopted not only in the Department of Bridges of New York city, but in every other department. We tear up our streets to lay sewers, and, having laid them, fill up the trenches and carefully repave the streets. Two weeks later excavations are begun in the same streets, for the purpose of laying gas pipes or electric wires, all to the great public inconvenience. A permanent engineering force in charge of those municipal departments which require the exercise of engineering judgment is certainly a crying need of New York city, an engineering force so permanent in its nature that its plans are not likely to be overthrown with each election, so well selected in its personnel that the interests of the city will be conserved with the same care that marks the management of a well-conducted manufacturing corporation.

CORROSION OF STEAM BOILERS.

In a paper recently published in a German contemporary (Stahl und Eisen) Mr. L. Vogt takes exception to the current practice of judging the availability of boiler-feed water exclusively according to its hardness, i. e., its percentage in substances susceptible of forming scale. According to him, the remaining components of the water should also be ascertained, as these give rise to repairs much more frequently than the former and even directly result in explosions. This problem is the more important as cleaning the water will in many cases produce strong corrosion, when, relying on the efficiency of the cleaning, the boilers are kept in operation for too long a period. In most cases, the prevailing substances forming scales, namely, sulphates and bicarbonate, are precipitated by means of soda and lime water, sodium sulphate being dissolved and pumped into the boiler along with the cleaned water. After the water has been vaporized, the sodium sulphate will remain undissolved in the boiler water. Now as with continued cleaning the concentration of the sodium sulphate is increased up to rather higher figures, this salt will finally exert corrosive effects on the boiler wall. The various nitrates and chlorides always present in boiler-water will, especially in the presence of air, be even much more noxious. Of all these substances, magnesium chloride seems to be the most noxious, barium and sodium chloride coming next.

In order to obviate the destructive effects of such substances as do not form scales, the author suggests maintaining their concentration below the limit at which they attain the property of attacking iron. It should, however, be borne in mind in this connection that a thorough intermixing of the water does not take place except in boilers with very active water circulation, whereas in many other cases the average concentration found by calculation is not immediately available for deciding the question at issue, which depends, on the contrary, on the maximum value of concentration, as obtaining at the point of strongest vaporization, i. e., in the neighborhood of the heat source. The author thinks soft water containing a not immaterial percentage of salt remaining in solution, to be more dangerous in this respect than a water otherwise equivalent but containing a higher percentage of scale formers, sheet iron being the more easily destroyed as its surface is of higher metallic purity. As regards the question as to whether cast iron or wrought iron offers less resistance to corrosion, Mr. Vogt thinks cast iron not to be less advantageous than wrought, corrosion being most likely due not to the material of the boiler but to the quality of the boiler water.

In testing a specimen of water, the minimum amount should be 3 quarts, so as to allow of a good quantitative analysis being made together with a checking analysis. Should it be necessary to use inferior water, parts of the contents of the boiler would have to be blown out every week and the boiler emptied out every 6 or 8 weeks, rinsed, and filled with fresh water. In the case of soda being not objectionable, owing to manufacturing reasons, a daily addition of soda of sufficient strength to give a slight alkali reaction would be advisable.

NEW METHOD OF GOLD EXTRACTION FROM PYRITES USED IN ITALY.

The process of gold extraction which has been put in practice in Italy by the Belgian chemist Body is awakening great interest among metallurgists. A few years ago the English geologist Morse and others observed that wherever there were placers of free gold there was also to be found in the neighborhood a source of combined gold in a volcanic matrix which was much richer in the metal. This theory has just been confirmed in a striking manner by M. Body. The process which he is now using in Italy is in reality only the geological synthesis of the formation of alluvia, and confirms the theory which attributes the formation of the placers to volcanic action.

The process is based, not upon the elimination of sulphur, but upon its addition; although this seems in contradiction to the present metallurgical processes, the result is said to be remarkable, and the output of gold obtained in this way greatly exceeds that which is given by the usual processes. The method is founded on the polysulphuration which is obtained by chemically disaggregating the mixture by means of special salts, under the influence of a temperature which does not exceed a cherry red. The process is of a relatively short duration. The disaggregating action removes the gold from its most stable compounds. At the Piedmont works, where the process is now employed, it costs only $2 or $3 to treat a ton of ore. It should be remarked that the new process is not an extraction of the gold, properly speaking, but a process of transforming the pyrites, which is so difficult to treat, into a product which can be worked in the ordinary way. As gold-bearing pyrites exists in great quantities in nature, the new process is likely to prove of great value.

BORAX AND FOOD.

Dr. Wiley's elaborate investigations on the influence of boric acid and borax on digestion and health will shortly be published by the Department of Agriculture. We are enabled to present the following preliminary account of results obtained:

These investigations were commenced in the autumn of 1902. Prior to their beginning, a careful study of similar work done in this and other countries was undertaken and some of the laboratories where this work had been carried on, notably the laboratory of the Imperial Board of Health of Germany, at Charlottenburg, were visited and the method of experimenting investigated. The plan finally decided upon was to secure the voluntary services of a number of young men who would try the effect of the added substances upon their digestion and health, to make the necessary observations, and to submit themselves to the rigid analytical control which such a series of investigations required.

The number finally selected for experiment was 12, as this was found to be about the maximum number which could be cared for with the analytical and culinary facilities afforded by the Bureau of Chemistry. A kitchen and a dining room were fitted up in the basement of the Bureau and in December, 1902, the actual experimental work began, and it continued in the case of boric acid and borax until July 1, 1903. The work was so divided that no one of the young men under observation was required to submit himself to the rigid control necessary to the conduct of the work more than one-half of the time. The men selected were taken partly from the force of the Bureau of Chemistry and the rest from other Divisions and Bureaus of the Department of Agriculture. Each one was required to subscribe to a pledge to obey all the rules and regulations prescribed, and to abstain from all food and drink during the period of observation save that which was given him in the course of the experiment. Careful medical inspection of each of the members of the experimental class was secured, both directly and by collaboration with the Public Health and Marine Hospital Service. The details of the work, both analytical and medical, are found in full in the bulletin above mentioned, which is now in press.

A summary of the results of the investigations, omitting all technical and analytical detail, is as follows:

(1) Both boric acid and borax, when mixed with the food, are excreted from the body chiefly through the kidneys, about 80 per cent of the total amount exhibited being recovered in the urine. The rest of these bodies is excreted chiefly through the skin with the perspiration. Only traces of them are excreted in the feces. These facts show that these bodies are almost if not quite all absorbed into the circulation from the intestinal canal.

(2) When borax or boric acid is administered in the food it appears in traces in the urine in a very short time, but if equal quantities of this preservative be administered daily the maximum quantity excreted in the urine does not appear until about the third day. After that if the same quantities be continued equivalent quantities are excreted from day to day. These facts show that there is not any great tendency to the accumulation of these bodies in the system beyond what would be given over a period of about three days, and even the whole of this is not found in the body at once, as small portions of it, gradually increasing in quantity, begin almost immediately to be excreted after exhibition.

(3) The most convenient method of administering this preservative is by inclosing it in capsules. When mixed directly with the food it tends to give the person eating it a dislike for the food in which the borax is found, due largely to the mental attitude rather than to a bad taste or flavor.

(4) When boric acid or borax equivalent thereto, in small quantities not exceeding a half grain per day, is given in the food, no notable effects are immediately produced. If, however, these small doses be continued for a long while, as for instance in one case 50 days, there are occasional periods of loss of appetite, bad feeling, fullness in the head, and distress in the stomach. These symptoms, however, are not developed in every person within the time covered by the experiment, for some are far more sensitive to the action of these bodies in small quantities than others. There is no tendency in such cases to the establishment of diarrhœa or of diuresis, though there is a slight tendency to increase to a very small extent the amount of water in the feces. There is, however, no measurable tendency to increase the volume of the urine.

(5) When boric acid, or borax in equivalent quantities, is given in larger and increasing doses, there is a tendency to the somewhat rapid development in a more accentuated form of the symptoms above described. The most common symptom developed is a persistent headache, a sense of fullness in the head, with a clouding to a slight extent of the mental processes. When the doses are increased to 3 grammes a day these symptoms are established in a majority of the cases but not in every case. They are also sometimes attended by a very distinct feeling of nausea and occasionally by vomiting, though the latter act is rarely established. There is a general feeling of discomfort, however, in almost every case, but the quantities required to establish these symptoms vary greatly with different individuals. In some cases very large quantities may be taken without the establishment of marked symptoms, while in other cases from 1 to 2 grammes per day serve to produce in a short time feelings of discomfort and distress.

(6) The specific action of the boric acid and the borax upon the digestive processes is not very well marked. There is but little apparent disturbance in the process of digestion or assimilation. But there is a slight tendency to decrease the proportions of the food which are digested and assimilated, and thus to cause the excretion of larger quantities of undigested materials in the feces. This action, though it may be traced definitely when large numbers are submitted to experiment, is not of a character to cause any very serious consequences. It is, moreover, not marked enough to warrant the statement that the administration of these bodies in small quantities causes a distinctly unfavorable effect upon the processes of digestion and assimilation, except when its use is long continued.

(7) The effect of the administration of borax upon the weight of the body is very well marked. As its continued exhibition decreases the desire for food, interferes somewhat with the digestion of the food in the alimentary canal, and produces, in certain cases, persistent headache, bad feeling, and discomfort in the region of the stomach, its final effect in diminishing the weight of the body is not doubtful. The compilation of the weights of the body obtained during the whole period of the observations shows a slight tendency to diminish the weight of the body during the administration of the preservative. This tendency becomes so well fixed that it is not entirely eliminated for several days after the administration of the preservative ceases. In the after periods extending in some cases for ten days, and during which time the subject was kept under observation after the administration of the preservative ceased, there was not a uniform nor even a general recovery of the original weight and of the original condition. Any effects produced by the administration of the borax do not extend to any considerable period of time, and apparently no permanent injury to any one of those experimented upon is produced.

(8) No conclusions were reached in regard to smaller quantities than half a gramme per day of the preservative, and therefore, any statements in regard to the administration of smaller quantities must be based largely upon the results obtained with the quantities actually employed. It is reasonable to infer that bodies of this kind not natural to nor necessary in foods which exert a marked injurious effect, when used in large quantities for short periods of time, would have a tendency to produce an injurious effect when used in small quantities for a long time. The general course of reasoning, therefore, would seem to indicate that it is not advisable to use borax in those articles of food intended for common and continuous use. When placed in food products which are used occasionally and in small quantities it seems only right, in view of the above summary of facts, to require that the quantity and character of the preservative, that is, whether borax or boric acid, be plainly marked so that the consumer may understand the nature of the food he is eating.

(9) The use of borax or boric acid as an external application to cured meats to preserve them in a proper condition during shipment to foreign countries when the use of such preservatives is not prohibited in such countries and when it is especially asked by the purchasers that they may be used, is a question which is not to be decided upon the data which have been obtained. Inasmuch as it is evident that in cured meats the processes of absorption and diffusion will be very much restricted, it is evident that unless the shipment of the product in question extends over a long period of time there could be no very great penetration of the preservatives to the interior of the package. The quantity of borax thus introduced into the food product would be minimal and the desirability or undesirability of its presence would be a question which should be left solely to the decision of the authorities in the countries to which the product is sent.

(10) The convincing justification of the use of boric acid and borax for domestic food products must lie in the possibility of proof on the part of those using them that the food products in question if not preserved in this manner would develop qualities far more injurious to health than the preservatives themselves.

(11) While many of the individual data obtained are contradictory, the general results of the investigation secured by combining into single expressions all the data relating to each particular problem studied show in a convincing way that even in doses not exceeding half a gramme (7½ grains) a day boric acid and borax equivalent thereto are prejudicial when consumed for a long time. It is undoubtedly true that no patent effects may be produced in persons of good health by the occasional use of preservatives of this kind in small quantities, but the young, the debilitated, and the sick must not be forgotten, and the safe rule to follow is to exclude these preservatives from foods for general consumption.

SCIENCE NOTES.

An interesting discovery of old Roman and Anglo-Saxon relics has been made in the course of some excavations in a field at Mitcham, a southwestern suburb of London. Seven skeletons in a group accompanied by several spearheads were at first unearthed. A little later this discovery was followed by the finding of three more skeletons, all in an excellent state of preservation. In every case, the skeleton was lying on its back with the feet toward the east, and in separate graves made in the gravel. Remnants of old-fashioned armor, some spurs, and a two-edged broadsword were found near the remains. Several three-inch lengths of brass or bronze rod, with eyelets at the head, and portions of an old handsomely carved glazed vase were found on the chest of one of the skeletons. Another skeleton had a spearhead to the left of the skull, with a buckle and knife or dagger at the waist. The skeletons and relics of the implements have been carefully examined by archeologists, and their investigations incline to the theory that the bodies were buried about the year A. D. 400. As a matter of fact, there exists records of a battle having been fought near Mitcham about this period. The researches are to be continued carefully under the supervision of scientists and antiquarians, and it is anticipated that many more interesting links with the past will be discovered.

It has been observed that oysters grow much more slowly on some beds than on others—that in certain places they fail to fatten. These places were usually on overcrowded beds, and sometimes good results could be secured by transplanting or thinning out. Qualitative and quantitative study of the diatoms (which constitute the food of oysters) on beds where the oysters fatten well, and on other beds where they fatten poorly, showed that the number of diatoms per liter of water was very much greater in the former than in the latter. It was therefore believed that if the supply of diatoms could be increased on the unproductive beds the oysters on them would grow and fatten. Experiments along these lines were recently inaugurated at Lynnhaven, Va., under the immediate direction of Dr. H. F. Moore, of the Bureau of Fisheries. A small cove was selected where the bottom and the salinity of the water were favorable, but where diatoms were scarce. Commercial fertilizers of certain kinds were used to furnish food for the diatoms, and it was very soon found that the latter greatly increased in abundance, and lean oysters transferred to this cove fattened rapidly. Details of the process need not be given here, but it is believed that the experiments will demonstrate the entire practicability of the artificial feeding and fattening of oysters on a commercial basis.—National Geographic Magazine.

Some time before the ashes and lava of Vesuvius in 79 A. D. covered up Herculaneum and Pompeii, a municipal election was held in the latter city. Mr. Joseph Offord read a paper before the Society for the Encouragement of the Fine Arts concerning this election, about which nothing would have been known but for the terrible eruption, which from 79 to 1755 buried the municipium and its electors alike in a lava tomb. Mr. Offord showed that many of the inscriptions uncovered on the walls of the city relate to elections and claims of candidates, much in the same way as do the placards posted in our streets to-day. Some were rudely inscribed, others set forth with artistic embellishment, and one, at least, contained a topical verse written by some minor poet, and painted in red. Like our candidates, those in Pompeii were run by their supporters, who represented various trades and interests. The wood-cutters, fishers, perfumers, dyers, barbers, and the like had their men pledged to promote or protect their rights and privileges. There were faddists, too, in Pompeii, who were looked after by such societies as the Ball-players, Long Sleepers, Deep Drinkers, and Little Thieves, to adopt a free translation of some of their titles. At Pompeii's ultimate civic contest the Long Sleepers and Deep Drinkers appear most appropriately to have run a candidate in common—the main plank in their platform being the suppression of street noises. Even Pompeii had its religious difficulty. As every visitor to those wondrous unburied ruins knows, it was the home of a cosmopolitan and, for its age, cultured and tolerant people, and to this day stand altars erected to Egyptian gods side by side with those of the established worship of Venus. Naturally there arose some differences between them. It is suggested that further excavations may prove that at the 79 election there were Isis passive resisters. Thus near came imperial Rome to representative government.

A NOVEL AIR COMPRESSOR.

The air compressor is now so universally used for mining and braking purposes, that it would seem as if it had reached the stage of completeness for economical work. It appears, however, improvements have been invented whereby it is thought the efficiency of the compressor as compared with the steam pressure employed is considerably increased.

The compressor shown in the accompanying illustration is constructed upon an entirely different principle from those in ordinary use, that is, the steam power is transmitted from the crank of the steam engine through what is termed a floating beam and toggle joints to two direct single-acting air-compressing cylinders.

In this way it is possible to extend the stroke and to combine the energy exerted through both sets of toggles in their straightening and deflecting motions.

Thus the whole force developed through the toggles up to their exhaustion is available for the work of compression nearly the first nine-tenths of the stroke, hence the compression is continued by the deflecting set through the agency of the floating beam. The large illustration, taken from a photograph, gives an excellent idea of the general appearance of the machine. The diagram in the upper left-hand corner shows the plan of construction. The operating horizontal connecting bar *B* is reciprocated to and fro by the revolution of the steam engine crank, and is connected at each end to the knees of the toggles *D* and *C*. These are stationarily pivoted at their lower ends to the base of the compressor, while their upper ends are pivoted to the floating beam *A*; from the extreme ends of this beam rise the air compressor piston connecting rods, to the pistons shown in the compression cylinders *G* and *H*.

The beam *A* is supported at its center on a vertically movable support to allow for the variations in the movements of the toggles. One form of this variable support is a weight placed on a lever at *F*, the other end supporting the pivot rod *E*, on which the beam *A* rests. It is obvious other means for allowing for this variation can be used.

In the position shown, the toggle lever *C* has been straightened by the movement of the connecting bar *B* to the left, which has forced the beam *A* upward, and made a compression in the cylinder, while in the cylinder *G* the piston has been drawn down by the bending of the knee of the toggle *D*, and is in a position to begin compression on the movement of the bar *B* to the right.

As the beam *A* overhangs the toggles by one-fourth of its length, it becomes a simple lever, with each toggle set alternately acting as a fulcrum. The motion on the joints is very slight, an arc of only one-eighth of a circle representing the frictional travel on the pins.

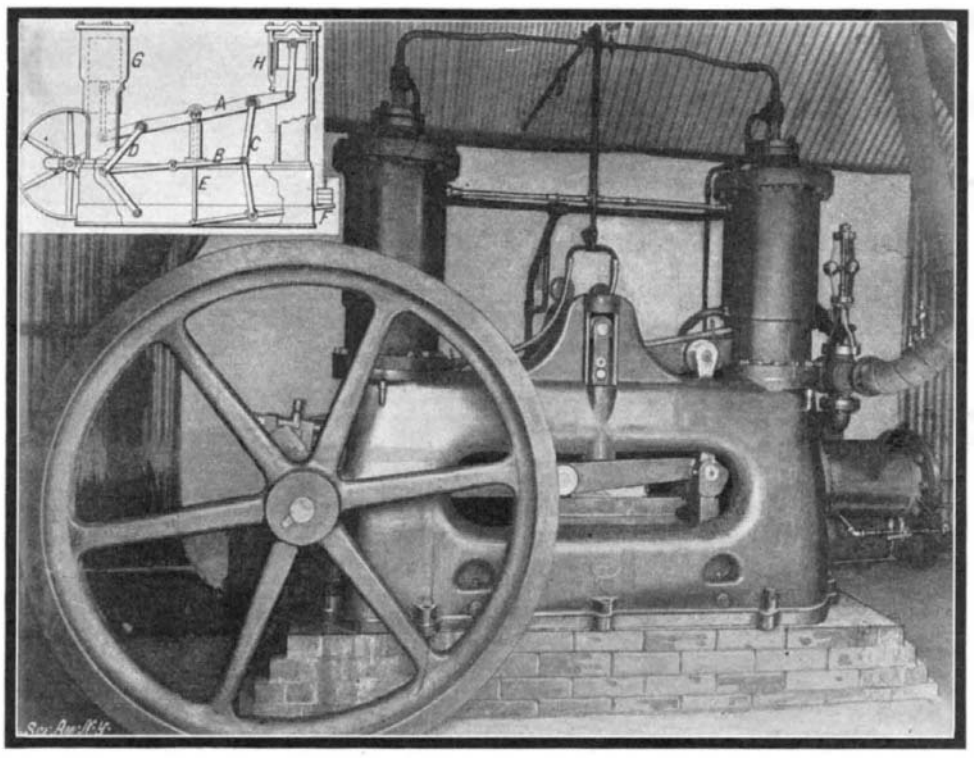
The size of the cylinders of the compressor, actually experimented with, is 12 inches in diameter by 16 inches stroke for the steam, and also 12 inches by 16 inches for the air cylinders, which are single-acting. The inventor states that the mechanical efficiency of the compressor is 90 per cent.

Special arrangements are provided for the cooling of the air during compression, so that the results are practically isothermal, the air being discharged dry.

The compressor is the invention of Mr. Henry Bland, of Sydney, Australia, and is being introduced by the Bland Compressor Company, Limited.

We are informed that the representative in the United States is Mr. T. B. Reynolds, Whitehall Building, No. 17 Battery Place, this city. The compressor is protected by patents in several countries.

As to the efficiency of the compressor, the inventor states that at a steam pressure of 50 pounds G. P., with the engine making from 100 to 120 revolutions per minute, a pressure of 250 pounds to the square inch (receiver pressure) is easily maintained. On occasions this has been increased to 300 pounds or more, the engine governing freely meanwhile. Air taken in at 72 deg. F. is delivered under 250 pounds pressure at 90 deg. F., as actually determined by a thermometer test. The volumetric tests show an efficiency of 97 per cent. The amount of horse-power required to compress a given quantity of air to a given pressure is in the proportion of six horse-power to one hundred cubic feet of free air compressed to 75 pounds pressure.



THE BLAND AIR COMPRESSOR.

Various tests under the direction of Mr. Herbert E. Ross, C. E., have been made in different ways, showing a higher efficiency—from thirty to fifty per cent—than is ordinarily the case under a stated steam pressure.

The utilization of the lever and toggle principle in securing greater compression is quite unique and novel in an air compressor, and one that is shown by actual trial to be more economical in relation to the initial steam pressure than is usual.

AN APPARATUS FOR PREVENTING SEASICKNESS.

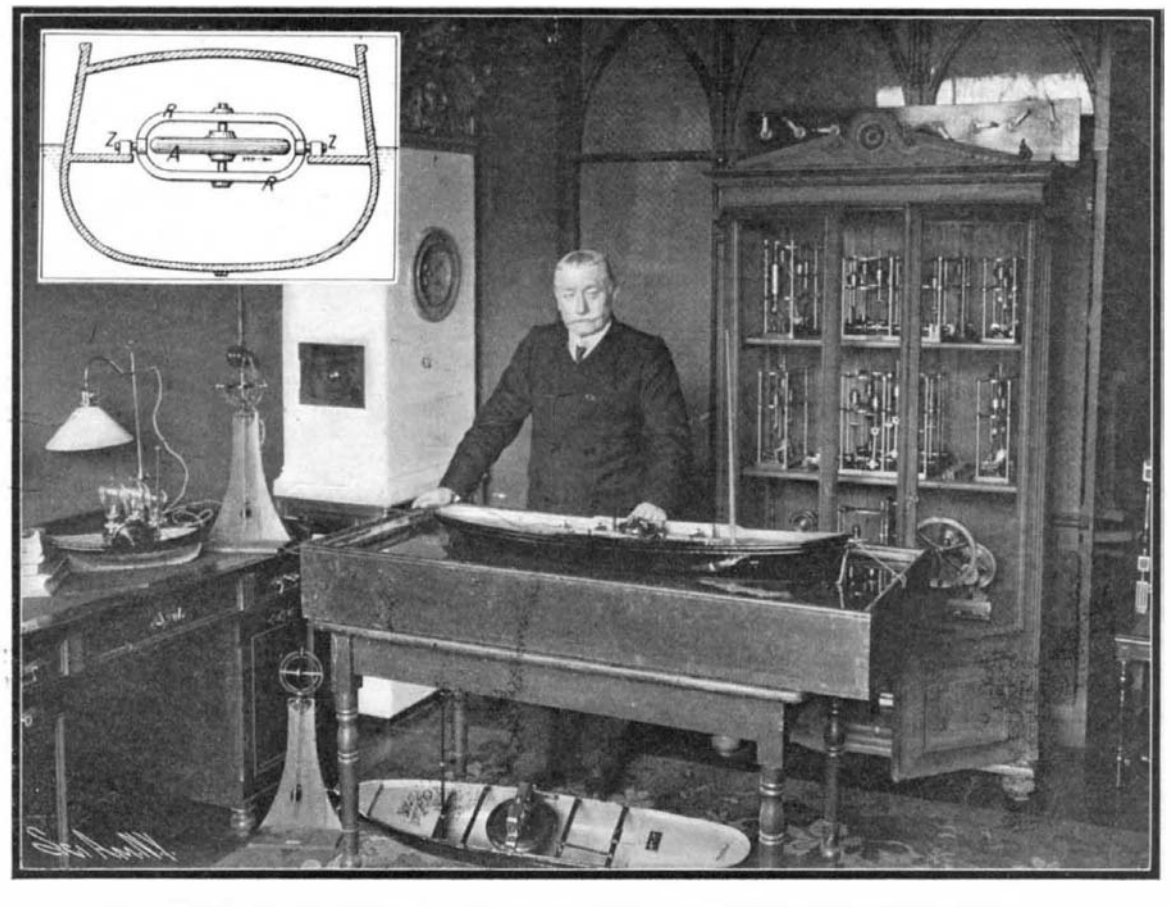
BY DR. ALFRED GRADENWITZ.

The pitching of a ship in a rough sea is certainly a serious drawback both to the physical welfare of passengers and crew and to the expedition of any work made on board. While any endeavors made to prevent or to diminish pitching have so far been in vain, the rolling may be acted against efficiently by increasing on the one hand the period of the lateral oscillations as far as possible, and decreasing on the other the amplitude of oscillation after an inclination has been produced by an impinging wave. No apparatus has, however, been so far designed for obtaining both of these actions at the same time. A high period of oscillation may be obtained by increasing the moment of inertia and diminishing the metacentric height. As, however, this means can be resorted to only within narrow limits, the results obtained are rather poor.

The principal means of limiting the oscillation amplitude, on the other hand, is the use of drift-keels and water chambers. A very clever device presented by Mr. Thornycroft to the Institution of Naval Architects in the spring of 1892 should be mentioned in this connection.

Now, Mr. O. Schlick, a well-known naval engineer of Hamburg, Germany, has brought out an ingenious apparatus designed at the same time to increase considerably the period of oscillation of the rolling movements and to diminish the amplitude of oscillation. This apparatus is based on the gyroscopic effect of a flywheel mounted in a peculiar manner on board a steamer, and caused to rotate rapidly. The vertical axis of the apparatus is so located as to be able to move pendulum-like in the central plane of the ship. The permanent and rapid oscillations of the wheel will result in rendering the ship insensible to the effect of the wave motion, the rolling movements being practically eliminated. As the device will exert an energetic effect even with the smallest lateral oscillations of the ship, a propagation of the motion, resulting in a strong oscillating movement, will be impossible, whereas any drift-keels so far used do not act before the rolling movement has become marked.

The underlying principle of the apparatus is the fact that a rotating body will oppose to any inclination of its axis a resistance the higher as its rotation is more rapid and its weight more considerable. The diagram shows a flywheel. In a large frame, *RR*, rotating on a horizontal axis at right angles to the longitudinal direction of the ship by means of two pivots, *zz*, there is mounted the vertical axis of the flywheel *A*, caused to rotate rapidly by an electric motor. As the forces producing the rolling movement of a ship are by no means excessive (in fact, twenty to twenty-five men running in proper time from one side of the deck of a large steamer to the other are known to cause the latter to perform considerable rolling movements) the weight of the flywheel in a ship 6,000 tons in weight need not be higher than 10 tons with a diameter of 4 meters (13.12 feet). The apparatus will therefore be specially available for use on steamers of moderate dimensions.



MR. SCHLICK AND HIS MODEL OF AN APPARATUS FOR REDUCING THE ROLLING OF A SHIP.

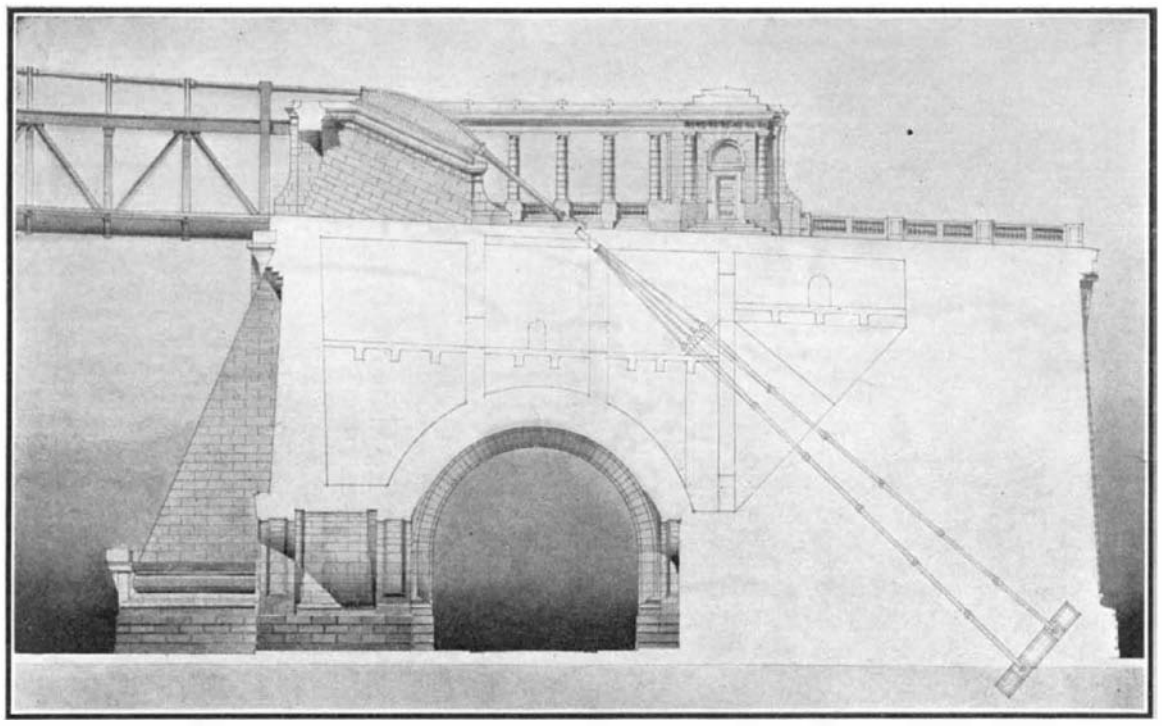
A new machine for producing belting and textile fabrics has been invented by Mr. J. W. Hyatt, of London. The apparatus is a combination of the loom and the sewing machine. The belting it turns out is a first-class article, double-selvedged and of great strength and durability. The most prominent feature of this belting is its small amount of elasticity, and imperviousness to water, oil, and chemicals. It has a stretching strain of only three per cent, and its breaking strain is 30,000 pounds, as compared with the 7,000-pound breaking strain of the best leather belting, while it can be produced about fifty per cent cheaper. Demonstrations with this new production have proved such a high standard of strength and durability, that a motor-tire manufacturing firm has decided to utilize the fabric for the foundation of tires instead of canvas.

THE PLANS FOR THE NEW MANHATTAN BRIDGE.

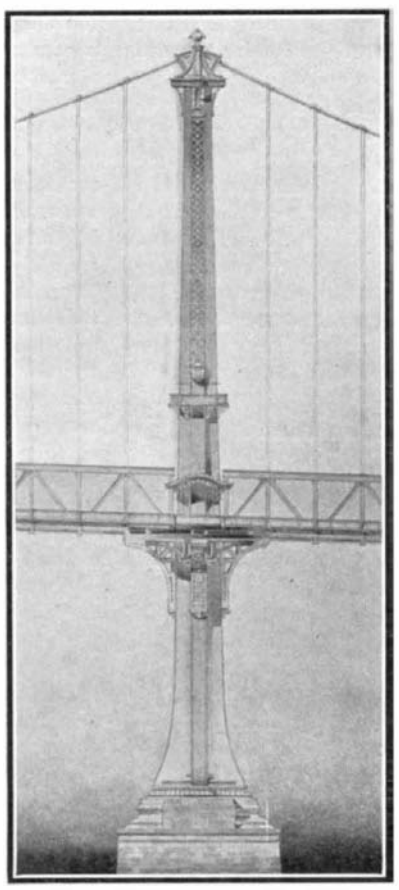
Gustav Lindenthal's design for an eye-bar bridge across the East River has probably received its quietus. In its stead, plans for a wire-cable suspension bridge have been submitted to the Municipal Art Commission, which plans will probably be finally adopted. In the present article we shall dwell simply upon the architectural features of the new plans, leaving an engineering discussion of the bridge to a future issue.

It may be stated that structurally the new Manhattan Bridge is not very different from that which Mr. Lindenthal condemned. The stiffening truss, which has so successfully contributed to the monumental hideousness of the Williamsburg Bridge, will also be a feature of the Manhattan Bridge. It will be shallower than the Williamsburg truss, however, and architecturally less objectionable. In the original wire suspension plans, the cables passed under the stiffening truss, supporting the roadway and carrying it horizontally into a plain cubical mass of masonry, which constituted the anchorage. In the new bridge the cables will extend to the top chord of the stiffening truss and over the saddles on the anchorage. This new arrangement of cables has necessitated a redistribution of strains, and a modification of some structural details.

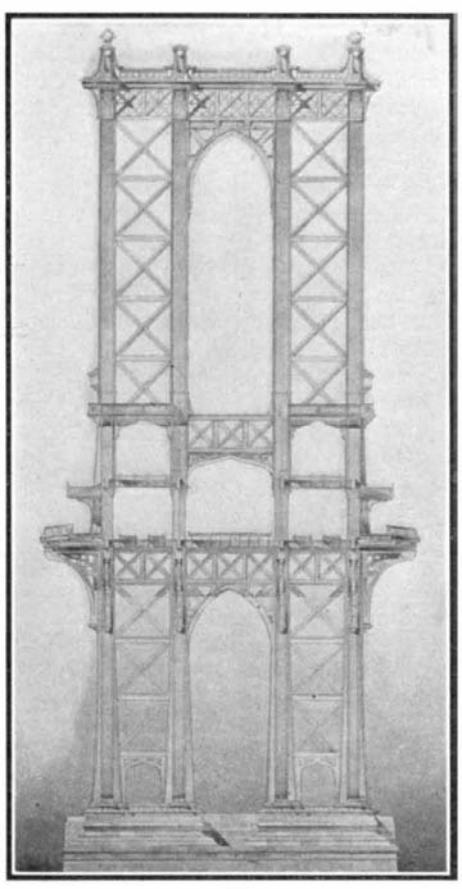
Architecturally considered, it must be confessed that the plans for the new structure are pleasing enough. The lifting of the cables above the truss has undoubtedly added to the beauty of the structure. The architects have devoted most attention to the anchorages. On either side of the footways peristyle courts are to be built, 120 feet above the water level. The anchorages, with their area of 225 feet in length by 175 in width, certainly lend themselves well to such treatment. An attempt has been made to utilize the masonry supports for the anchorage saddles by combining them with a colonnade. One of the pavilions of the colonnade on either side of the anchorage will be provided with staircases connecting with the interior of the anchorage, and finally with the street. Such has been the treatment of the anchorage courts and the towers, that the bridge will afford ample accommodation for those who care to rest under cover and obtain a view of the boroughs of Manhattan and Brooklyn. The bridge, therefore, becomes something more than a means of communication between two great communities that flank the East River; it will become, in a word, a vast "recreation pier" in the hot weather.



Longitudinal Section of an Anchorage.



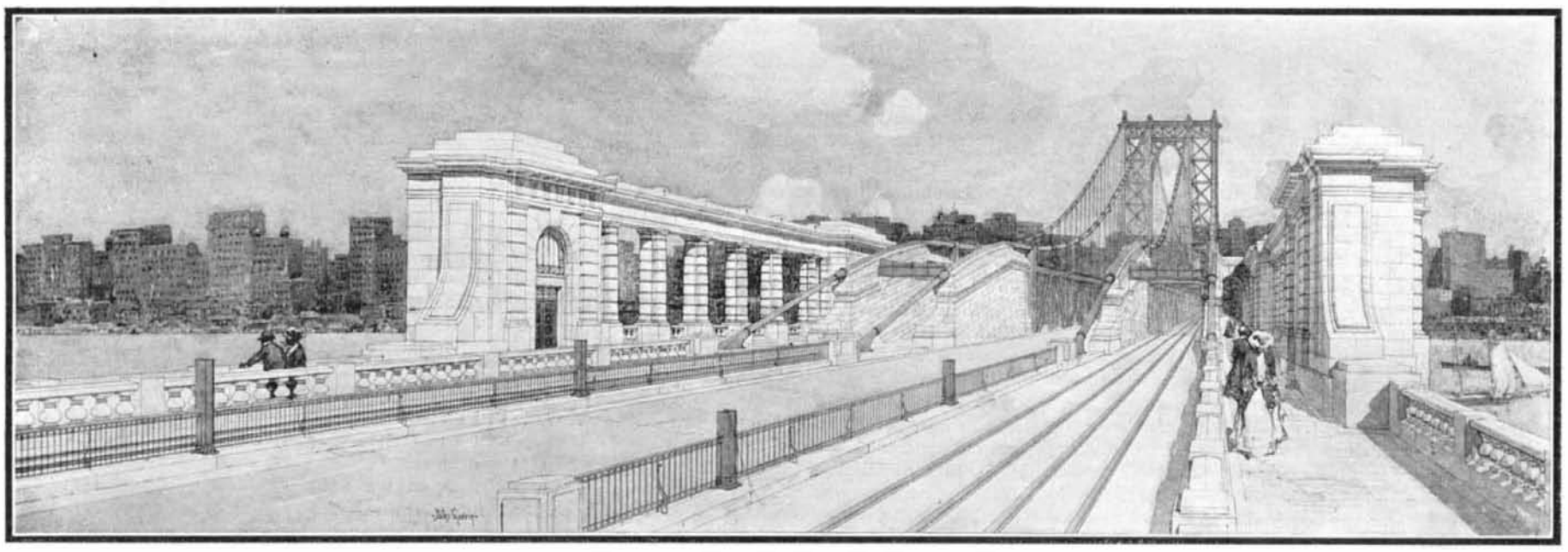
Side Elevation of a New Tower.



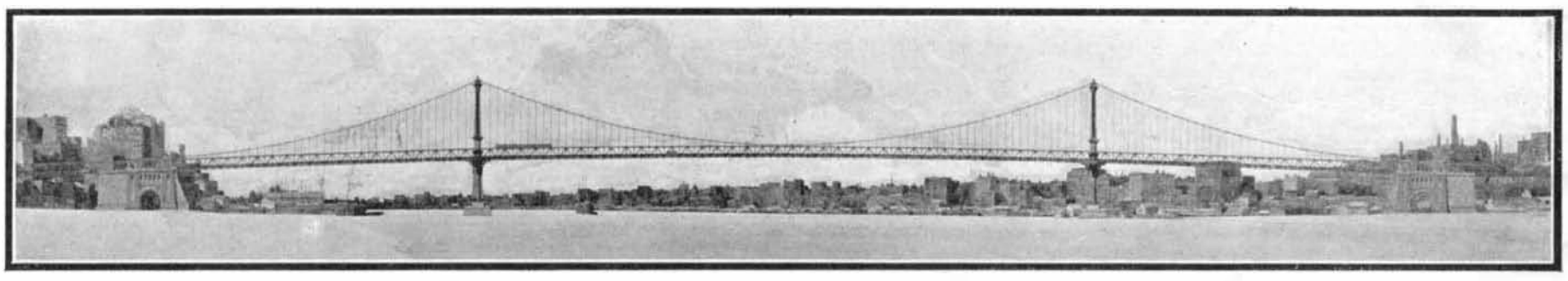
Front Elevation of a New Tower.

Since the tower foundations have already been built, the main dimensions of the bridge will probably remain substantially what they were before Commissioner Lindenthal entered into office. The clear span is fixed at 1,470 feet, with two identical shore spans, each 725 feet long. The width of the bridge will be 120 feet. Comparing this with the 84 feet width of the old Brooklyn Bridge, it becomes evident that ample provision has been made for traffic. Over the roadway an elevated railway is to be built. The central roadway will be 35 feet wide, and the footpaths each 10 feet wide. Between the roadway and footpaths on each side double trolley tracks will be built.

In striking contrast both to the old Brooklyn Bridge and the recently completed Williamsburg Bridge are the towers. These rise some 320 feet above the water level, and are extremely slender, almost delicately so, in form. They will be practically solid metal, and will be only 18 feet wide. The cuts show each tower to be an oblong frame of twin towers strongly braced, with a central arch not unlike that of the picturesque Brooklyn Bridge towers. The architects found the main lines of the cables and suspended trusses as designed by the engineers so graceful that further architectural treatment seemed to them unnecessary. Therefore the tops of the towers are ornamented simply with a cornice.



The Roadway Over the Anchorage, Showing the Colonnades.



THE NEW MANHATTAN WIRE-CABLE SUSPENSION BRIDGE ACROSS THE EAST RIVER AS IT WILL APPEAR WHEN COMPLETED.

Electric Sterilization of Milk.

BY EMILE GUARINI.

The sterilization of milk is a problem that was once regarded as solved, but which is at present being earnestly discussed. The technical press has for several years been making public the profound transformations that heat brings about in the nutritive ingredients of milk. In order to sterilize milk, in fact, and guarantee its preservation almost indefinitely, it is necessary to prolong the action of fire for a considerable length of time. Ebullition of the liquid, however, even for a long time, does not by any means destroy all its germs, and, in practice, we are obliged to attain a temperature of 120 deg. C. (248 deg. F.) and continue the operation for 20 minutes in closed vessels. It is not astonishing that, through such a treatment, the milk should undergo a great modification. It is especially in infants that, through the gastric disorders that it occasions, we recognize the absence of digestive properties in milk thus treated. We remark, besides, in infants fed with sterilized milk, a tendency toward rachitis, due, it seems, to a want of phosphorus. The true cause of such anomalies has been found within the last few months. A very able chemist recently presented to the Academy of Sciences of Paris a highly interesting study of this subject based upon a long series of experiments. From this it results that in milk sterilized by the action of fire, lecythine, the valuable ingredient that furnishes the organism with the phosphorus necessary for its normal development, becomes transformed and ill adapted for absorption by the stomach, especially by that of infants. Although, on the one hand, hygienists wish to ostracize milk thus sterilized, the same disciples of Esculapius, on the other, put mothers on their guard against the germs of tuberculosis insidiously concealed in milk that has not passed through the sterilizing digester. The problem that therefore confronts us is this: how shall the microbes of milk be killed without altering the latter's composition? Some efforts have been made to solve this question, and in several different ways. Ozone has been employed at various times on account of its bactericidal properties; and trial has been made also of oxygenated water, which is quite a powerful disinfectant, but the practical results obtained do not seem sufficiently encouraging to warrant the use of this agent. In order to effect the destruction of the germs without carrying the action of fire too far, a partial saturation with oxygen has been tried. It is probable that in this direction the perseverance of experimenters will some day reach the solution of the important problem of milk sterilization. Driven to despair, and not knowing to what other saint to turn, an appeal has been made by some to electricity to perform for milk one of those numerous miracles that it alone can effect. The researches made up to the present day, especially in Italy, have not, however, given the results that were anticipated. Mr. Guarini and Dr. Samarini, nevertheless, have just solved the problem at Brussels after numerous and long researches. They have not only succeeded in sterilizing milk electrically, but have also explained why their predecessors were unable to obtain results reached by themselves. The alternating as well as the continuous current had been employed and it was concluded from the unsuccessful issue of the experiments that the problem could not be solved by electricity. Such was not the opinion of Messrs. Guarini and Samarini when they took up the question, since it was evident, *a priori*, that the investigators had not made their experiments with a sufficient knowledge of the phenomena invoked by them. In fact, for the experiments with a continuous current they had employed one generated by a few batteries or a high-tension one furnished by a static machine. If we consider that the deadly effects of the electric current are not produced by the tension, but by the intensity of the current, we shall see that the effects sought could be obtained in neither case. In the case of batteries the tension was too low to permit a current of sufficient intensity to traverse the milk, being given the great resistance of the latter. In the second case, the tension was sufficient, but the intensity was negligible, as it generally is in static machines. In order to verify the matter, Messrs. Guarini and Samarini, after trying the experiment again, with the same negative results, rendered it more striking by substituting fishes in water for the microbes in the milk, and found that the animals exhibited no uneasiness in the presence of the current. The experimenters then employed a continuous current up to 170 volts, and, with a quart of milk, raised the intensity to 5 amperes. By extracting some of the milk at a certain distance from the electrodes, by means of pipettes, it was found that it was perfectly sterilized and could be preserved. Unfortunately, however, the experimenters were confronted by another difficulty, and that was that the milk, beginning in the vicinity of the electrodes, became coagulated. Upon employing fishes in water, the animals were of course perfectly electrocuted. Upon employing special electrodes with a current of water, the coagulation was much diminished and almost imperceptible. The experimenters nevertheless abandoned the continuous for the alternating current. In the first place they repeated the experiment of their predecessors, employing the Ruhmkorff coil. The milk was not sterilized, and the fishes, moreover, experienced but a slight shock. Messrs. Guarini and Samarini then had recourse to a 110-volt alternating current, with carbon electrodes. The milk was perfectly sterilized when the density of the current was adequate and was not coagulated when the frequency of the current was sufficiently elevated. It might be thought that it would prove advantageous to add to the milk certain substances of a nature to render it more conductive; but the experimenters found that such was not at all the case, and that in such an event it became necessary to employ a much stronger current. They made this fact evident by electrically treating some fishes in fresh and salt water. In the second case it required a much greater intensity to kill the animals than it did in the first, because the greater part of the current went through the water and not through the body of the living organism.

It may be concluded from these very interesting experiments that, in order to effect an electric sterilization of milk, the three following conditions must be realized: (1) The milk must be traversed by an alternating current of sufficient frequency to prevent the decomposition of the liquid; (2) the density of the current must be sufficient to electrocute the microbes; (3) the alternating current must be of a sufficiently high tension to overcome the somewhat high resistance of the milk. If we have only an alternating current of low tension at our disposal, we might at a pinch add a salt or an acid to the milk in order to render it more conductive. In this case there would be required a much greater current intensity and substances capable of being subsequently eliminated without altering the quality of the milk.

As for the practical application of the process, the apparatus for that is very simple, and consists of a well insulated receptacle and two electrodes, say of platinized carbon. Two factors evidently intervene—the duration of the treatment and the intensity of the current. Since the use of electricity is daily becoming more general, it may be that the process will be adopted to a certain extent, since it gives absolutely sterilized and in no wise altered milk.

About a Baseball's Curves.

BY RICHARD MEADE BACHE.

It is now thirty-three years since the question arose at Yale University as to whether or not a baseball thrown from the hand could be made to deviate horizontally from a straight line. The experiment was then and there tried, proving that the flight of a ball could be made to curve to the right or to the left by skillful pitching. This was accomplished by the simple expedient of placing a plank upright on the ground and, from a point at right angles to the middle of one of its broad sides, twirling a ball to a point back of the center of the plank. Since then, it is accepted as fact by all baseball players, that the flight of a ball can also, under fine handling, be made to incurve abnormally downward or upward with reference to its landing place; that is, either in the direction of, or contrary to, the attraction of gravitation.

The period mentioned was in the infancy of skilled baseball playing. Since then, a generation of players of the game has grown up, and the constant repetition of the phenomenon mentioned has become so engrafted with common experience, that few persons conversant with the game ever think that it needs explanation. The character of the pitch, whatever it may be, seems just as natural to them as that of the slight vertical curve of the ball when compounded simply of the forces of its projection and the attraction of gravitation. To so feel about the abnormal curved courses of the ball is, however, only a habit of mind, habitual experience of any kind of action mostly assuming, without appreciating, the reason for things. The average baseball player accounts for the phenomenon by saying that it is caused by the pitcher's giving the ball a twist as it leaves his hand. But that statement does not account for its being thereby compelled to move in an eccentric orbit.

If, in a calm, one lets fall a feather, one sees that it descends slowly and with deviation from the vertical. But, let him cause a feather to fall from the top of the inside of the exhausted glass receiver of an air pump, and he will see that it falls plumb, like a shot. A body projected in space would proceed forever at the same rate, and in a straight line, were not space full of bodies that would attract it. This is one of Sir Isaac Newton's laws of motion. Resistance of some kind is, in a word, indispensable to making a moving body deviate from the particular speed and course impressed upon it by its original projectile force and by the attraction of gravitation.

It is, therefore, the resistance of the atmosphere, as well as the forces of projection and rotation of the baseball, which makes the ball describe a curve to the right, to the left, upward, or downward. The right-handed pitcher delivers his "outshoot" with much greater effect of incurve at the plate than he can accomplish with his "inshoot." The left-handed pitcher, in a reversed position, but correspondingly, delivers his "outshoot" more effectively than his "inshoot." The reason is that although, in each case, the speed of the ball for "outshoot" and "inshoot" is the same, the speed of its rotation is very different. The centrifugal rotary force impressed by the pitcher upon the ball, opposed by the friction of the atmosphere, packed by the ball's rapid duplex movement, being weaker in the "inshoot" than in the "outshoot," permits of less curvature there in the ball's flight than is possible in the "outshoot." In all cases, the ball makes its incurve at the plate, whether horizontally, from right or left, or vertically, from above or below, because friction of the atmosphere, compressed by the ball's combined velocity and speed of rotation, retards and finally exhausts its movement of rotation at the end of its flight. The two movements of the ball, and the resistance of the atmosphere, forming together three compounded forces, compel the flight of the ball to assume the form of a curve. As the ball leaves the hand of the pitcher, it whirls onward until, the quickness of its rotation being diminished by friction on its surface from the atmosphere, and thereby weakened, it curves either upward, inward, or from right or left with reference to the "plate" of the baseball field.

Anyone should be able to realize the truth of this demonstration of the principle through which the course of balls can be curved, if one has ever realized the density of the atmosphere, and the fact that it is a compressible, elastic gas. These properties of the atmosphere make of it, under the circumstances described, a continuous elastic cushion upon which the rotating ball impinges, and by the intervention of whose moderate resistance the course of the ball is modified in direction. The average pressure of the atmosphere, at the level of the sea, to the square inch of the earth's surface, is 14.7304 pounds, commonly called, in round numbers, 15 pounds. The average barometric height is about 30 inches at the level of the sea; but it is only 24.75 inches in height at Denver, Colorado, a difference in height between the two situations corresponding to a difference in weight of atmosphere of over two and a half pounds out of nearly fifteen. Yet it has been lately stated, that batting averages at Denver are the same as those on the eastern coast of the United States. However that may be (and it seems utterly irreconcilable with what has been shown here), there must be, in so rare an atmosphere as that of Denver, compared with that of the eastern coast of the United States, less possible curvature to the flight of balls than is common to pitching them in the latter region.

The main fact here elaborated as to cause may be concisely stated in language not forbiddingly scientific. The "upshoot," "downshoot," and right and left "outshoot" and "inshoot" of the baseball, thrown by pitcher to "plate" of baseball field, represent, through their various incurves at the "plate," resultants corresponding with the compounded forces of the projection of the ball, its rotation in varying positions of its axis of revolution, and the resistance due to the density of the atmosphere; the last factor being known as *vis inertiæ*, the force of inertness, which involves resistance to motion, and which is therefore truly regarded as a species of force.

Remarkable Phenomenon of Crystallization.

A curious phenomenon was observed lately by Prof. Stanislas Meunier, of the Paris University. He found that a certain number of plaster balls, left to dry after a short immersion in salt water, became entirely transformed into a conglomeration of gypsum crystals, and some of the latter reached 1-5 of an inch in length. In an account of this phenomenon which he gave to the Academie des Sciences, he states that although the balls of plaster had been formed under quite similar conditions and even used in the same experiments, they were far from showing the same crystalline appearance. In some of them a glass was needed to see the crystals, while in others they could be distinguished with the naked eye and were from 0.2 to 0.25 inch long. Some of the specimens showed a radial arrangement of the crystals which is not seen in the natural plaster stone. The crystalline structure varies with the distance from the surface in the same ball. It is scarcely noticeable on the surface, and the ball must be broken in order to observe it. When broken in halves, the crystallization is more strongly marked near the center than in the outer parts. At the periphery there is a compact coating or skin about 1-30 inch thick. Starting from this, the mass assumes the character of an irregular assemblage of crystals, more or less coherent, which often fall apart at the least shock. As to the cause of this remarkable phenomenon, it seems that the salt which was used to impregnate the plaster must have a kind of *crystallogenic* faculty, acting as it does to bring about the formation of crystals. If this is so, it is one step toward explaining the causes which bring the gypsum in the earth's strata into the crystalline state.

Correspondence.

Paper-Lined Tin Cans.

To the Editor of the SCIENTIFIC AMERICAN:

I notice in your issue of July 2 an English invention for lining tin food cans with paper parchment. I would suggest that instead of lining the finished cans, the sheets be covered before making up. There is also a great field for capital in making long strips or coils of tin, paper-coated, of suitable width for the body of the cans, thus saving cost both in the first manufacture of the tin and also in the better adaptation of long coils to the use of automatic machinery for making the cans. GEORGE D. CLARK.

Plainville, Conn., July 4, 1904.

Halter Embedded in Horse's Skull.

To the Editor of the SCIENTIFIC AMERICAN:

I am familiar with the photograph of horse's skull published in last week's issue.

The skull is of a three-year-old colt, and it was found in the bush at a place called Swan Hill, distant 214½ miles from Melbourne, or 114 from Bendigo. It was found in this condition some thirty years ago, and was given me three years since by the person who found it.

There appear no facts beyond what the skull itself and equine pathology teach us, i. e., when the periosteum of this species is injured, a deposition of bone is thrown out—Nature's endeavor to strengthen and assist the part—which becoming ossified, gives rise to many external blemishes.

This has assuredly taken place. The skull still growing, and the rope probably contracting at the same time, then the rotary movement of the jaws during mastication caused this irritation to the periosteum, and hence in time brought about the condition seen in the photograph. The animal probably died of starvation.

It is by no means a made-up specimen; and has been examined by many veterinary surgeons of this State, and all the medical men of this city, who one and all agree that it is the most wonderful specimen they have yet seen. ERNEST W. MITCHELL.

Bendigo, Australia.

Discovery of One Hundred and Fifty-two New Variable Stars in the Large Magellanic Cloud.

The two Magellanic Clouds have long been objects of careful study, on account of the extraordinary physical conditions which prevail in them. They have not, however, heretofore been known as regions in which variable stars are numerous. The discovery of a large number of variable stars in the Small Magellanic Cloud led to an examination by Miss Leavitt of the Large Cloud, although a detailed examination of the region immediately surrounding N. G. C. 2070, the Looped Nebula, had already been made, with negative results. Over one hundred variable stars have thus been found. Twenty-one plates, taken with the Bruce 24-inch telescope and having exposures of from one to five hours, were used. A series of six of these, taken within ten days of each other, has made it possible to derive some inferences as to the periods.

The variability of all of these stars has been confirmed either by Mrs. Fleming or by Miss Leland. It is probable that the range will be increased when a photometric scale is substituted for that here used. Many of the faint stars in the Large Magellanic Cloud show slight fluctuations in brightness. This renders it probable that many more variables may be discovered from an examination of later plates.

Preparations are being made for determining the precise positions, periods, and light curves of all of these variables.

The total number of variables found in nebulous regions by Miss Leavitt is at least 277. It is a remarkable illustration of the results to be expected from a systematic study of the Harvard Library of Astronomical Photographs. During 1903, a grant from the Carnegie Institution permitted a corps of eight or more observers to carry on such investigations. Since then this corps has been disbanded, and the means of the Observatory have permitted but one observer to be employed on similar work, with the results here shown. EDWARD C. PICKERING.

Harvard College Observatory.

The Current Supplement.

The current SUPPLEMENT, No. 1489, opens with an account of the giant 5,000-horse-power engine and dynamo furnishing the lighting current for the Louisiana Purchase Exposition. An excellent picture accompanies the text. The Paris correspondent of the SCIENTIFIC AMERICAN tells much that is interesting of the house of the Vetii, a Pompeian villa that has been the subject of considerable archeological discussion. Mr. H. G. Wells' article on the "Discovery of the Future" is concluded. Mr. Charles A. Stevenson describes the making of leather from alligator skins. Some excellent formulas for varnishes are given. An illustrated description of storage battery locomotives for shop transportation is published. Dr. L. Brandt writes interestingly on the sensitiveness of chemical reactions.

Engineering Notes.

The project of digging under the English Channel has raised a storm of objection in Great Britain. Every time the scheme crops up, the same criticisms are leveled at it. Mathieu's proposal made in 1802, which received parliamentary sanction both in France and in England, came nearest to realization. The plan has again been proposed, and seems no nearer realization than before. M. Peltereau in an elaborate report shows how commercially advantageous it would be to England and to France. Englishmen, however, have received the French advances with anything but cordiality. Admitting the economic advantages which would result, and the comparative ease with which modern engineers could build the tunnel, they deplore the moral effect on the British nation, whatever that moral effect may be. Fears are expressed that a powerful army would steal through the tunnel, and invade England with the utmost ease. The absurdity of the objection hardly deserves comment.

According to the Elektrotechnische Rundschau, a new process for utilizing exhaust steam to produce power in low pressure steam turbines has been developed in Germany. The device is especially intended for utilizing the exhaust from intermittently working mining engines. While an ordinary condensation in most of these engines will have but a very slight effect (the vacuum in the cylinders being negligible, and considerable condensation losses being caused by a high cooling of the steam cylinder during stoppages), the new outfit will permit the use of the exhaust from these machines so as to secure higher economy than can be obtained, for instance, in the case of a high-class triple-expansion engine. From the exhaust steam from a hauling engine 500, and from that from a reversing machine 1,000, electric horse-power may be generated. Moreover, the first cost is much lower than in a high-tension steam plant of the same output, while there are no expenses for operation worth mentioning. The principle of the process consists in storing the exhaust steam issuing in variable amounts from the intermittently working engines in an exhaust steam accumulator and of transmitting the stored steam in a uniform manner to a low-tension turbine. The latter, after receiving the steam as a rule at atmospheric tension, will give it off again at the condenser tension. In the accumulator the exhaust steam has a pressure by 0.15 to 0.3 atmospheres higher, the pressure varying within these low limits with the charging and discharging of the apparatus.

In the case of an amount of heat, q, per hour traversing a wall, there must be, as is well known, a certain temperature gradient. Considering a portion of the boiler heating surface, the side of the sheet metal turned toward the water will take the temperature, t, and the side turned toward the fire the higher temperature, t_1. In the case, however, of any portion of the water side of the plate being coated with boiler scale, there is an obstacle to the heat being drawn off, so that the fire side of the plate will have to assume a higher temperature, T, in order to be traversed by the same quantity of heat. The temperature gradient thus increases from $t_1—t$ to $T—t$, when a "stagnation of heat" takes place beneath the boiler scale coating. This phenomenon, the name of which does not seem to be well chosen, plays an important part in connection with boiler explosions. According to Austin's researches, a discontinuity in the behavior of the temperature will occur in similar cases, the water side of the sheet metal wall having a temperature superior by some degrees to the immediately adjoining water layer. The experiments carried out by the Physikalische Reichsanstalt have shown this sudden fall of temperature to be smaller in the case of the water being stirred up violently, as compared with the case of calm water. According to Volk, in a paper recently read before the Cologne section of the Verein Deutscher Ingenieure, this accounts for the so-called ebullition delay, which formerly was resorted to for explaining the occurrence of explosions produced on heating. In fact, as soon as the valve is opened, a violent evolution of steam would be produced, the water being stirred up and the fall in temperature becoming less, and as the wall thus is hotter than necessary, the surplus heat is set free suddenly. According to Mr. Ernst, about 2,000 heat units would traverse each hour a plate of boiler scale 1 millimeter (.039 inch) in thickness and 1 cubic millimeter in area with a temperature gradient of 1 deg., while an oil layer will lead 100 heat units under the same conditions, and a coating of ashes 65 heat units. When considering that in the same case 50,000 to 60,000 heat units will traverse the iron, it will be possible to ascertain the temperature limits in the passage of heat through the boiler heating surfaces. This local superheating of the walls results in the firebox being put to higher strains, while the influence exerted on the walls themselves is still more important, an alteration in the shape and a diminution in their resistability being produced. A similar superheating may be produced not only by deposits of scale, but as well by the effect of the flame; moreover, the walls of the boiler will be prevented from cooling by adjoining masonry or by ashes, thus remaining at a much higher temperature than the surroundings.

Electrical Notes.

The Schuckert & Co. Electric Company, of Nuremberg, made some time ago comparative tests of incandescent gas and electric arc lights, the results of which have just come to hand. These experiments, carried out by Dr. Lehmann Richter, gave the following results: The surface luminous intensity at the level of the eye proved fully satisfactory for both light sources, the arc light affording also a uniform distribution of light. In the case of the electric arc light, no noxious alteration of the air was noted, the temperature would not rise to any appreciable extent, nor would the percentage of carbonic acid be augmented. With incandescent gas light, on the other hand, the temperature at the level of the eye was found to rise by about 6 deg. C. in the course of three hours, while the percentage of carbonic acid was found to increase to more than five times the initial figure. As regards the cost of operation of both classes of light, this proved somewhat smaller in the beginning with the Auer light, whereas, after a short time, the figure corresponding to the cost of operation of the arc light was reached, even without taking the lighting flame into account. When accounting for the lighting flame, on the other hand, the cost of the Auer light would be much higher than that of the electric arc light.

In a recent issue of La Energía Eléctrica, Madrid, Mr. G. J. de Guillén Garcia records some interesting experiments made by him in conjunction with his son. In connection with some wireless telegraphic researches, the younger Garcia happened to note that in the telephone of the Tommasi coherer located at the receiving station, there was a difference in sound varying according to the air gap in the interrupter of the Ruhmkorff apparatus. This suggested the idea that a similar apparatus would be susceptible of transmitting the human voice to a distance without wires. The author was eventually enabled through the courtesy of Prof. Marcel, of the Barcelona Seminary, to carry out his idea. The experimental apparatus is rather simple. At the transmitting station there is a Ruhmkorff apparatus 3 centimeters in spark length, as well as the necessary oscillator, a small antenna, and a grounded conductor. Between the transformer (i. e., the Ruhmkorff coil) and a small battery of Grenet cells, is a special microphone, acting both as manipulator and as interrupter. The automatic interrupter of the induction coil is stopped, while the condenser is used for enforcing the oscillator spark. At the receiving station is a Tommasi coherer, connected with the receiving antenna and the grounded conductor. In a telephone receiver, the noise produced by the Hertzian waves on traversing the coherer is noted. On bringing the mouth to the microphone and singing or speaking, every sound vibration will be attended by an interruption in the passage of the electric current through the primary circuit of the transformer, the number of sparks in the oscillator thus being varied. The underlying principle shows therefore some analogy with the mechanism of an ordinary telephone. Any results so far obtained in the reproduction of singing are said to be quite satisfactory, whereas the rendering of language leaves much to be desired. The defect seems to be the difficulty of designing a microphone of sufficient intensity; Mr. Garcia, it is true, has remedied the imperfections of his apparatus to a certain extent, by using a condenser and augmenting the potential difference; this, however, could not be driven because electric arcs were easily formed.

An interesting lecture was recently delivered in London by J. M. Bacon, the aeronaut, upon the subject of photographing from a balloon. There is great uncertainty about obtaining good photographs from a balloon, on account of the atmospheric influences. Even on a clear day, when the sun during the ascent is shining, definition gradually becomes blurred, until at a height of 4,000 feet photography becomes impossible, owing to the dust motes that reflect the sunlight. Warm and cold air currents coming in contact with one another give rise to conditions that prevent photography, but over water sharp definition is generally possible, owing to the moisture in the air. Some of the most striking results have been obtained on a dismal, rainy day, when leaving the earth and passing through the clouds into genial weather above, while the cloud masses below were brilliantly illuminated by the sun. An ascent from Clifton on the occasion of the meeting of the British Association produced some exceptionally beautiful photographs, that were obtained toward sunset.

THE NEW WHITE STAR LINER "BALTIC"—THE LARGEST VESSEL IN THE WORLD.

BY THE ENGLISH CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

The success of the "Oceanic" showed that the most remunerative type of craft for the transatlantic traffic is the vessel of a medium speed, maintained under all varying conditions, but of a tremendous tonnage. Although speed may be an important desideratum from one point of view, such a qualification is in reality only appealing to a limited quota of passengers, the bulk of travelers preferring greater comfort and steadiness of the vessel, especially in rough weather. Each of the two vessels built after the "Oceanic" has marked an increase in size and tonnage upon its predecessor.

The latest liner, the "Baltic," surpasses in size anything that has thus far been attempted, though it is by no means the finite, for Messrs. Harland & Wolff have declared their readiness to build a vessel of 50,000 tons. The realization of such a vessel is dependent upon the capacity of a dock to accommodate it.

The length of the "Baltic" over all is 725 feet 9 inches. This is an increase upon the length of the "Celtic" and "Cedric" of 25 feet. The beam is the same, being 75 feet; the depth, 49 feet. The gross tonnage is 23,000 tons, an increase of about 3,000 tons. The cargo capacity is about 28,000 tons, and the total displacement at the load draft approximates 40,000 tons.

Although the two sister ships are practically of recent construction, yet so rapid is the progress of development in shipbuilding design and construction that this latest vessel contains several interesting improvements, possible of embodiment owing to the immense size of the boat.

The same standard of luxury and comfort in the accommodation and appointments for the convenience of the passengers so characteristic in the previous ships is maintained, but the accommodation is more commodious. The total complement of passengers is 3,000 passengers, and a crew of about 350. The general arrangement of the ship is similar to the other two vessels of this type—a continuous shade deck running fore and aft, with three tiers of deckhouses and two promenade decks above same. On the upper promenade deck is the first-class smokeroom and library, and the two houses below contain the deck staterooms. All the first-class accommodation is situated amidships. One of the most notable features in the "Baltic" is the grand dining saloon situated on the upper deck. It extends the full width of the ship, 75 feet, is exceptionally lofty and airy, and has seating accommodation for 350 people. It has a domed skylight, and the decorations are most artistically and effectively carried out.

Immediately abaft the first-class is the second-class accommodation, together with a comfortable smoke-room and library.

The third-class passengers are provided for abaft the second-class, and to a limited extent at the fore end of the vessel. A great feature in this accommodation is the large number of staterooms two, three, and four-berth, and the commodious and comfortable dining rooms, fitted with tables and revolving chairs.

The maximum of safety is secured by the exceptional strength and structure of the vessel, together with the elaborate system of watertight compartments. One very important safety device which is the first instance of its application to a mercantile vessel is the electrical indicator, which is utilized in the British navy, for the prevention of collisions. This device is placed on the bridge. It indicates the exact position of any other vessel entering its magnetic zone. There is a dial carrying a needle on its face similar to a compass. Directly the other vessel enters the magnetic zone, the radius of which in this instance is five miles, the needle revolves and points directly toward it, thereby indicating its precise location. This apparatus is highly sensitive, and even the screw revolutions of the approaching vessel are registered by the wave vibrations. In this manner the officer on the bridge can estimate the exact time he is distant from the other vessel, and act accordingly so as to clear it. With this precautionary device it is absolutely impossible for another vessel to creep up even in foggy weather or under cover of darkness without the officer being aware of its approach.

Other important devices which tend to insure greater safety are the electrical lead and log. When in operation the speed of the ship and the depth of water are indicated at regular intervals of ten seconds.

The cooking and refrigerators are also electrically operated, by which provision greater cleanliness and coolness are obtained. The odors of the cooking galley are withdrawn by means of electric fans and carried through pipes and exhausted into the open air at the stern of the vessel. The machines for the refrigerating chambers are worked upon the CO_2 principle. The whole of this plant is electrically operated, thereby obtaining an appreciable economy in ice storage, as the vessel will be able to leave port with a smaller supply of ice than is feasible upon other vessels fitted with existing systems.

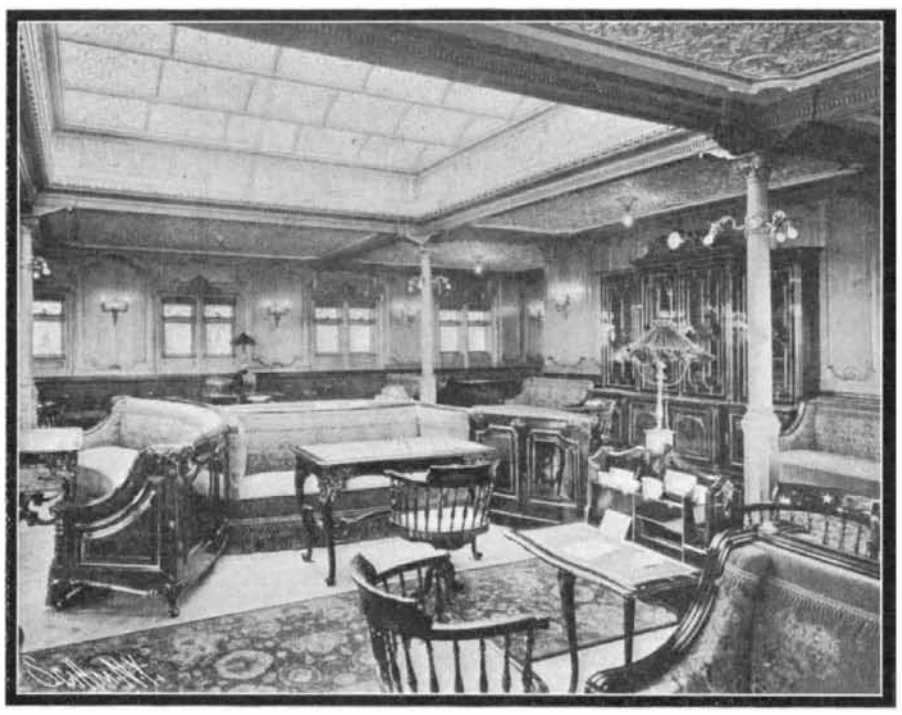
The private staterooms are equipped with electric chafing dishes, warming pans, and other utensils, which the passengers can immediately use whenever desired, an innovation which will doubtless be highly appreciated.

The vessel is not speedy. In the case of the "Oceanic" a speed of 20 knots can be maintained, but in the subsequent vessels this was reduced to about 16½ knots. The "Baltic" will approximate the same speed, with a great reserve of power, to enable this rate of traveling to be maintained even under adverse conditions.

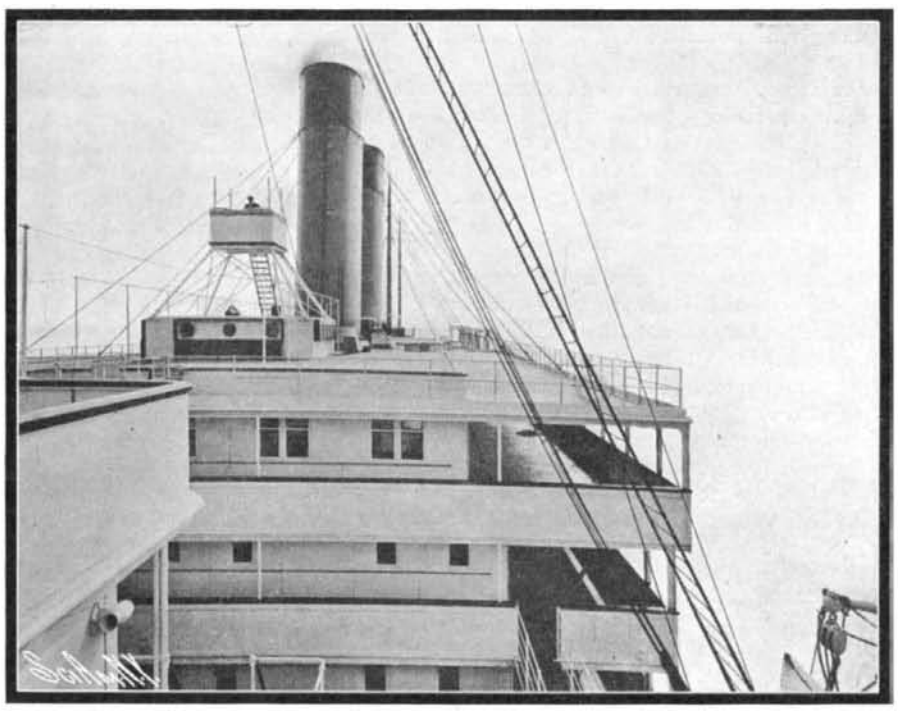
The "Baltic" is fitted with engines of Harland & Wolff's quadruple-expansion type, developing about 13,000 I. H. P. The engines are arranged on the balance principle, which practically does away with all vibration. The twin engines and twin screws afford another element of safety to the ship and passengers, and the possibility of danger is reduced to a minimum.

The maiden trip of the "Baltic" was made without incident. Her trip occupied 7 days, 13 hours and 37 minutes. She left Liverpool at 5 P. M. on June 29, and by 8:21 had passed Rock Light on her way to Queenstown. Her daily runs were: July 1, 312 knots; July 2, 395 knots; July 3, 403 knots; July 4, 417 knots; July 5, 387 knots; July 6, 407 knots; July 7, 414 knots.

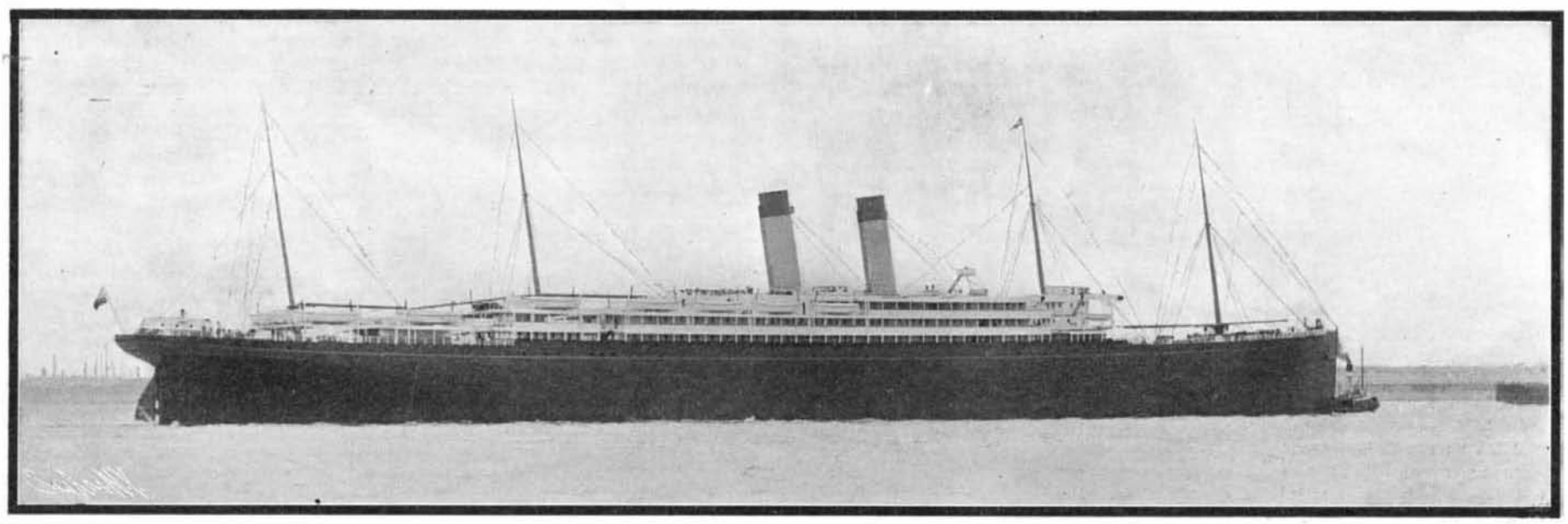
The engines ran from seventy-eight to eighty revolutions a minute, while the forty-eight furnaces consumed only 235 tons of coal a day. The "Baltic's" best day's run was on July 4, when 417 knots were logged, and she maintained an average hourly speed of seventeen knots. Her average for the trip was 16.1



In the Library.



The Four Decks of the "Baltic."



Length, 725 feet, 9 inches. **Beam,** 75 feet. **Maximum Displacement,** 40,000 tons.

THE NEW TRANSATLANTIC STEAMSHIP "BALTIC," THE LARGEST VESSEL AFLOAT.

Part of the Colonnade and the Lateral Cascade.

The Festival Hall, the Colonnade of States, and the Cascades.

A General View of the Festival Hall and the Cascades.

THE LOUISIANA PURCHASE EXPOSITION.—[See next page.]

knots an hour. Her engine and fireroom force is comparatively small—fourteen engineers, fifteen oilers, thirty-six firemen, twenty-six coal passers, two storekeepers, two stewards and one winchman making up the three watches.

CASCADES AND COLONNADE OF STATES AT THE EXPOSITION.

BY THE ST. LOUIS CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

Compared with previous expositions, the present grounds at the St. Louis Fair are laid out on a scale of magnificence which renders them certainly the most imposing and beautiful architectural display ever made in an enterprise of this character. The architects took advantage of a dominating hill about 100 feet in height, which slopes gradually to the plain upon which the exhibition palaces are grouped, and placed upon the apex of this hill the leading architectural feature of the whole. The exhibit palaces are laid out on avenues which radiate from this common center, and upon the crest of the hill stands the central architectural building, the great Hall of Festivals, forming a center of a vast gently curving structure known as the Colonnade of States. The latter terminates at either end in circular pavilions, each 140 feet in height and corresponding somewhat in architectural treatment to Festival Hall. The Colonnade itself, which is 52 feet in height and over a quarter of a mile in length, forms a vast arc of a circle along the brow of the hill, crowning the crest of a natural amphitheater that rises 70 feet above the surrounding country.

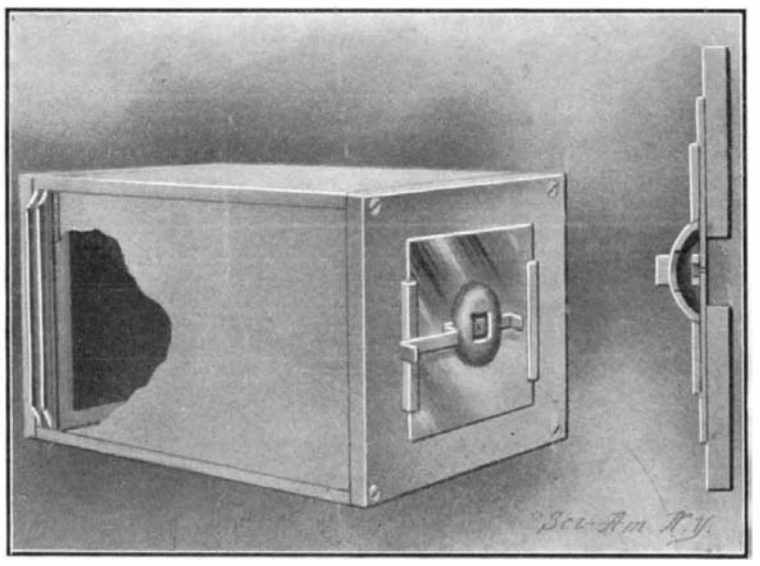
At intervals along the Colonnade are mammoth allegorical statues, representing the fourteen States included in the Louisiana Purchase. The face of the hillside fronting the Industrial Palaces is laid out as a sloping lawn, which just now is blazing with a wealth of color, due to the wealth of bloom in the flower beds. From the front of the Festival Hall and of each pavilion flanking the Colonnade, there gushes forth the water of three large cascades. The central cascade starts with a width of 50 feet, and gradually broadens out to a width of 152 feet, where it takes its final plunge into the central cascade basin below. The total fall is 95 feet, and the length down the face of the falling water is about 300 feet. All three cascades converge to the central lagoon, and at night time, by the aid of colored electric lighting, a most beautiful and varied effect is produced. From an engineering standpoint the cascades are a truly notable performance, involving as they do the lifting of 90,000 gallons of water every minute to a height of 95 feet, the water circulating in this way from the lagoon to the summit of the cascades and back again. The pumping machinery is located beneath one of the side cascades, and the work is done by three large centrifugal pumps that are operated by induction motors, each of 2,000 horse-power capacity.

The lagoons from which the water is drawn hold about twenty-five million gallons, and when the pumps are running at the rate of 90,000 gallons a minute, it takes about four and one-half hours to pass the entire water in the lagoon through the pumps. It is evident that such rapid handling of the water necessitated special provisions to prevent a vortex in the lagoon; and to overcome the difficulty, and to promote a general circulation of the water, the suction pipe leading to the pumps is carried some 500 feet down the main lagoon, and is so arranged that water can be drawn at will through screened openings distributed throughout its entire length.

The great Hall of Festivals itself carries a dome 140 feet in diameter that rivals in size that of St. Peter's at Rome. Of course, in height it is considerably smaller than St. Peter's, which extends some 450 feet from the ground level, whereas the height from the grand court to the top of the dome of Festival Hall is about 250 feet. The diameter of the hall at its base is 192 feet, if we exclude the terrace upon which it stands. The whole building covers more than two acres, and it has accommodations for about 4,000 people.

As the building has a strictly festive purpose, the architect and the sculptor have aimed to render it joyous in its spirit and treatment; but above and beyond that, the entire composition of the Cascades, the Colonnade, and Festival Hall has been given an historic as well as an allegorical significance, expressive of the jubilation which a great nation must naturally feel that the sway of liberty was extended by the Louisiana Purchase from the Atlantic to the Pacific. This idea is strongly brought out in the sculptural decorations. Around the central cascades stairways descend on both sides, and swing away in opposite directions to the Basin below. The side cascades represent in their treatment the Spirit of the Atlantic and the Spirit of the Pacific. Each is 400 feet in length, and the scheme includes fifteen groups of statuary for each side. At the head of each cascade and in front of the pavilions are groups which the sculptor has named respectively "Spirit of the Atlantic" and "Spirit of the Pacific," the Atlantic Ocean being symbolized by the figure of a vigorous youth at whose feet soars an eagle, typifying the restless and turbulent character of the Atlantic, while beneath are groups of children and forms of sea lions. A graceful girl reclining above a sea gull, a grizzled sea god, and other allegorical expressions are scattered throughout the length of this cascade.

The fountain for the opposite cascade is surmounted by a flying female figure with an albatross, and various groups of characteristic statuary attend its progress to the lagoon below.



A LENSLESS OR PINHOLE CAMERA.

The Colonnade of States, which forms the background of this splendid picture in turf and stone and water, finds its motive in the majestic approach to St. Peter's at Rome, and it is, of course, in some degree reminiscent of the lovely Peristyle at Chicago. Throughout the structure of the Colonnade, square pylons serve to give a dignified and worthy framing to the colossal statuary, which typifies the twelve States and two Territories which have been formed from the original purchase. If the architects and sculptors had done nothing more at the Fair than produce this Festival Hill, with its cascades and lagoon and magnificent reach of landscape garden effects, they might well rest satisfied; for it is in itself, independently of the great work to be found embodied in the palaces and their flanking and surrounding statuary, a splendid tribute to the high position which America is winning among the nations of the earth in the field of sculpture and architecture.

A PHOTOGRAPH TAKEN WITH THE PINHOLE CAMERA.

The Speed Record of the "Colorado."

On her builders' trial, the United States armored cruiser "Colorado" attained a maximum speed over the measured mile of 22.31 knots an hour. The average of two runs under forced draft was 22.1 knots an hour.

LENSLESS PHOTOGRAPHY.

BY N. R. BRIGGS.

The taking of a photograph, and a good one, too, with a camera without a lens, may seem to many utterly incredulous. Nevertheless, it is done, and this innovation in photography has become an interesting feature with many lovers of the photographic art.

A piece of tinfoil, through which was pierced a fine needle hole, to serve the purpose of a lens in admitting light to the sensitive plate, was secured to the front piece of the camera, in place of a lens, and the exposure made in the regular manner. Pictures thus made are now popularly known as pinhole photographs. The pictures, however, were not wholly satisfactory, owing to the difficulty of getting a perfectly round and smooth hole through this soft, flexible metal, for in this lay the main principle of success. But this has led to the bringing out of a new invention called the "radioscope," which consists of a very thin piece of hammered brass plate, through which is bored an accurately round and smooth hole, and so mounted that it can be quickly adjusted to any camera, or any light-tight box that fancy may dictate.

The accompanying illustration is from a reproduction of a pinhole photograph of a scene in Central Park, taken for the writer by Mr. Charles G. Willoughby, of New York.

As will be observed, there is a lack of that extreme sharpness produced by a regular photographic lens; but, as has been wisely said, this is more than compensated for by a softness of tone equaled only by the brush of an artist.

The interest manifested in this new objective is due to the fact that it is of universal focus—the rays focusing in the stop; the perspective is true, no part of the picture being out of focus, while interior and architectural photographs are rectilinear, that is, without distortion of any kind, for the rays of light fall directly upon the plate without interference of any kind.

Nor is the work of the pinhole objective confined to any one subject, for with it most pleasing portraits can be made. And it is said that work requiring the sharpest definition, such as copies, reproductions of documents, etc., can be often better done by the pinhole objective than it can with a fine lens. The reason is obvious. A lens focuses often sharper than the eye, giving a staring, unnatural effect to the resulting print.

Another singular feature in connection with the pinhole objective is that any size camera may be used. For instance, it will take a picture upon a plate three inches long or twenty inches long. Therefore, it will be seen that all one has to do is to arrange his camera for a small or large plate, and with the latter, interesting panoramic views could be secured. There is no doubt that a very cheap and satisfactory folding camera, in which to use any of the present series of roll films, could be made for special panoramic work.

Of course, it should be understood that, owing to the small amount of light admitted through a pinhole objective, the time of exposure will naturally be longer than with a lens; and while it is possible to overexpose, there is less liability than with a lens.

Smoke as a Preventive of Frost.

M. Bignon has recently addressed to the French National Society of Agriculture a note giving interesting information on the efficacy of artificial clouds in preventing late frosts. For many years he has successfully practised this. His vineyard thus protected covers about 15 acres and is divided into five parts, separated from east to west by walks 12 to 15 feet wide and circled by an avenue of equal width. These walks facilitate the placing of the fires, which are built in a small basin sunk into the earth and filled with 15 or 20 pounds of resinous matter and some pieces of pine and other vegetable débris. The basins are some 50 feet apart.

In 1903 the frosts were very heavy for a week, and recourse was had four times to artificial fires. The total expense was $400. The effect is stated as having preserved 25 per cent of the harvest, or some 125 to 150 barrels of wine.

It is stated that any substance can be burnt which gives a thick and abundant smoke, such as green herbs, moss, damp straw, tufts of grass, etc., but best results have been obtained in France by the heavy oils which are the residues of gas.

Every Danish state locomotive that has gone for some years past into the shops for repairs has had its wheel peripheries gaged, and, besides less wear with large wheels, it is found that single drivers run better than four-coupled, and four than six-coupled, where the road is the same, and that, in each class, where the road is more flimsy, the wear is greater.

Patent Department

THE NEW AUSTRALIAN PATENT ACT.

On the inauguration of the Commonwealth of Australia on the 1st of January, 1901, inventors and their representatives looked forward to an early change in the patent practice of that British colony. Under the laws then in force, it was necessary to secure separate patents in each of the seven Australian colonies in which the inventor was desirous of protecting his invention, but when it was known that the confederation of six of the colonies was an accomplished fact, it seemed that it would be but a short time before the patent laws would be amended and an inventor would be enabled to protect his invention in the several states forming the new colony, under a patent granted on a single application, with the payment of only one government fee. But in that, interested persons were mistaken, for time passed and the question of the passage of a new law received little, if any, attention of the Australian legislators, whose time was much occupied with the consideration of other questions which the general changes in the administrative departments made of prime importance.

The new law after receiving the consideration of the legislators for several months was not passed until October 22, 1903, and it was even then provided that the law would not go into effect until it was subsequently proclaimed. At last the new law has been proclaimed, and the new provisions are now in full force. With the exception of New Zealand, the commonwealth includes all the Australian colonies, including Tasmania.

While under the law it remains for the commissioner of patents to define the section referring to the novelty of invention, it is thought that from the other sections and the general provisions of the patent laws of Great Britain and its colonies, the commissioner will, without doubt, rule that patent applications should be filed before the invention is publicly known in the commonwealth, either by the publication of the invention in public print or the public use of the new device. As the United States Patent Office Gazette is sent to Australia, and as most inventions are fully disclosed in the claims and drawings which appear in the Gazette, inventors should not delay their Australian applications, but should file them before the issue of the United States patent. Applications will be examined to ascertain whether the inventions are novel in Australia.

There is no requirement that the patented invention be manufactured, but if the patentee fails to supply the reasonable requirements of the public, he may, after two years from the granting of the patent, be compelled to grant licenses to others for a reasonable consideration.

Patents previously granted under the Australian state patent acts remain in force for their full time, and, under the commonwealth act, they may be extended throughout the commonwealth, provided action is taken before the invention is publicly known in the states other than the one in which the patent was granted. Inventors who have secured patents under the old laws and who desire to extend them under the new law, should proceed with their commonwealth applications without loss of time.

Provision has been made for the Australian commonwealth to join the International Convention for the Protection of Industrial Property, but until it is so ordered by the King of Great Britain, through an order in council, inventors will be unable to claim in Australia protection under the provisions of that treaty.

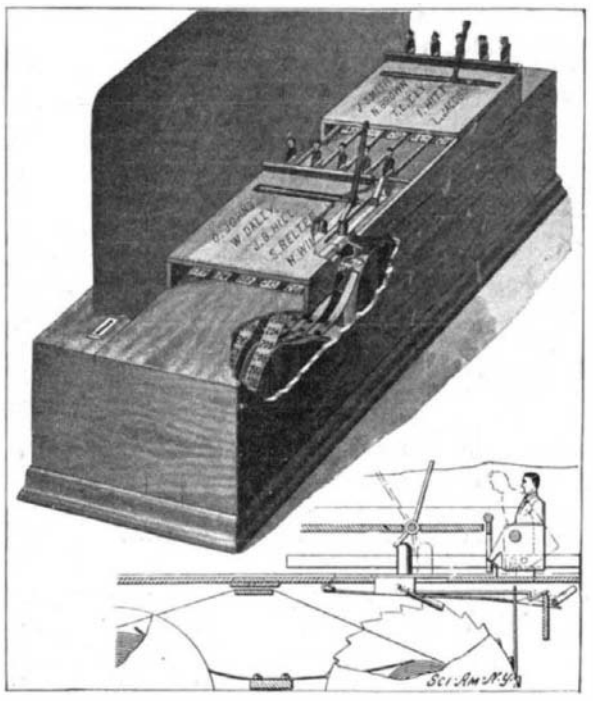
Instead of annual taxes, the new law makes it necessary to pay after the issue, and during the life of the patent, only one tax of £5, which becomes due before the expiration of the seventh year of the patent term of fourteen years.

Every patented article sold in Australia under a patent granted in that country should be marked with the word "Patented," together with the number or the patent and the day and year it was granted. Failure to so mark the patented goods may prevent the patentee from recovering damages for the infringement of the patent.

Henry C. Peabody, the inventor of the rifle bearing his name, who died a short time ago, left an estate valued at $375,000 which, by the terms of his will, was left for the founding of the Peabody Industrial School for Girls.

VOTING MACHINE.

We illustrate herewith a novel type of voting machine, invented by Mr. Andrew H. Hart, of Winchester, Ky. This machine is designed to carry a bust or photograph of each candidate to be voted for, so that



A NOVEL TYPE OF VOTING MACHINE.

the voter may be given some idea of the man for whom he is voting. Our illustration shows the voting machine as arranged for only two tickets of six candidates each, but it will be evident that a machine could be built on the same principle for recording the votes on any desired number of candidates and any number of tickets. The machine consists of a casing inclosing two groups of rolls, one for each ticket, and arranged one in advance of the other. These groups consist of pairs of rolls, one pair for each candidate. Coiled on the forward roll of each pair is a tape which is printed with consecutive numbers. This tape passes under a glass-covered opening in the casing, and thence to the second roll, on which it is wound up. The flanges of the latter roll are formed with ratchet teeth which are engaged by a dog carried by a movable slide in the top of the casing. This slide is formed with a pin which is adapted to be engaged by the lower arm of a bell crank loosely mounted on a transverse shaft at the top of the casing. This bell crank may be moved laterally on this shaft to engage any one of the pins desired, and then when drawn forward to the dotted position shown, it moves back the slide which is engaged, rotating the ratchet one notch, thus bringing the next consecutive number into line with the glass-covered opening in the casing. The slide carries a spring latch which locks the parts against further movement. The portraits of candidates are mounted on hinged blocks, which are tipped forward as they are voted for by bars attached to the slides and engaging the lower edges of the blocks. To prevent a voter from casting votes for two candidates for the same office, the portrait blocks of rival candidates are connected by rods in such manner that when one is tipped forward, the other one will be also tipped. Each block is provided with a projecting finger which, when the block is tipped, engages the end of the bar on the slide and prevents the latter from being advanced to move the numbered tape. Thus when one candidate is voted for, no vote can be cast for the rival candidate for that same office. After the voter leaves the voting booth, an official turns a rock-shaft which releases all the latches and brings the parts to normal position. In order to compensate for the gradually increasing diameter of the tape on the take-up roll, the numbers are spaced gradually further apart, so that they will always register accurately with the glass-covered opening in the casing. If desired, a record of the number and names of the voters may be kept by requiring each one on entering the booth to write his name on a slip of paper and put it in a chamber in the machine through the slot shown in our illustration.

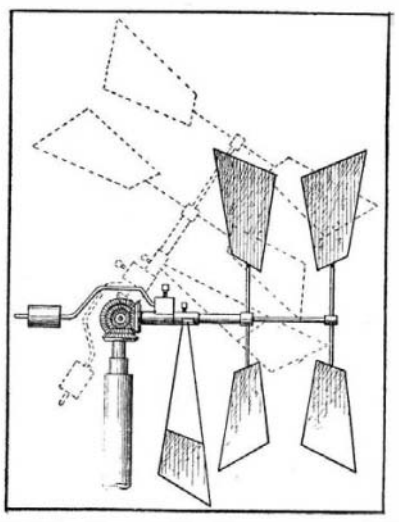
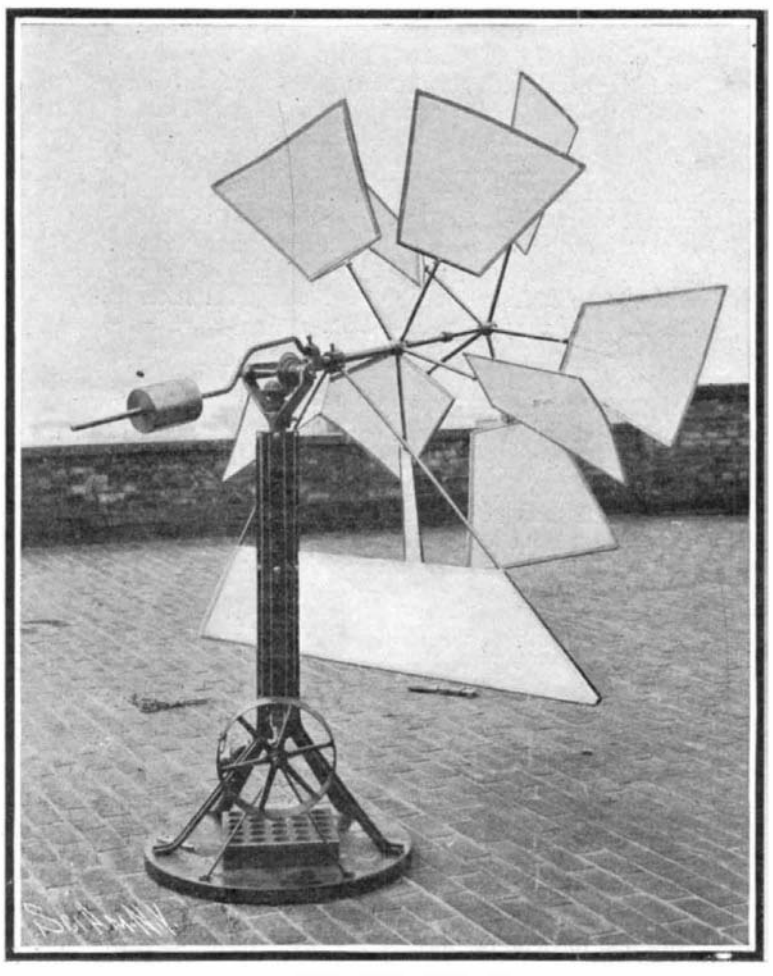


DIAGRAM SHOWING TWO POSITIONS OF WINDMILL.

A COMPENSATING WINDMILL.

Inventors have been endeavoring for some time to invent a windmill of such construction, that no matter how great the velocity of the wind, the power transmitted would be practically constant, or not above a predetermined limit. Many such constructions have been patented, but in the majority of cases they have proved impracticable when put to an actual test. In the accompanying engraving we show a construction which gives every promise of success, and which, moreover, is very ingeniously contrived. This windmill is so designed that as the strength of the wind increases, the windwheels will be tilted upward, as indicated by dotted lines in our diagram, so that the force of the wind upon them will be modified. The windmill is preferably made with two windwheels, whose sails are oppositely inclined, so that they will rotate in opposite directions, and thus tend to balance each other. The inner windwheel is secured to a hollow shaft, through which the shaft of the outer wheel passes. These shafts are mounted in a bracket, which has a universal joint connection with the windmill standard, and the weight of the windwheels is balanced by an adjustable counterweight. At their inner ends the shafts carry bevel gears which, through the medium of a pair of idlers on the horizontal hinge pin of the windwheel bracket, transmit power to a pair of concentric bevel gears turning on a vertical axis. The outer one of these gear wheels is mounted on a hollow shaft which, at its lower end, carries a bevel gear engaging the upper teeth of the gear wheel on the power shaft of the windmill. The lower teeth of the power wheel are engaged by a bevel gear, secured to a shaft, which passes through the center of the hollow shaft, and carries at its upper end the inner bevel gear wheel of the concentric pair. As a result of this arrangement both windwheels, though turning in opposite directions, act together to drive the power shaft in the same direction. The vane of the windmill consists of a blade or sail, which lies adjacent to and below the level of the windwheels, and occupies a plane normally transverse to the direction of the wind. As the velocity of the wind increases, the pressure against this blade causes the windwheels to rise, so that they will rotate at an acute angle with the direction of the wind, thus modifying the force of the wind upon them. It will be obvious that any increase in the velocity of the wind will be compensated by an increase in the angle between the axis of the

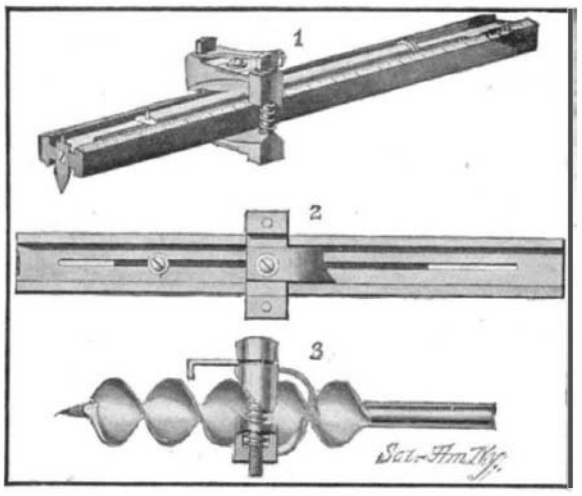


A COMPENSATING WINDMILL.

windwheels and the direction of the wind. Mr. Alfred Fornander, 32 West 66th Street, New York city, is the patentee of this novel windmill. He is an inventor of some note, having devised a number of machines and articles, among them tapestry-yarn printing machinery and the "perpetual" pencil. His present invention certainly seems a marked advance on the windmill with which most of us are familiar.

IMPROVED GAGE.

The gage which is illustrated in the accompanying engraving is capable of quite a variety of uses. It

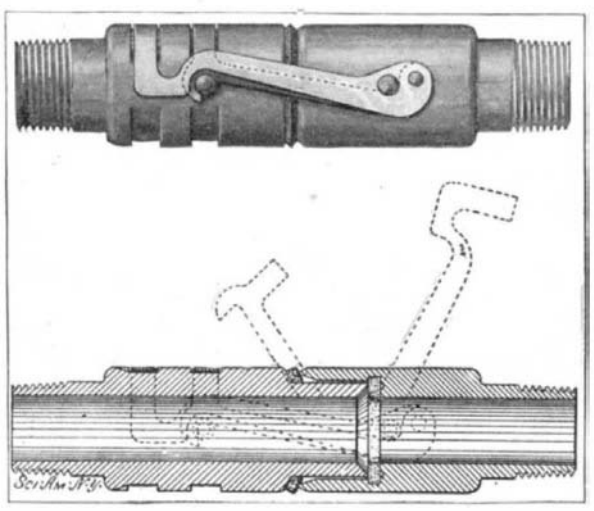


IMPROVED GAGE.

may be used either as a single-tooth gage for marking, or as a double-tooth gage for mortising work, as a cutter for forming dovetails and deep cuts, or as a stop on auger bits to limit the depth of holes. As indicated in Fig. 1, the device comprises a bar which is I-shaped in cross section, and is graduated along the edge. Resting on the web of the bar is a slide, which is loosely held in place by a screw threaded therein, and passing through a central slot formed in the web. This is illustrated in Fig. 2, which shows the underside of the device. A cutter is fastened to one end of the gage bar. This cutter is provided at its opposite end with a scratch pin. A scratch pin is also secured to the adjacent end of the slide, for making parallel scratch lines for mortising work. The space between the scratch pins can be regulated by moving the slide to any desired position. The slide when thus adjusted is held by a clamping head adapted to abut against the side of the work when using the tool as a marking gage. The clamping head consists of two transversely-extending jaws, held together at their outer ends, against the tension of two coil springs, by means of thumb screws. When the clamp is to be used on an auger bit, the gage bar is dispensed with, and merely the clamping head is used. The latter is secured to the bit by means of two braces, one on each jaw, which engage opposite sides of the auger at its middle portion. A stop piece secured to one of the jaws serves to limit the inward movement of the auger after the hole has been drilled to a predetermined depth. Mr. George Arnold, of 7002 St. Lawrence Avenue, Chicago, Ill., is the inventor of this improved gage.

HOSE OR PIPE COUPLING.

A novel hose or pipe coupling, which has been invented by Mr. S. N. Vernon, of Sonora, Ohio, is illus-

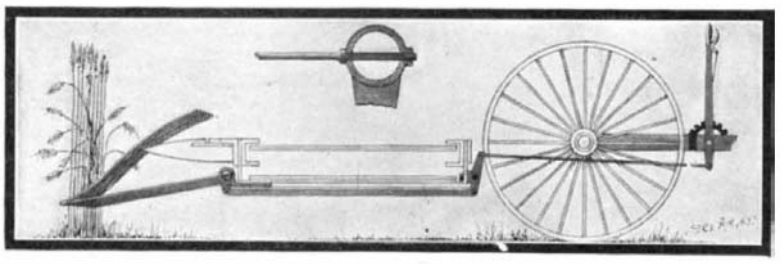


HOSE OR PIPE COUPLING.

trated herewith. The improved construction provides a very simple and convenient locking device, which will securely clamp the coupling sections together in a water-tight manner. The two coupling sections are made of metal, and are threaded at their outer ends to receive the hose or pipe. One of the sections, that shown at the right in the engraving, is cup-shaped at the inner end, to receive the neck formed on the inner end of the other section. A packing ring is placed at the bottom of the cup, against which the sharpened edge of the neck section bears, and, similarly, a packing ring is placed at the base of the neck, to receive the sharpened edge of the cup section. Fulcrumed to the right-hand member is a locking link of general U-shaped formation, that is, it comprises two levers connected at their outer ends by a yoke band. A second, shorter member of similar form has its two arms pivoted to the two arms of the locking link just back of the main fulcrum. The shorter member is formed with hooks on each arm adjacent to the yoke band, which are adapted to hook over two pins formed on the left-hand coupling section. To couple the two sections together, it is merely necessary to slip the neck of one into the cup of the other, bring the hook member into engagement with the pins, and then press down the locking link which, owing to the eccentric pivotal connection of the hook member with the locking link, will result in drawing the coupling sections tightly together and pressing their sharpened edges into the flexible packing rings, thus effecting a water-tight joint. In this position the coupling sections will be locked until the locking link is lifted again. Recesses are formed in the left-hand coupling section to receive the yokes of the two U-shaped levers.

GRAIN LIFTER FOR HEADERS.

The improved grain lifter, illustrated herewith, is adapted for removable attachment to any header or like machine, and is especially designed for straightening individual stalks of the grain, so that the heads need not be lost in the cutting. The device is not intended for use upon grain lying flat upon the ground, but particularly for use in connection with grain upon which the header can be readily worked, or grain in which the heads have sagged down for any cause, so as to be below the level of the platform of the machine when the platform is at its lowest point. The body of the device consists of a bar, preferably tubular, and a series of lifting arms or fingers carried thereon, and located at desired intervals apart along the length of



GRAIN LIFTER FOR HEADERS.

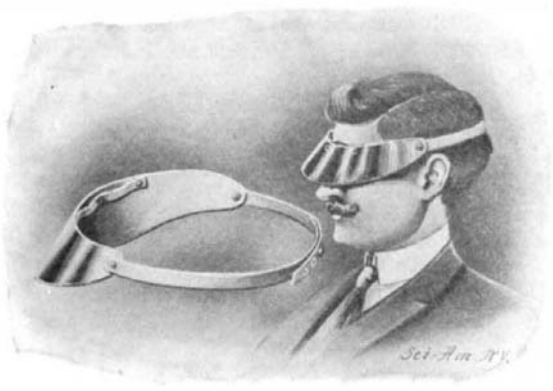
the bar. The lifting fingers are formed of spring steel rods, which project horizontally forward from the body bar, and are bent upward and backward at their outer ends, as shown. To prevent the fingers from turning in the body bar, they are made with rectangular shanks, which fit into rectangular openings in the bar. The grain lifter is mounted in hangers secured to the header. A pair of crank arms are secured to the body bar, from which suitable connections extend to an adjusting lever. The latter may be operated to raise or lower the lifting fingers, according to the condition of the grain to be operated upon. It is evident that the device will very effectually raise the majority of the heads of grain which may have dropped from any cause, and carry these heads upward, so that the grain can be acted upon at a suitable point below the heads, and be cut by the sickle blades of the machine. It will be noted that all the operating parts of the device are carried rearward beneath the platform of the header, so that it can readily be attached thereto, and will in no manner interfere with the proper operation of the machine. The inventor of this improved grain lifter is Mr. Jacob Mees, of Lane, So. Dak.

Blanks for Pearl Buttons.

In the cutting of blanks for pearl buttons, much of the operator's time is consumed in the sharpening of the saw, which must be done at very frequent intervals. This must be done three or four times an hour, and each time about three minutes is consumed in putting a new edge on the saw teeth. A new invention by which this can be done in about ten seconds has recently been patented by J. W. Miller, of Muscatine, Iowa, and the inventor claims that not only is this time saved but better work is done. The time saved alone represents an additional product of between fifteen and twenty gross of blanks in the course of a week. The device is merely an attachment made to the regular blank cutting machine, being fastened adjacent to the maple plug. When an operator wishes to set his saw, he adjusts the machine and without stopping the cutter, sets the saw. He then stops the machine and adjusts the filing machine, which consists of a number of small steel files working rapidly back and forth on the teeth of the saw. In ten seconds the saw is filed and set and the cutter has nearly a half a gross of buttons cut before his neighbor who is using the old method has finished filing his saw.

VENTILATED EYE-SHADE.

The ordinary type of eye-shade possesses the serious defect of improper ventilation. It is arranged to fit closely to the eye, and its shape is such as to catch and hold the heated air which drifts therein. This pocket of hot air is very annoying to the eyes, and causes them to burn and smart. The heat also affects the head, producing a dull, stupefying headache. These ill effects are avoided in the eye-shade here illustrated, since ample provision is made to permit the

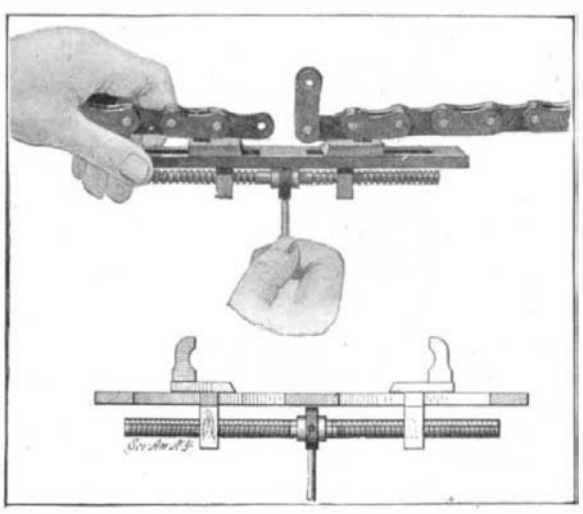


VENTILATED EYE-SHADE.

heated air to escape. The eye-shade is spaced from the forehead by means of a flexible ribbon, secured along its upper, inner edge. This ribbon is sinuously disposed on the eye-shade, that is, it is looped, instead of lying flat thereon, and these loops bear against the forehead, causing the eye-shade to stand out a distance of about a quarter of an inch, thus forming a large ventilation passage for the heated air. A patent on this eye-shade has recently been granted to Mr. William S. Bevan, of 829 Gates Ave., Brooklyn, N. Y.

CHAIN CLAMP.

In the accompanying illustration we show a simple clamp, which can be attached to any chain in such manner as to relieve the tension on any part, to permit removal or separation of that part from the rest of the chain. The device will be found very useful in repairing automobile chains while on the road. The main advantage of the invention is that one or more links may be removed from the chain without taking the chain off the sprockets or letting it drop to the ground, thus obviating the possibility of dirt or sand clogging or injuring the chain or sprockets. By use of this chain clamp, injured links may be removed from the chain without disturbing its adjustment. The clamp is a very compact little device, as shown. It comprises a metal bar formed with two slots, to receive the depending arms of two blocks. These arms, at their lower ends, are threaded to receive a screw rod. One-half of the screw rod is cut with a right-hand thread, and the other half is cut with a left-hand thread, so that when the rod is turned in one direction the blocks will be drawn together, and when turned in the opposite direction the blocks will move apart. The blocks are formed at their upper ends with curved lugs adapted to fit against the pivot pins or bolts of



CHAIN CLAMP.

the sprocket chain. When the lugs are thus applied back of the chain pins on opposite side of the injured section, the screw rod is turned to draw the links together. This relieves the tension from the injured section, and permits removal of the broken or weakened link without otherwise disturbing the rest of the chain. Mr. Hermann Huhn, of Macon, Ga., is the inventor of this improved clamp.

RECENTLY PATENTED INVENTIONS.

Electrical Devices.

ULTRA-VIOLET-RAY ELECTRODE.—C. F. W. HORN, New York, N. Y. In this patent the invention relates to electrodes for the production of ultra-violet rays; and the principal object of the improvement is the provision of an electrode by means of which these rays may be produced in large quantities and which may be conveniently employed in the application of the rays to the cure of disease.

Of Interest to Farmers.

STOCK-WATERER.—F. S. SEYMOUR, Manchester, Iowa. The present invention relates to certain improvements in apparatus for containing an automatically-regulated supply of drinking water for live stock, particularly on farms, but also in towns, villages, and in such other places as it may be desirable to care for the stock. The water is kept clean and free from the effects of temperature, thus keeping the liquid cool in summer and preventing winter freezing.

CULTIVATOR.—M. JENNINGS and J. H. JENNINGS, Elizabeth City, N. C. This apparatus is especially an improvement in straddle-row cultivators, and one object of the invention, among others, is to provide a construction of beam and of devices for supporting the same so the different sections of the beams can be readily adjusted in order to set the plows in any desired relation.

AUTOMATIC COUPLING.—T. W. LUIKENS and E. HUGHES, Hoopeston, Ill. An object of the invention is to provide an automatic coupler adapted for use under conditions which will hold with absolute security, preventing accidental uncoupling of the engine from its load when on the road, and which may be quickly and easily uncoupled, the uncoupling of the coupler being effective to set it in position for automatic action when the coupling-bar is introduced therein.

MOTOR-DRIVEN CULTIVATOR.—E. IMPERIALE, Naples, Italy. In this patent the invention relates to an apparatus for cultivating land, said apparatus comprising a cultivating tool or tools mounted on a wheeled frame and a motor connected by suitable gearing with the tool or tools and with the traction-wheels, so that the tools may be operated and the vehicle propelled over the ground to follow the operation of the tools.

THRESHING-MACHINE.—M. DAVIS and W. A. LEIBENBAUER, Ames, Oklahoma Ter. A purpose of this invention is to provide a box or casing in which is located a hollow shaft carrying knives tapering in direction of the casing exit, which knives have their cutting edges bent over in direction of the motion of the shaft, and, further, to provide a drive-shaft which passes loosely through the tubular shaft, being turned thereon in an opposite direction, and to provide a governing comb opposite the delivery ends of the knives to prevent a too rapid feed of the cut material to the fans and off-take mechanism. It is an improvement on a former patent allowed to these inventors.

VINE-CUTTER.—S. V. JEFFORDS, Waycross, Ga. Mr. Jeffords's invention relates to that type or class of cutters employing suitably-spaced runners adapted to be drawn along by horse or manual power and having blades whereby the vine is cut at opposite sides of the row, the runners being provided with handles adapting them to be guided as they are drawn along.

Of General Interest.

STAGE-FLOODING SYSTEM.—G. J. GIBNEY, Mobile, Ala. This invention is an improvement in fire-extinguishers, having for an object to provide a novel construction of stage-flooding mechanism, so that in case a fire breaks out a valve or valves under the control of persons from the stage can be opened and the entire stage quickly flooded with water.

FOUNTAIN ATTACHMENT FOR PENS.—J. W. LANGDON, Walla Walla, Wash. One object among others in this case, is to provide a novel construction which can be fitted and held on the pen and which can be filled and emptied through its front end and which at its said front end will be free from contact with the pen-point so that the flexibility of the latter will in no wise be impaired.

METHOD OF PRODUCING ARTIFICIAL FUEL.—G. K. HOLLISTER, JR., New York, N. Y. The object of this invention is to provide a method of producing artificial fuel, the fuel having a high rate of heat units and being in solid or briquet form, practically smokeless and odorless before and while burning, and intended for use in household-furnaces, kitchen and other stoves, boiler furnaces, and the like, and capable of producing a high heat.

TRAP-DOOR OPENER.—C. H. MOOS, Stillwater, Minn. The object in this instance is to provide features of construction that are simple, practical, and inexpensive, take up little room, do not obstruct the door-opening, afford means for counterbalancing doors of different weight provided with the improvement, and also permit graduation of the lifting power, so that the door will remain closed until started to open by slight manual effort.

FORMALDEHYDE APPARATUS. S. RAUSCHENBERG, Mount Vernon, N. Y. Broadly stated, the process employed in this case consists in boiling liquid formaldehyde, whereby it is converted into its polymers, which are volatilized along with the steam, which still holds formaldehyde absorbed in it. This is passed through a superheater. The high temperature entirely liberates formaldehyde from the steam, converts polymers into active formaldehyde, and discharges it with the steam in superheated state through the door into the chamber to be fumigated.

FOLDING BOX.—A. L. REYNOLDS, Madison, N. J. Mr. Reynolds' object is to provide a box arranged to permit packing and shipping it flat or collapsed, to allow quick and convenient setting up of the box for immediate use, and to securely lock the parts in position and prevent accidental unlocking, and at the same time presenting unobstructed inner faces of the top, bottom, sides, and ends of the box.

ERASER.—H. B. TOOKER, New York, N. Y. This mechanical eraser is more especially designed for use on type-writing machines and arranged to enable the operator to quickly and accurately erase either a single letter, sign, or the like or a word or an entire line without danger of marring the remaining writing or injuring the paper, and to readily brush the paper clean of abrading matter to allow of striking another letter on the erased part without blurring.

ART OF PURIFYING NITROCELLULOSE.—F. I. DU PONT, Wilmington, Del. Mr. Du Pont's invention refers to improvements in the art of purifying mitrocellulose and analogous substances, his more particular object being to dislodge impurities which affect the stability of nitrocellulose and also to remove any gaseous impurities which may be occluded within the material owing to its organic structure.

HOMOLOGUES OF ISOIONONE AND PROCESS OF MAKING SAME.—RICHARD SCHMIDT, Holzminden, Germany. The present invention relates to the manufacture of homologues of alpha and beta ionone illustrated by the following example: Fifty parts of crude or pure cycle-citral are mixed with one hundred of methyl-ethyl-ketone, and to this mixture five parts of sodium dissolved in alcohol are added. This is left at ordinary temperature an hour or two or more, if necessary, until the odor of cycle-citral has disappeared. It is then acidified slightly with a solution of weak acid, such as tartaric acid, and is distilled in steam, which carries over first all excess of the methyl-ethyl-ketone and finally the methyl-ionone.

POST-LIFTER.—H. O. ROTVOLD, Hesper, Iowa. In operation to pull posts, large or small, the lifter may be placed with the stand about a foot from the base of the post. The handle end of the lever may now be lifted up and the barb pressed against the post as low down as possible and the chain be passed around the post from the eye and secured upon the returned end at the opposite side of the point at the end of the lever. The chain will prevent any slipping of the barb or spur on the post, and the handle end will be brought down and the post be lifted out of the ground.

FLUID-PRESSURE REGULATOR.—J. W. SCOTT, Colorado Springs, Col. The aim of the present invention is to provide a regulator arranged to permit the diaphragm to expand and contract in both circular and diametrical directions to prevent buckling of the diaphragm and to allow up-and-down movement without danger of the diaphragm bending unduly. The invention relates to fluid-pressure regulators such as shown and described in the former Letters Patent granted to Mr. Scott.

REINFORCED TERRA-COTTA PARTITION.—P. H. BEVIER, New York, N. Y. Means are provided in this case for increasing the strength and efficiency of the mortar or cement joint between superposed tiles, and to attain this end a metallic member of open-work construction is placed between the courses of tiles and imbedded in the plastic bond in a way for the material while plastic to pass through the metallic member and to adhere to the surfaces of adjacent tiles, the mortar and the open-work member producing a thin, strong, and secure joint between the tiles.

FENCE.—J. PENCE, Gratis, Ohio. In this instance the invention his reference to improvements in metal picket fences, an object being the provision of a metal fence, preferably made of steel, that will be of light structure, yet very strong and serviceable, and that may be sold at a comparatively small cost.

DUST-ARRESTER.—W. J. NEWTON and R. DIGGLE, Accrington, Lancashire, and G. WATSON, Leeds, York County, England. In this case the invention relates to improvements in dust-arresters, an object being to provide an automatic and effectual means of arresting or preventing the escape of dust or the like from refuse-burners or other furnaces and flues and so arranged that the accumulated matter may be removed without interfering with the furnace-draft.

VENDING SHOW-CASE.—I. KLAYMAN, Baltimore, Md. Mr. Klayman's invention is in the nature of a vending show-case for retail tradesmen for containing all sorts of small articles held for sale, such as candies, spool cotton and silk, screws, nails, bolts, and various other small articles which are kept in assorted sizes, styles, and prices.

MUSICAL INSTRUMENT. SARAH W. CLARK, New York N. Y. The invention relates particularly to improvements in upright pianos or similar upright musical instruments, an object being to employ in connection with such instrument a curved sounding-board and a curved or concaved lid, which also serves as a medium to diffuse and give enlarged tone and effect to the sounds deflected upon it by the curved board within the instrument.

TRANSFER-TICKET.—W. KLEIN, JR., Brooklyn, N. Y. This inventor's ticket is particularly designed and adapted for use in transferring passengers from one line of cars to intersecting lines, and for this purpose the ticket is composed of a body or main portion and attached coupons. The purpose of the ticket is to prevent a passenger from riding in a circuit on the cars of any street-railway system, and it is an effective check against this.

SAFETY HOOK OR RING.—D. L. TROYER, Shanesville, Ohio. Though adapted to various uses or purposes, the device is intended more especially as a safety hook or ring for connecting the ring of a watch, charm, locket, or the like to a chain, fob, guard, or similar contrivance. It is also admirably adapted as a key-ring, as well as a connector for belts, cables, etc.

PORTABLE APPARATUS FOR THAWING FROZEN GROUND.—C. W. JOYNT, Seattle, Wash. The object in this instance is to provide a portable apparatus adapted to utilize the combustion of wood for thawing frozen ground in a very economical manner, effect rapid dissipation of frost that pervades the ground by directing the entire volume of heat from fuel combustion upon the bottom surface of an excavation, a further object being to enable the starting of the fire at the upper surface of the ground, and also enable convenient removal of the heating apparatus from the excavation to permit the thawed ground to be readily loosened and elevated from the shaft.

ACID-PROOF COMPOSITION.—F. A. PANK, Butte, Mont. This composition or paint when applied to iron pipes used in copper-mining industry prevents their corrosion by acids normally contained in the copper water. Heretofore such pipes were lined with wood; but expensive and cumbersome lining of wood may be dispensed with if the pipes have been properly coated with this paint. It admits of general use, and is not limited in its application to pipes of this kind, being suitable for use in building, marine, naval, and other construction work, and to prevent corrosion of iron and steel generally.

KNOCKDOWN CASE. — R. SCHOUTEN, Keokuk, Iowa. The invention has reference to improvements in cases or boxes particularly adapted for shipping bread or the like, an object being to provide a case that will be light yet strong and durable and so constructed that it may be compactly folded to take up but little space during the return shipment or in storage.

COLLAPSIBLE MEGAPHONE. — H. STURGES, New York, N. Y. In this patent the object of the inventor is the provision of a new and improved megaphone adapted to be collapsed and folded into comparatively little space for convenient storing aboard ship or other place and adapted to be quickly and readily extended for use.

RETORT-LID.—C. F. A. HENTSCHEL, Stettin, Germany. The invention refers to a cover or lid for securing, tightly closing, or sealing vessels, mainly retorts used for purposes of coal or other distillation, the object of the invention being to avoid as far as possible the radiation of heat from the iron lid, which has hitherto proved to be a grave inconvenience in practice and one that very seriously interfered with the operation of the retorts.

EXPANSIBLE ROLL.—J. H. BRECK, Bristol, N. H. Mr. Breck's invention relates to rolls the peripheries of which may vary in size, and more particularly to those adapted for use in paper machines. In such machines difficulties occur that cause loss of time and production in stopping operations, and damage often is caused. To obviate these difficulties and provide means for readily varying the rolls without the necessity for stopping the machine are the principal objects of his invention.

HORSESHOE.—R. E. JOHNSON, New York, N. Y. This shoe is provided with a pad or rubber or analogous material to relieve the shock to the horse due to striking the hoof on the ground. The invention comprises the combination, with the shoe proper, of a compressible frame arranged to be clamped on the shoe carrying the pad which engages the ground as the horse travels.

MUSIC-TRANSPOSITION CHART.—W. H. FINLEY, Chicago, Ill. The purpose of this improvement is to provide a chart through the medium of which any one can transpose a piece of music at sight without chance of mistake and which will be of material aid to persons writing music. It will prove an accurate guide readily understandable to any one having a slight knowledge of the principles of musical composition.

Hardware.

KNIFE-SHARPENER.—A. W. JOHNSON, New Brunswick, N. J. This invention consists of a reversible grinding-tool having a coarse abrading-face on one side and a fine-finishing face on the other, in connection with means for presenting the respective faces of the tool at different angles to the edge portion of the knife or blade, whereby the coarse side of the tool is available for grinding the bevel on the knife in a rapid manner, and the fine surface of the tool is presentable to act only on the edge portion in a way to produce a keen cutting edge.

COMPOUND TOOL.—A. L. GHEEN, Creede, Col. Mr. Gheen's object in view is the provision of a combined screw-driver and nut-wrench wherein the parts may be folded compactly, so as to be carried conveniently in the pocket, provision being made for locking the members in their unfolded operative positions, so that the tool can be used to good advantage.

HAND-TOOL.—W. W. BARTON, Salt Lake City, Utah. Briefly stated, the device comprises two jaw-like members having handles at one end and a chain or other means for adjustably connecting together their opposite ends. Connected with the chain is a spike, which is employed in connection with the jaws for prying off covers or for various other purposes, as will suggest themselves during the practical use of the device.

BUCKLE.—H. W. LUHMANN, Hays, Kas. The intention in this instance is to provide a buckle adapted to clasp or clamp an attached strap, and thereby dispense with the usual tongue, whereby securing of the strap end is effected. It has advantages over all similar buckles in forming a bend over a transverse rib and by double-clamping action effected on opposite sides of the bend through means of cams and an under transverse rib.

WIRE-TIGHTENER.—T. J. CORRIGAN, Arkansas City, Kas. This invention relates to improvements in devices for tightening or taking up the slack in wires, particularly fence-wires, the object being to provide a tightener of simple construction by means of which the wire may be quickly and neatly tightened with very little labor and without danger of drawing the fastening-staples from the posts.

Heating and Lighting.

ACETYLENE-GAS GENERATOR.—J. C. WAUGH, Moline, Ill. One object of this improvement is to provide a form of carbid-magazine wherein the carbid is confined in isolated layers by mechanical devices adapted to be released in an automatic and successive manner for the purpose of dropping the carbid layers on the successive downward movements of the floating bell, such magazine being easily removed for the purpose of cleaning the parts and renewing the carbid-supply.

ACETYLENE-GAS GENERATOR.—N. LIKINS, St. Paul, Minn. In this patent the invention relates to an apparatus for facilitating the generation of acetylene-gas. It is especially adapted for railway use and in other places where gas-holders cannot be conveniently used. When, however, a gas-holder is to be used, valves may have suitable connection with the gas-holder, so as to be automatically operated thereby.

ACETYLENE-GAS MACHINE.—G. ANDEREGG and F. A. SELL, Red Lodge, Mont. First, this invention accomplishes the automatic supply of carbid in given quantities when gas in the holder is diminished by consumption at the burners; second, the quick and easy replenishing of carbid; third, the prevention of gas leakage through a hand-hole and stuffing-box; fourth, reduced ebullition of water in generator when carbid is dropped therein; fifth, to expel gas and flood generator on consumption of carbid in magazine before opening generator to clean the same; sixth, to facilitate discharge of water and residue from generator; finally connecting reserve generator of battery to intermediate connecting devices with gas-holder.

RANGE.—Q. CRANE, San Diego, Cal. In this patent the invention relates particularly to improvements in a combined range, baking oven, and serving-table, an object being to provide a device of this character that shall be accessible from all sides, and that will occupy but comparatively little space, adapting it for use in hotels or restaurants.

OVEN FOR GAS, GASOLENE, OR OIL STOVES.—ELLA D. HARRIS, New York, N. Y. The purpose in this instance is to provide a construction which will be simple, durable, and effective, and such that the base can be vertically adjusted to place a pan, griddle, gridiron or broiler, or other cooking vessel or utensil employed in the desired relation to the flame.

Household Devices.

DOOR-OPENER.—T. E. LEE, Chulavista, Cal. Though particularly adaptable to screen-doors, the invention may be used in connection with doors of other sorts; and it comprises a means mounted on the door mechanism or frame which when engaged by the foot of a person passing the door will act to enable the person to pass through the door without using the hands to open it.

STEP-LADDER.—H. L. SCHWALBE, Jersey City, N. J. In the present patent the invention has reference to improvements in extension step-ladders, the particular object being the provision of a step-ladder of this character that will be very simple in its construction and very rigid and strong in any one of its adjusted positions.

CURTAIN-FIXTURE.—O. MALMQUIST, New York, N. Y. The purpose of the inventor is to provide a fixture adaptable to receive a rod for supporting a lace or other light curtain and which is employed as a fixture auxiliary

to the main bracket utilized as a support for the curtain-pole or the pole adapted to sustain a portière or other heavy curtain, the auxiliary fixture being so made that it may be quickly and conveniently clamped upon the lower limit of the main bracket and secured in position and as expeditiously and readily removed.

REVOLVING SASH.—J. F. Blanchard, New York, N. Y. The invention relates to sashes having horizontal pivots to the side edges mainly for convenience and cleanliness. A main feature of the invention consists of auxiliary sash stiles formed of two longitudinal members; interposed springs between the members permit them to move toward and from each other, the springs yielding when the sash is turned on its pivots.

FLUSHING-TANK.—B. Walker, Jr., Austin, Texas. A purpose of this invention is to provide means whereby the water may be let out of the tank through an outlet-pipe having slip connection with a fixed flushing-pipe, which outlet-pipe is automatically closed by the upward action of the tank, and to provide an overflow-pipe in connection with the closing or valve device for the outlet-pipe whereby to regulate the amount of water to be received by the tank to obviate the pounding noise common to flushing-tanks due largely to siphons sucking air and water just as the siphonage is broken.

ADJUSTABLE STEP FOR BOOK-SHELVES.—T. S. Martin, Butte, Mont. In libraries, where tiers of shelves are of such height as to require a temporary foot-rest to enable one to reach upper shelves, it is desirable to have the foot-rest always in place and adapted for vertical adjustment. The object in this case is to provide details of construction which afford a simple and convenient step capable of vertical adjustment and clamped connection with upright portions of a tier of book-supporting shelves to enable one to readily reach books on high shelves.

WATER CLOSET.—F. W. Bender and J. M. Schlotter, New Rochelle, N. Y. The aim of the invention is to provide a new and improved water-closet, more especially designed for use on railroad-cars, marine vessels, etc., and arranged to prevent upward draft in the bowl and to allow of flushing the bowl to keep the closet at all times in proper sanitary condition.

DRAPERY-HOOK.—L. Nachmann, New York, N. Y. The object the inventor has in view is the provision of an article adapted to sustain the upper edge portion of a curtain above or alongside of the curtain-pole, whereby a plurality of the hooks serve to support the curtain or portière in a way to conceal the pole and the rings without resorting to stiffening media for holding the curtain.

WINDOW-SASH. A. C. Goddard, Woodcliff, N. J. In this instance the invention relates particularly to that class of sash adapted to slide vertically in the window-casing and to swing on horizontal pivots, so that the sash may be turned to any desired angle or completely reversed for convenience in washing both sides of the glass by a person within the room; and the object is to provide a mechanism permitting the movements with ease and without noise.

Machines and Mechanical Devices.

FEED-GEARING.—J. B. Hart, Clarksburg, W. Va. In this case the invention is an improvement in the feed mechanism of sawmill-carriages, and has for an object, among others, to provide a compact arrangement of devices whereby motion is transmitted from the saw-mandrel to the feed shaft of axle and to support the intermediate friction-wheel and the other friction-wheel as well in the feed-controlling frame.

WEIGHT-REGISTERING WEIGHING-MACHINE. H. Pottin, 100 St. Lazare Street, and L. M. Delogelière, 25 Caumartin Street, Paris, France. An important feature of this contrivance consists in that the "weighing-machine," properly so called, is independent of registering mechanism and takes up position of equipoise without moving any of the parts save its own levers and its cursor, which may be so arranged as to move without any sliding friction, so that the weighing-machine may be of the very greatest sensibility. As the registering mechanism is acted independently of the load to be weighed it may be of very compact construction and made to fulfill a plurality of functions without impairing sensibility or precision of apparatus.

CAROUSEL.—H. S. Thomas, New York, N. Y. In this case the invention has reference to improvements in carousels or merry-go-rounds, an object being to provide a device of this character in which there is a variety of movements and so arranged as to not only give amusement to the riders, but also to produce a peculiar illusion to onlookers.

VENDING-MACHINE. F. Lynes, Johnstown, N. Y. Mr. Lynes' object in this invention is to provide a machine adapted to contain articles of different values or grades, such as cigars, and operating to deliver an article from any desired one of the several receptacles upon the insertion of a coin, and directing the money by means of a novel mechanism and a controlling mechanism for the desired receptacle.

DECORTICATING-MACHINE.—P. P. Faure, 21 Place du Champ de Foire, Limoges, Haute-Vienne, France. This machine for decorticating ramie and other textile plants and leaves, comprises rolls between which stalks are fed, a beater-wheel for breaking stalks and separating fiber from coarse impurities, a shaker-frame for continuously agitating stalks while operated upon by the beater-wheel, a conveyor for removing fibers, drums arranged in parallel consecutive pairs and provided with intermeshing members, and means for rotating said pairs of drums at different speeds for scraping the fiber.

TYPE-WRITER.—J. Alexander, New York, N. Y. The aim of this inventor is the provision of a type-writing machine of comparatively simple construction so arranged that the type-carrying bars and operating-levers may be moved to printing operation by a very little pressure and upon release be quickly returned to their normal position.

WELL-DRILLING MACHINE.—H. H. Wilburn, North Yakima, Wash. The main object of this invention is the provision of a walking-beam with which a gasolene or steam engine may be successfully used for well-drilling, so shaped and hung as to cause the drilling-tool to move in direct perpendicular lines, thus preventing the rope or cable from rubbing against the sides of the well and wearing the rope or cable away.

PUMP-CONTROLLING APPARATUS.—G. V. Ellis, New York, N. Y. The invention relates to an apparatus for automatically priming and starting pumps, particularly centrifugal pumps used for lifting sewage, bilge-water, and the like. By its means as the level of the water rises to a height requiring its discharge a liquid-pressure is opened to prime or fill the pump and simultaneously to throw the pump-controller, whereby to start the operation of the pump. The present invention represents a further adaptation of the automatic starting apparatus forming the subject of a former patent granted to Mr. Ellis.

PRESSURE ATTACHMENT FOR LUMBER-MATCHING MACHINES. A. Milne, Burk's Falls, Ontario, Canada. The principal object of the inventor is to provide a machine which shall have the pressure-arm carrying the blocks thereof so mounted on the machine that they may be independently operated—that is to say, if any uneven strip of material is being passed through the machine the blocks will at all times bear upon the under surfaces of the same in such manner that it will be held even to the machine, and thereby prevent any unevenness in the matching of the same.

POLISHING-MACHINE.—G. A. Ensign, Defiance, Ohio. More particularly this invention relates to polishing-machines using an endless sand or other polishing belt. The object is to provide a machine more especially designed for polishing wagon and carriage wheel spokes, neck-yokes, swingletrees, whiffletrees, handles, and other turned articles requiring high finish, the machine being arranged to automatically rotate the article when moving it in contact with the polishing-belt.

ORE-SLIMER.—I. F. Monell, Boulder, Col. In this patent the invention has reference to certain improvements in ore-slimers, a particular object of Mr. Monell being the provision of an ore-slimer of novel construction and so arranged as to quickly and wholly separate fine gold from sand and slimes.

DUPLICATING-MACHINE.—C. H. Colter, Decatur, Ind. In this patent the object of the invention is to provide a new and improved machine, more especially designed for use in banks and other financial institutions and business houses and arranged for making a complete record of all commercial papers received and sent out to permit of obtaining immediate reference at any future time to previous transactions or disposals of notes, drafts, checks, domestic and foreign exchange, etc.

Pertaining to Vehicles.

WAGON-TOP.—J. Pohlig, New Orleans, La. In this instance the invention relates particularly to improvements in side-curtain mechanism for wagon-tops, an object being to provide a simple and novel means for supporting the rolling side curtains, and a further object is to reduce the cost of construction by omitting certain elements shown in a former patent recently granted to Mr. Pohlig.

TRICYCLE.—C. J. Madonna, New York, N. Y. The purpose of this improvement is to provide a race-horse tricycle, or a tricycle in which the body is in the form of a horse in two pivotally-connected parts, the rear being supported by two wheels on the same axle and the forward part by a single wheel which is a steering and at the same time a driving wheel, so that the head of the horse-like body always points in the direction of travel.

Photography.

PHOTOGRAPHIC-SHUTTER-OPERATING MECHANISM.—J. H. Hammer, Marquette, Mich. The purpose of the invention is to provide a trigger-operated cushion-controlled device for making and breaking circuit connection with an alarm device, a bulb operating device operated by the alarm device, the bulb acted upon being connected with the shutter of a camera, and means whereby the trigger may be brought into action manually or through connections with an alarm clock or trap to effect closure of said circuit whereby the device may be set to provide for an automatic instantaneous photography of animals, birds or like moving objects.

FOCAL-PLANE SHUTTER—W. F. Folmer, New York, N. Y. In this patent the invention relates to an improvement in focal-plane shutters; and its special purpose is to provide a construction whereby the alinement of the shutters to each other and the alinement of the connection-tapers for the shutters with respect to the reeling device will be maintained under all conditions of adjustment and operation of the shutters.

STEREOSCOPIC APPARATUS.—V. S. L. Owen, Adrian, Minn. The object of this improvement is to provide means for displaying stereoscopic views more effectively and in greater numbers than heretofore. The pictures may be instantaneously changed without the necessity of taking the eyes from the lenses, and therefore strain and discomfort heretofore entailed in removing one picture and emplacing another are avoided. Also the pictures are effectively protected from abrasion and injury and the number which may be shown is practically limitless.

FILM-DEVELOPING MACHINE.—J. M. Brainerd, Rome, N. Y. The primary object of the invention is to produce an improved structure adapted for use in the daylight for the purpose of developing the sensitized exposed surfaces of a film and for fixing the developed surfaces without resorting to a dark room, either portable or stationary, and without the possibility of the latent impressions becoming "light struck" during the process of treating the film.

Prime Movers and Their Accessories.

OIL-FEEDING DEVICE.—W. W. Mathews and C. Bauer, Eureka, Utah. In this patent the invention relates to a means for introducing a supply of lubricating-oil into steam on its way to the engine; and it consists in certain peculiar devices by which the flow of lubricant may be regulated at will and kept feeding at a steady rate.

MUFFLER.—I. B. Ullom, Claysville, Pa. In operation, the exhaust is introduced through the main inlet-pipe and upon striking the projection in the T is divided and passes out through branch pipes into the casing, where it expands, losing force and impurities against the casing-head, striking upon the conical projection walls and being deflected all directions back toward the center of the casing, where the two portions meet and mix, whereby further deadening effect is secured. The exhaust rising through the outlet-pipe is deflected by the cone and directed against the ring, the latter's concavity tending to return it toward the casing. These impacts further deaden sound and it escapes through ring opening practically without noise.

HYDRAULIC AIR-COMPRESSOR—J. H. Alexander, Ymir, British Columbia, Canada. It is the object of this inventor's improvement to provide an apparatus for compressing air wherein a falling column of water is received by an air and water separating tank, which is connected with a hydraulic air-compression apparatus proper whose operation is such that the air compressed by it may be delivered to the same pipe through which the column of water falls, and thus be conveyed into the said separating-tank, whence it is conducted into a storage-tank.

LUBRICATOR.—O. E. Gay, Rockymount, N. C. The present invention has for an object to provide a novel construction whereby to minimize the danger of breaking the glass through which the feed is seen and to provide for renewing such glass in each sight device without stopping the operation of lubricating the other cylinder or the air-pump lubricating devices connecting with the same cup.

Railways and Their Accessories.

FEED-VALVE. J. L. Curran, Rocklin, Cal. The prime object of Mr. Curran's invention is to provide a single feed-valve which may be made to serve the purpose of the plural valves now commonly employed. This end the inventor attains by constructing the valve with means facilitating its ready adjustment from one pressure to another, so that the single valve may be made to feed high or low pressure.

WINDOW-SCREEN.—H. F. Christzberg, Winston Salem, N. C. This invention relates particularly to screens for railway-car windows to shield passengers from cinders, dust, and the like while riding with windows open, an object being to provide a screen of simple construction that may be sold at a very small price, easily placed in a window or removed therefrom by a passenger, compactly folded or rolled when not in use, and conveniently carried in a valise or secured to the outer side thereof.

Designs.

DESIGN FOR A MEMBER FOR BAG-FRAMES. C. Flax, New York, N. Y. This inventor has designed an original and ornamental design for a member of a bag frame.

DESIGN FOR A PAPER-WEIGHT.—W. D. Paulson and R. D. Heinbockel, Manitou, Col. The design of these inventors represents an original and ornamental paper-weight, square in form.

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Manufacturers of patent articles, dies, metal stamping, screw machine work, hardware specialties, machinery and tools. Quadriga Manufacturing Company, 18 South Canal Street, Chicago.

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Inquiry No. 5753.—For a steam plow and steam engine portable on horses' backs, or on a one-wheel hand push wagon.

Inquiry No. 5754.—For a set of tints for a tintometer; must be of the Lovibond scale, for refined cottonseed oil.

Inquiry No. 5755.—For makers of wood alcohol.

Inquiry No. 5756.—For makers of boot-blacking by electricity.

Inquiry No. 5757.—For a fan with either a battery attached, or could be run by an accumulative battery which could be charged from a dynamo at a mill, and then moved to a residence to furnish cool air for a sick-room, desk, etc.

Inquiry No. 5758.—For makers of small portable dredges for cleaning and deepening small canals and ditches.

Inquiry No. 5759.—For makers of machinery for making pottery, earthenware, etc.

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Inquiry No. 5764.—For automatic machines for turning and drilling pearl buttons.

Inquiry No. 5765.—For makers of pearl-button machinery.

Inquiry No. 5766.—For makers of gymnastic apparatus made of wood, such as Indian clubs, etc.

Inquiry No. 5767.—For manufacturers of machines known as saw gins and roller gins, such as are used in the South.

Inquiry No. 5768.—For parties who make air compressors adapted to the up-stroke of a pumping windmill.

Inquiry No. 5769.—For makers of cold-drawn, seamless copper or steel tubing suitable for high-pressure boiler purposes,

Inquiry No. 5770.—For manufacturers of electric fans which run with a dry battery.

Inquiry No. 5771.—For the manufacturers of the "Ever-ready" electrical goods.

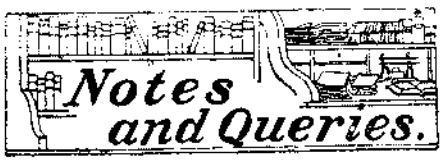
Inquiry No. 5772.—For makers of electric motors with attachment of emery wheels and polishers.

Inquiry No. 5773.—For makers of tinfoil for wrapping moist goods, etc.

Inquiry No. 5774.—For makers of gas traction engines.

Inquiry No. 5775.—For the makers of a cigar called "Good Health Cigar."

Inquiry No. 5776.—For a large quantity of screws, cold rolled thread, having flat bottom, with slot on top, either flat or round; all to be about 3-8 inch or 5-16 inch and from 3½ to 9 inches long.



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.

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(9420) I. H. C. asks: 1. What power would be required to operate a fan 7 feet diameter of the best design to carry air into a cylinder the same diameter at the speed of 6,000 feet per minute? A. A 7-foot fan cannot be practically driven to a greater speed than 500 revolutions per minute, at which speed it should deliver 160,000 cubic feet of air per minute with a velocity through a 7-foot tube, without back pressure, of 4,210 feet per minute. To run the above fan at 500 revolutions per minute will require 36 horse-power. 2. What pressure would be exerted upon a circular surface 7 feet in diameter by a wind blowing 70 miles per hour? A. The pressure of wind on a flat surface at 70 miles per hour is 26 pounds per square foot, or 1,000 pounds on a circular surface 7 feet in diameter.

(9421) F. G. B. writes: About a year or two ago, in your column of answers t correspondents, there was given a solution of the problem of obtaining the number of feet, board measure, in a telegraph pole. Please give me the date of paper. A. To obtain the contents of a telegraph pole in board measure, add together the squares of the diameters of each end in feet or decimals of a foot and the product of the diameter of each end. Multiply this sum by 0.7854 and the product by the length of the pole in feet and divide the last product by 3 for the cubic feet. For the board measure multiply the cubic feet by 10 to allow for scarfs and waste.

(9422) J. M. S. writes: There is some device on the market for cooling water, etc., without the ice coming in contact with the water. There is a container that you put the freezing matter in and set it right into the pitcher or vessel or whatever you wish to cool. We saw an item concerning this in the SCIENTIFIC AMERICAN about a year ago, but we were not interested then very much. Will you be kind enough to advise us what you know about it, and greatly oblige? A. The material used for cooling is nitrate of ammonia dissolved in its bulk of water, in which the temperature falls from 50 deg. to 4 deg. F. Thus, by setting a vessel of water into an ordinary water cooler with water and dropping in the nitrate in small portions, the water in the inner vessel will soon be cool enough for drinking and may be frozen with a full charge of the nitrate. The method you describe is also a practical way of cooling a pitcher of water by filling a tin cylinder with equal parts of nitrate of ammonia and water and setting it in the pitcher for a few minutes. See SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 32 and 605, for illustrated examples of this class of domestic refrigeration, ten cents each mailed.

(9423) A. T. L. asks: 1. Suppose a jar which is a perfect vacuum to be instantly opened, will there be a time when the air that fills the jar would be at a greater density than the air on the outside of the jar? A. If a small opening were made into a jar in which was a perfect vacuum, the air rushing in would fill the jar slowly. In this case the inrushing current of air would be diminished in quantity gradually until the jar was full, when it would cease. 2. If there is a time when the air in the jar is at a greater density than that on the exterior would this density be increased by holding a funnel over the mouth of the jar while the air is rushing in to fill said jar? A. If the opening into the jar were very large as compared with the size of the jar, so that the time of filling the jar would be very short, it is probable that the air would rush in with a concussion, and would oscillate somewhat to and fro before it settled to rest. This is because the air is an elastic body, and would rebound upon itself. In this latter case it might be that the air within the jar would be momentarily at a greater density than the air on the outside of the jar. If now the air were passed into the jar through a funnel, the action would be no different from that in the first case supposed, since the funnel would simply constitute a small opening into a larger place, and there would probably be no time when the air within the jar was denser than the external air. 3. Suppose the ground connection of a lightning arrester for a telephone or dynamo to be connected to a steam boiler, would the lightning passing through that ground affect the steam boiler? A. The question you propose concerning a lightning arrester connected to a steam boiler as a ground, may be answered by saying that the lightning would pass through the steam boiler to the earth. We do not see that the metal of the steam boiler could have any electrical effect upon the lightning. The case is perfectly parallel to that of iron ships at sea. They are frequently struck and the lightning passes off from the hull into the water without damaging the hull.

(9424) J. K. asks: Will you please tell me if a lightning rod placed on a pole a few feet from a barn will insure the safety of the barn. In other words, if lightning is in a straight course for a building will a pole and rod placed in said position attract the lightning from its course? A. A lightning rod standing above a building but attached to a pole several feet from the building will make it less likely that the building will be struck by lightning. It does not act in the manner you describe, by *drawing* a discharge which is aimed at the building and is coming through the air from its source and away from the building. A flash of lightning takes place in some such way as this: A cloud comes over a place. The cloud is charged with electricity. This attracts electricity of the opposite kind from the earth and into the highest objects of the earth under the cloud. These charges of electricity in the cloud and the earth react upon each other until they pull strongly enough upon each other to rupture the air between them and then the flash which signals their coming together is seen. If the most intense part of the charge on the earth is in the building, the flash will go to the building; if it is in the lightning rod the flash goes to the rod. Now the chance is that the highest objects will be most highly charged by the action of the cloud, and thus be the points to be struck. No power can divert the discharge when once it starts for its destination, which is the most intense place charged by the opposite kind of electricity to that of the cloud. It goes to that point and to no other. Nor are we to think that the flash always starts from the cloud and falls to the earth. It as likely starts from the earth as from the cloud, and starts from both at the same instant. It sometimes flies back and forth many times from cloud to earth and from earth to cloud before the surging action dies out. Rods protect by furnishing an easier path for the discharge since they are metal. Much may be learned upon this topic from Thompson's "Electricity and Magnetism," price $1.50 by mail.

(9425) J. J. A. asks: Please answer the following: Is it possible to recharge a dry cell? If so, let me know the proper way. A. A dry cell can be recharged in the same way as a storage cell is recharged, by sending a current through it in the opposite direction to that in which the current comes from the cell when it is furnishing current. Connect the positive pole of the charging current to the carbon of the dry cell and the negative pole of the current to the zinc of the dry cell. We have published a good mode of doing this in our SCIENTIFIC AMERICAN SUPPLEMENT No. 1451, price ten cents.

(9426) A. F. asks: 1. What are the advantages of using unsaturated (superheated) steam in running an engine? The superheated steam arrives at the cylinder having a high temperature, consequently there seems to be a small loss in condensation in the pipe conducting the steam from the boiler to the engine. The pressure, however, of this steam is not higher than that of the saturated steam in the boiler. What I would like to know is this: Is the small condensation in the steam-conducting pipe the only advantage of using superheated steam, or has it any special qualities or advantages when working in the cylinder? It seems the latter is not the case, because the pressure is the same as that of the saturated steam in the boiler—say 90 to 95 pounds—and hence for doing an equal amount of work, the engine would apparently consume an equal amount of saturated or unsaturated (superheated) steam. A. The advantages claimed for the use of superheated steam in engines are the saving from loss by condensation in the steam pipe, steam chest, and cylinder, and the gain from expansion of its volume by its increase in temperature; against which are the loss of lubrication of the cylinder walls by the condensing of wet steam and the cost of superheating, unless it is done by waste products of combustion after they leave the boiler. 2. Can superheated steam be used in any engine or is a compound or expansion engine necessary to utilize it? A. Superheated steam may be applied to any engine, but is most effective in compound engines. 3. Please to explain the expression, "the engine consumed 7.2 kg. steam per K. W. hour." (This expression was used in a German article.) A. The expression means 15.84 pounds of steam per 1.34 horse-power or 11.84 pounds of steam per horse-power hour. 4. Are steam turbines of about 60 horse-power manufactured in this country? Which seems to be more economical, especially regarding the steam question, engine or turbine, for electric lighting? A. Steam turbines are favorably considered for electric lighting on account of their high speed. 5. If electricity is always on the surface of a conductor why are larger wires not made hollow or also in thin strips whose surface would be equal to that of the respective size of wire? Is the above common rule only correct for static electricity and not for currents? Why? A. Electric tube wires are more expensive than solid wire. Ribbon wire is not suitable or easily manageable in the wiring of electric plants. This form of wire is the same for static and electric currents.

(9427) B. J. B. says: Please inform me through the columns of your valuable paper concerning "The White Horse of the Chalk Cliffs of England" and oblige a diligent but unsuccessful searcher. A. The "White Horse of the Chalk Cliffs of England" is an image of a horse which may be seen near Ashdown in Berkshire, on the cliff which rises above the valley. The legend ascribes it to Alfred the Great, who overcame the Danes in the valley below, and had the horse cut in memory of his victory. The white horse was the common emblem of the Saxons. This image is frequently alluded to in the opening pages of "Tom Brown at Rugby."

(9428) J. N. H. says: 1. Of what is sewer gas composed? A. Sewer gas is composed of the gases of fermentation and foul odors which are conveyed in the moisture-saturated air, all holding the germs of disease that are constantly poured into the sewers. See SCIENTIFIC AMERICAN SUPPLEMENT No. 1037 on "Analysis of Sewage Water," and No. 418 on the "Dangers of Sewer Gas," ten cents each, mailed. 2. Why will plumber's wiping solder remain in a molten state longer than pure pig lead? The former is composed of forty parts tin to sixty parts lead and therefore melts at considerably lower temperature. A. Plumber's solder is fluid at a greatly less temperature than lead and the heat lost is in proportion to the fluid temperatures. Hot bodies cool faster than cooler ones.

(9429) J. W. V. asks: A very long and narrow strip of country near here has lately been swept almost bare by a "cyclone" or tornado. Not only were the few houses in its path demolished, but large trees in comparatively deep and narrow valleys were uprooted, parts of barb wire fences taken out of the ground and the wire inextricably tangled, and, it is said, even rocks weighing several hundred pounds and lying flat on the ground were moved considerable distances. Can you give me a brief explanation, in your paper, of how such results are accomplished? Is there any foundation for the current belief that a "vacuum" exists in the center of the whirlwind, which assists in doing so much destruction? I cannot see how a vacuum anything like complete or sudden enough to cause the air contained in houses to burst the walls outward by its expansion, as is said to be the case, could be formed. A. The tornado is a violent, whirling storm, usually moving with considerable velocity over the country. It may be but a few rods wide. It is believed that the uprush of air in the center of the storm sometimes reduces the pressure of the air by as much as a fourth of the normal pressure. This reduction would be 533 pounds per square foot. This amount of pressure is sufficient to move stones and almost any other objects with great violence. Such a diminution of pressure will burst a house outward, as is often done, and scatter the debris far and wide. The upward motion of the air in the center of these storms has carried objects up into the air and dropped them at great distances from the point from which they started. Thus a piece of tin roofing has been carried 17 miles, and a letter has been found 45 miles from the place where it was when the tornado struck it. It is pretty certain that the wind in a tornado attains a velocity much more than 100 miles per hour, some say 300 to 500 miles per hour.

(9430) R. M. C. asks: Will you please inform me through your "Notes and Queries" how to make a simple device for varying the speed of a small battery motor, one that runs on three or four cells of battery (or advise me where I can find this information)? A. The simplest method of regulating the current from a primary battery is to raise or lower the plates of the battry by some mechanical device so that less or more of them may come into action according as you desire less or more current. You can in this way secure the amount of current necessary for running a motor at various speeds. A form of battery for this purpose is described in our SUPPLEMENT No. 792, which we will send for ten cents. Should you desire, however, to construct a rheostat or current regulator with wire in the usual form, you will find descriptions which will aid you, accompanied by diagrams, in our SUPPLEMENT Nos. 865 and 985, price 10 cents each. Of course you will require only a small apparatus for three or four cells of battery, and would better use rather a large wire, perhaps No. 16 iron wire. We think, however, the first method which we suggest would be the more satisfactory.

(9431) F. H. asks: 1. What are the chemicals used for the purification of air after it has been breathed? I have seen the statement several times that there are such chemicals, and I would like to know what they are. A. To secure pure air, pass the air through clean cotton to remove dust; then through sulphuric acid to remove ammonia and moisture; then through calcium hydrate and potassium hydrate to remove carbon dioxide; then through a solution of lead acetate to remove sulphur compounds, and lastly, through calcium chloride and soda lime, to remove the last traces of moisture and other impurities. There will be nothing remaining but pure oxygen, nitrogen, and argon. 2. What is the difference between static and dynamic electricity? A says that they are the same, and B says that they are different. A claims that if the secondary of an induction coil gives static electricity, that they are the same. He asks the question: "Can a Wimshurst machine be used to light lamps, or drive motors?" "If it can," he says, "static and dynamic electricity are the same, but if it cannot, then an induction coil does not give static electricity, as a transformer is nothing but an induction coil." A. Static electricity is electricity in the condition of a charge upon a body. The word static means without motion. The charge is at rest, but under tension, ready to move. Dynamic electricity is electricity in motion in the condition of an electric current. The distinction is radical and not dependent upon the apparatus by which the condition is produced. A Wimshurst machine when in operation but not producing a spark is in a static condition; when a spark is passing the discharge is a current and is dynamic. It is of enormously high potential and low amperage, and is momentary in duration. It will not light a lamp, because of these conditions. An incandescent lamp, 16 candle power, requires considerable current at a low voltage and continuing for a time to bring it to the temperature of incandescence. Nor will an induction coil light such a lamp, and for the same reasons. An induction coil arranged to transform a current at the proper voltage and amperage will light a lamp, but is not then in a static condition. It is sending current, which is dynamic. When a dynamo is running but no current is being drawn from it, the potential is there as a static charge, and the machine would charge a condenser. The circuit is then in a static condition. Turn on lamps or a motor and current flows. The machine has become dynamic. It is a dynamo now, as its name implies; it is sending current through its circuit. A's arguments are sometimes right and sometimes wrong. He does not seem to keep in mind the meaning of the terms he is using. 3. We have an alternating current here for lighting, of 220 volts. I can short-circuit this through an ordinary quart fruit jar, filled with water, and with two lead plates, about one inch wide by five long, in it. Can I get a spark with an induction coil as long, using this current without a condenser, as I can using batteries with a condenser? A. When you put the poles of the alternating current into a jar of water as described you have a water rheostat, which can be used to control the amount of current which shall flow for any purpose. It is quite commonly in use for this purpose. You can in this way run an induction coil for any desired length of spark. Such coil does not require a condenser. 4. How many amperes can No. 20 B. & S. magnet wire carry without becoming perceptibly heated? A. At an allowance of 400 circular mils per ampere, No. 20 B. & S. wire of copper can safely carry 2½ amperes. This will raise its temperature of course above that of the air. Any current will raise the temperature of a wire. No carrying capacity is given for wires under No. 18, since the Fire Underwriters do not allow them to be used in lighting and power circuits, and carrying capacity has no significance except in relation to lights and dynamos and motors.

NEW BOOKS, ETC.

ROOF FRAMING MADE EASY. By Owen B. Maginnis, Architect. New York: Industrial Publication Company, 1903. 8vo.; pp. 150. Price, $1.

The fact that this small handbook has reached its second edition is sufficient evidence that it has been found most valuable by architects and builders. The author treats very explicitly of the construction of all sorts of roofs, such as roofs for studios, towers, etc. The book is thoroughly practical in character, and is well illustrated by nearly one hundred cuts.

PRACTICAL LAWS AND DATA ON THE CONDENSATION OF STEAM IN COVERED AND BARE PIPES. To Which is Added a Translation of Péclet's "Theory and Experiments on the Transmission of Heat Through Insulating Materials." By Charles P. Paulding, M.E. New York: D. Van Nostrand Company, 1904. 8vo.; pp. 102. Price, $2.

The object of this monograph is to give to engineers a rational method of estimating the loss of heat from steam pipes and boilers covered with any of the standard non-conducting materials. Far from being new, the method to which attention is here called was worked out by the French physicist Péclet in 1850, but, in the absence of translations of Péclet's pamphlet, his deductions seem to have been generally overlooked in this country. The principles involved are so general that the loss of heat from covered pipes is only one of their many practical applications. To those who have to deal in any way with the problems of cold storage and refrigeration, the information and the formulas given in this volume will be especially useful.

THE LOCOMOTIVE SIMPLY EXPLAINED. By Charles S. Lake. London: Percival Marshall & Co., 1903. 16mo.; pp. 72. Price, 25 cents.

This handbook forms No. 17 of the "Model Engineer" series, and it was written to describe

in a popular way many of the main features of modern English locomotives, which are not familiar to the ordinary layman. It is illustrated with some twenty-five cuts, among which are several half-tones of English locomotives.

VADE MECUM GUIDE. A Popular Guide to Mineral Collections. With a Chapter on the Development of Mineralogy. By L. P. Gratacap, A.M. New York: The Broadway Press, 1904. 12mo.; pp. 178.

This is of a convenient size to slip into the average coat pocket, making it an especially handy and useful reference book for the frequenter of collections. The writer observes the order followed by Dana in the fifth edition of his "System of Mineralogy," supplementing the discussion with an index of minerals alphabetically arranged, so that any required description may be readily found. There are a number of full-page plates of crystals from notable American collections, and numerous figures illustrative of the methods of classification.

TWENTIETH CENTURY HAND-BOOK FOR ENGINEERS AND ELECTRICIANS. With Questions and Answers. By C. F. Swingle, M.E. Electrical Division by Henry C. Horstmann and Victor H. Tousley. Chicago: Frederick J. Drake & Co., 1904. 12mo.; pp. 500; 300 illustrations. Price, $2.50.

The "Twentieth Century Hand-Book," phrased in simple language and lavishly illustrated, aims to aid the man of limited education in increasing his practical knowledge and extending his usefulness. There are chapters of practical instruction in the care and management of steam engines and boilers. Problems and calculations in hydraulics are worked out in plain figures, without resorting to the use of algebra, and simple arithmetical rules are given for the solution of these problems. Particular attention has been paid to indicator work, and to evaporation tests. The electrical chapters deal with the principles, construction, and operation of dynamos, motors, lamps, storage batteries, etc. There are tables that will, in many instances, do away with the necessity of figuring. In a word, the papers give, thoroughly, and yet in as simple a manner as possible, just that knowledge of electricity which a steam engineer is apt to find himself in need of. The volume is bound in full leather, pocketbook style, the back cover being extended to form a protecting flap with snap fastening.

MINERAL TABLES FOR THE DETERMINATION OF MINERALS BY THEIR PHYSICAL PROPERTIES. By Arthur S. Eakle, Ph.D. New York: John Wiley & Sons, 1904. 8vo.; pp. 73. Price, $1.25.

This book of tables was compiled in order to aid students in the natural method of identifying minerals, namely, by noting their peculiarities of color, luster, hardness, specific gravity, and the like. The tables include all the common minerals and a few others of local prominence, which are generally considered as rare. The minerals are arranged primarily according to streak and color, while under each color the arrangement is according to hardness. The chief difference between these tables and those of Welsbach is that in the present book luster is regarded as an unimportant division. Various mineralogical works were consulted in preparing the tables, which will be found quite complete and valuable.

POINTS FOR BUYERS AND USERS OF TOOL STEEL. By George W. Alling, M.E. New York: David Williams Company, 1903. 8vo.; pp. 224. Price, $2.

This book was primarily written for the benefit of those who have not a technical education. It is designed chiefly for the use of the mechanic and tool maker; and while it does not go into details as far as percentages of carbon and chemical construction of steel are concerned, it should help the mechanic to avoid many of the difficulties found by every tool maker, who has to make numerous kinds of tools from the many varying sorts of steel which he obtains from the steel makers. Chapters on defects in steel, how produced, and how detected; how to test the quality and uniformity of steel; preparing steel for hardening, and hardening and hardening appliances, are among the most valuable in the book. Some sixty illustrations of samples of steel and of tools add to the value of the book, while a number of useful tables are contained in an appendix.

ELEMENTS OF INORGANIC CHEMISTRY. By Harry C. Jones. New York: The Macmillan Company, 1903. 8vo.; pp. 343. Price, $1.25.

This book, which is considered as an elementary textbook, treats the science of chemistry in an up-to-date manner, and while the older generalizations have been thoroughly discussed, those generalizations which have been more recently made are incorporated in the text. Thus, while the atom is still used as the smallest indivisible particle of matter, the ion, which is a later conception of an atom as carrying an electrical charge, is also thoroughly discussed. Another generalization which is treated is that concerning the law of Faraday as the basis of chemical valence. The physical properties of substances are treated more fully than in earlier textbooks, and are described in every instance after the chemical properties. The experiments on each substance are placed at the end of the chapter describing said substance, and are followed by the problems to be solved. Such portions of the author's "Principles of Inorganic Chemistry" as were considered adapted to the beginner are also contained in this book, which will be found an admirable textbook for the use of beginners in chemistry.

A LABORATORY GUIDE TO QUALITATIVE ANALYSIS WITH THE BLOWPIPE. By F. W. Martin, Ph.D., Analytical Chemist. New York: John Wiley & Sons, 1903. 12mo.; pp. 41. Price, 60 cents.

Believing that the use of the blowpipe, which has long been recognized as an indispensable apparatus in the study of mineralogy, has been largely restricted to that science, and been used to a very limited extent in other branches of analysis because there has been no manual on the subject treating of its use with compounds in general, the author has prepared this small volume for use as a laboratory guide by students of qualitative analysis, and as a work of reference by practising chemists. A systematic course of analysis for a long list of elements and compounds is succinctly given in these pages.

MODERN MICROSCOPY. By M. I. Cross and Martin J. Cole. Chicago: W. T. Keener & Co., 1903. 8vo.; pp. 285; 76 cuts. Price, $1.50.

This handbook is designed to give to the novice information and advice in choosing his microscope and accessories, and to direct him as to the proper way of using them. The book, which has reached its third edition, is in three parts. The first part, by Mr. Cross, treats of the microscope and accessory apparatus, and gives instructions for their use; the second part, by Mr. Cole, treats of microscopic objects, and tells how to prepare and mount them; while the third part, which is the new part of this edition, and which was specially prepared by Mr. G. West, of the Botanical Laboratory at Edinburgh, is on the choice and use of microtomes, or machines for cutting microscopic sections. All three parts are clearly and concisely written, and the book as a whole forms a complete handbook for the tyro microscopist.

TESTING OF ELECTRO-MAGNETIC MACHINERY AND OTHER APPARATUS. By Bernard Victor Swenson, E.E., M.E., of the University of Wisconsin, and Budd Frankenfield, E.E., of the Nernst Lamp Company. New York: The Macmillan Company, 1904. 8vo.; pp. 420. Price, $3.

This book is the first of two volumes which are intended for use as a college textbook and as a work of reference for engineers. The first volume deals with direct-current electromagnetic machinery and apparatus, and it is almost exclusively confined to dynamo-electric machinery. It has been the aim of the authors to impart a thoroughly practical knowledge of dynamo machinery and apparatus to the student, and the book can be used as a textbook for a practical dynamo laboratory course. For this reason the numerous experiments which the book describes are divided into (1) a review of the theory; (2) to the particular experimental method involved; and (3) to practical applications of the particular subject. Questions which bear directly on the subject are asked at the end of many of the experiments, with the object of stimulating independent thought and observation. These questions bear upon important, though less evident, relations of the phenomena involved. The book contains a complete list of references to other works on the subject.

THE LAYOUT OF CORLISS VALVE GEARS. By Sanford A. Moss, M.S., Ph.D. New York: D. Van Nostrand Company, 1903. 24mo.; pp. 108. Price, 50 cents.

This small volume, which is a reprint from the American Machinist, with revisions and additions, treats of the Corliss valve gear from a theoretical point of view. The "single eccentric" motion is treated from a rational standpoint, and a complete discussion is given of the theoretical principles underlying the kinematic design or "layout." Explicit instructions are given for making a layout on the drawing board.. These instructions are so simple that a layout can be made by anyone at all familiar with the common slide valve and other valves for steam engines. The book is theoretical in character, the kinematic features rather than the constructive features of the valve gear being described.

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"Peterson's Anti Tender Foot Shoe, The Natural Foot Cover," for boots and shoes, M. F. Peterson & Co. 11,237
"Triplet Brand Corn," for corn, United States Printing Co. 11,231
"Triplet Brand Tomatoes," for tomatoes, United States Printing Co. 11,221
"Wampum Brand Tomatoes," for tomatoes, United States Printing Co. 11,226
"Warala," for salve, C. Neuhaus 11,214

PRINTS.

"Aurora A. B. Co., Export Made from Choicest Malt and Hops," for bottled beer, Aurora Brewing Co. 1,019
"El Caro," for cigars, Caro & Co. 1,020
"Fehr's Malt Tonic," for malt tonic, Central Consumers Co. 1,018
"Girard Iron Works, Philadelphia, Pa.," for cask and vat supports, Girard Iron Works 1,022
"Is Your Hair Turning Gray," for hair restorative, Citizens' Wholesale Supply Co. 1,017
"Two Good Bread Makers," for flour, Washburn, Crosby Co. 1,021

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.

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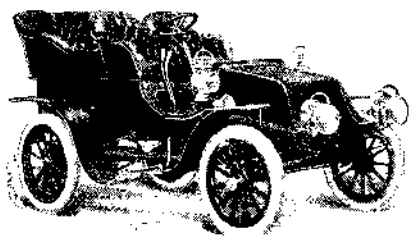

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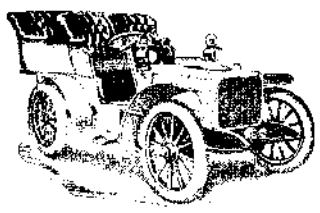

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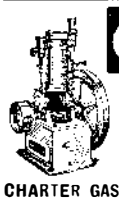

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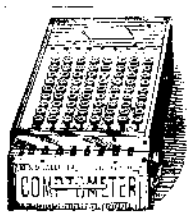

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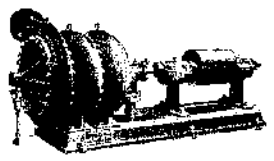

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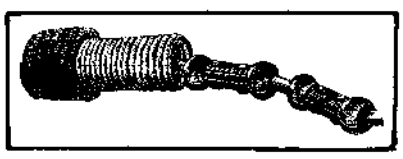

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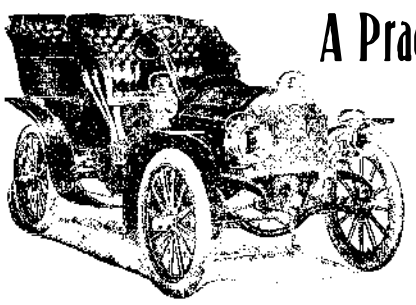

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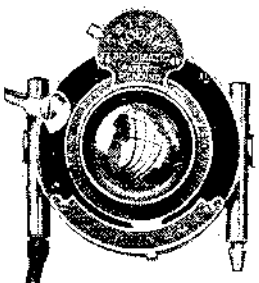

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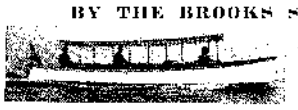

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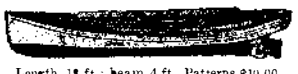

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