SCIENTIFIC AMERICAN

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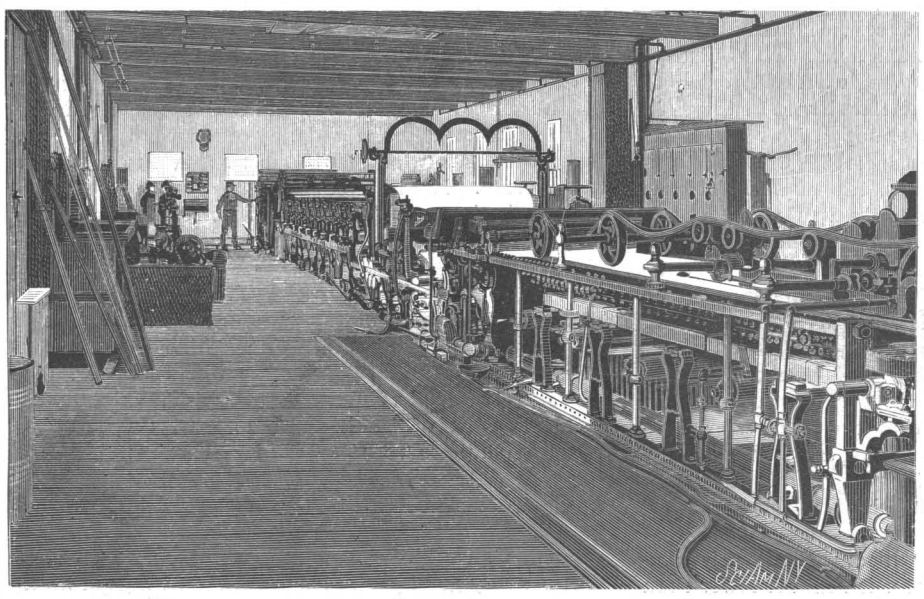

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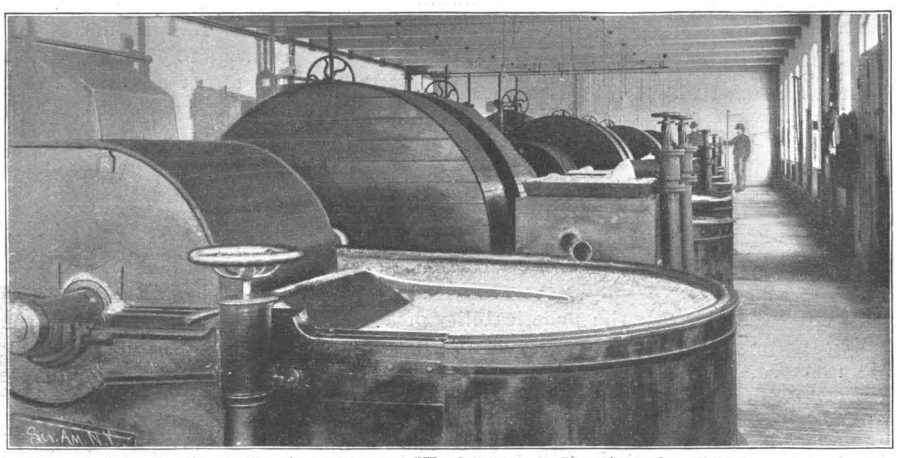
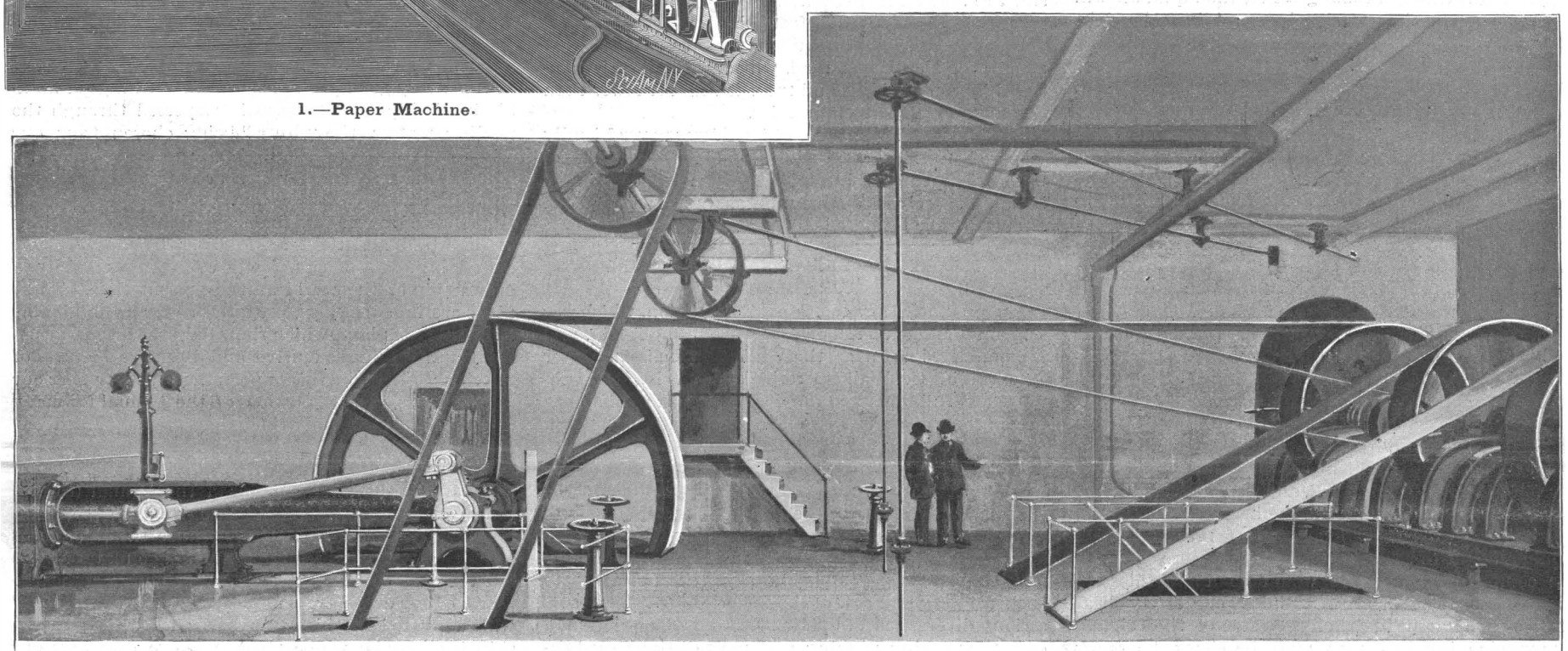


2.—Rag Engine Room—Washing and Beating the Rags.



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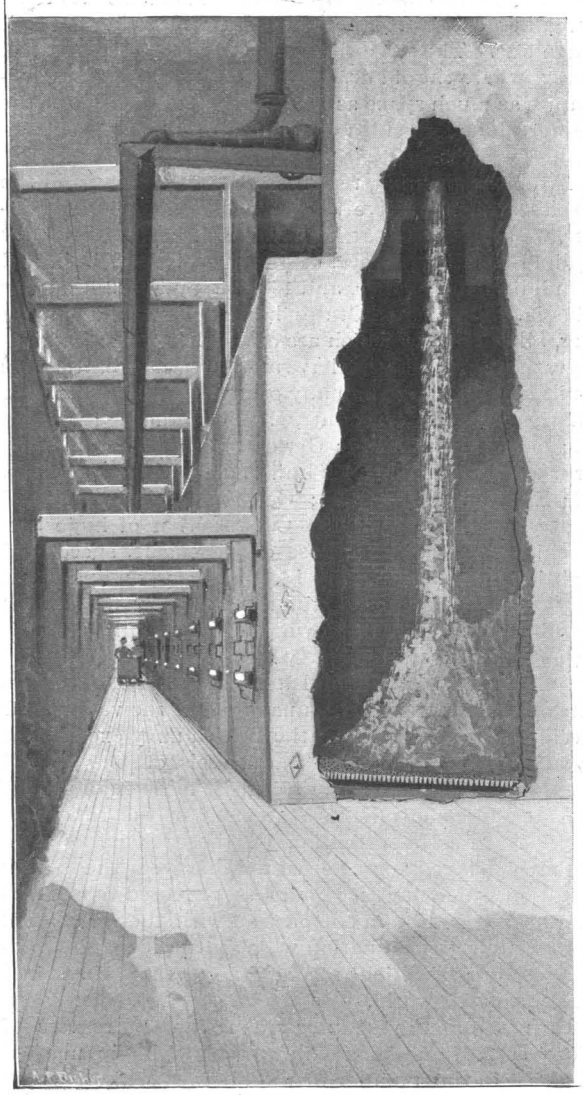

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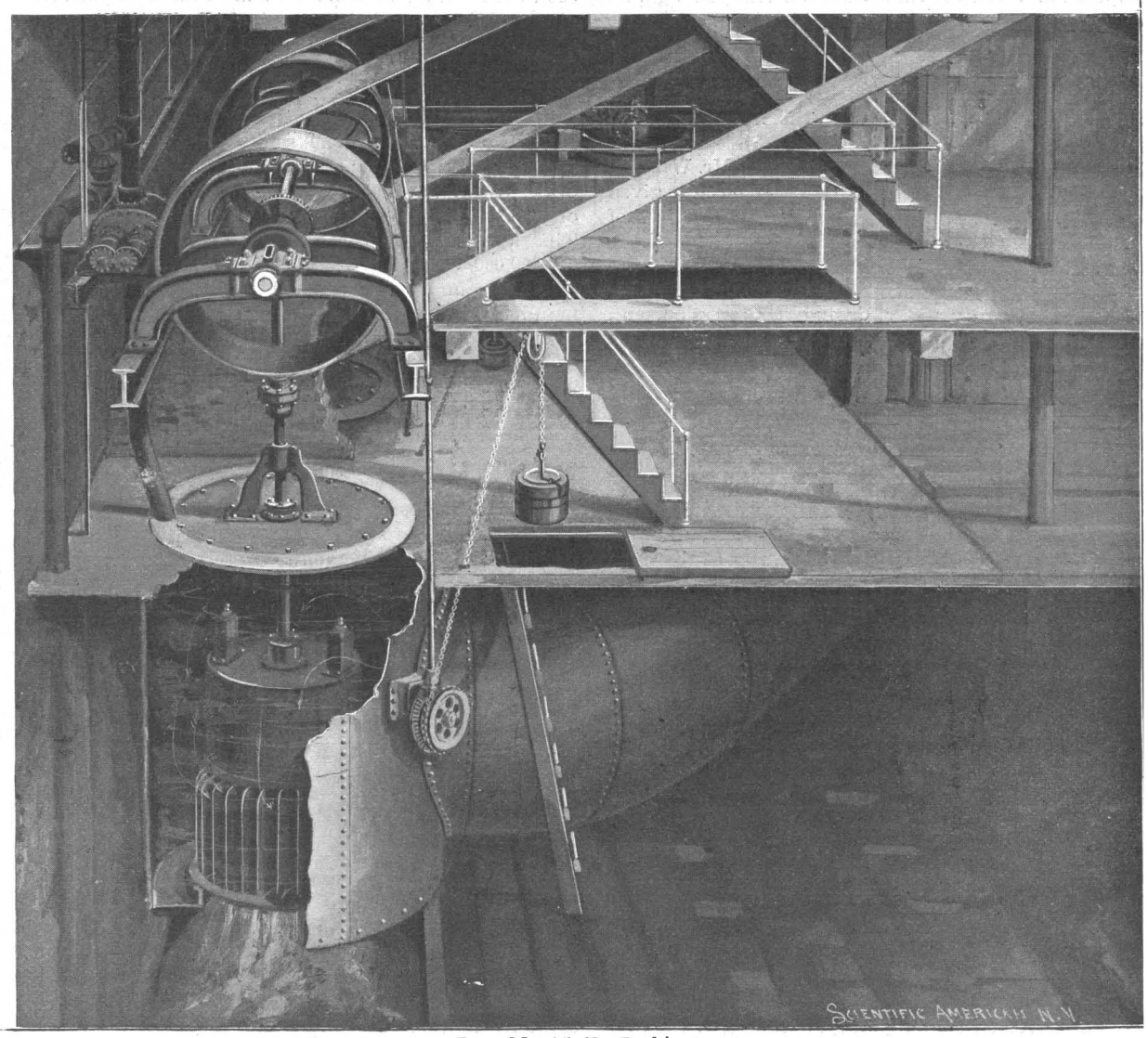

Two 150 H. P. Turbines.

MANUFACTURE OF LINEN LEDGER PAPER—PLANT OF THE BYRON WESTON COMPANY.—[See page 378.]

Scientific American.

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LIQUID AIR "SURPLUSAGE."

Now comes Mr. H. Gaylord Wilshire, editor and publisher of the The Philistine, a magazine "devoted to the demolition of preconceived ideas," who tells the Southern California Academy of Sciences that he can scientifically demonstrate the practicability of accomplishing perpetual motion by means of liquid air. Briefly stated, the demonstration is as follows: A given weight of liquid air will theoretically liquefy an equal weight of air without the aid of cooling water. If the resistance to compression of the air be reduced by passing it through cooling water, the liquid air will liquefy its own weight of air, plus an additional weight due to the cooling water. This is a "surplusage," and hence perpetual motion!

In detecting a fallacy it is sometimes as well, even at the risk of reiteration, to get down to first principles. If a given volume of air at atmospheric pressure and temperature be compressed to a smaller volume, it will have a pressure which is the result of its decrease in volume and the increase in its temperature due to its compression. The pressure due to reduction of volume is permanent at a given temperature, but the pressure due to the rise of temperature is transient, and will disappear as the heat of the compressed air radiates into the surrounding atmosphere. That part, then, of the energy expended in the compressor which appears as heat in the compressed air is a positive loss in all engines which make use of either compressed or liquid air as a motive power.

When air is compressed for power purposes, it is necessary to cool it during compression by passing it in a coil through water which is at atmospheric temperature. If it were not so cooled, and were delivered to the storage cylinders carrying all the heat of compression, it would suffer a subsequent fall of pressure which would amount to the same thing as if it were cooled at the compressor, and there would be a great loss of effect due to the heat so withdrawn. Every heat unit carried off in the cooling water of the original compression is a loss that must be charged against the compressed air or the liquid air, as the case may be, in every subsequent operation in which it plays a part; and when liquid air enters the lists in competition with steam, electricity, hydraulic or any other form of power, it starts with this heavy handicap against it.

In the lecture to which we have referred, Mr. Wilshire argues that in a theoretically perfect engine a given weight of liquid air would produce the same weight of compressed air, if both the liquid air cylinder and the compression cylinder were in free contact with the atmosphere. He then supposes the compressed air to be cooled with water during compression, and argues that such cooling would enable the liquid air to compress an additional volume of air, which he called a "surplusage." The fallacy of the argument lies in the fact that the liquid air itself has already been robbed of its own heat of compression, and the application of cooling water to the air which it is now compressing would merely enable it theoretically to produce by compression and expansion in a frictionless engine a weight of air just equal to itself.

There is no "surplusage" except in the exuberance of the lecturer's own imagination, and the cumbersome wit with which he rails at what he is pleased to call the "scientific Gradgrinds," who, be it said, have very effectually pricked the liquid air bubble. Mr. Wilshire's lecture, which is quite unique in its way, will be reviewed in the next issue of the SCIENTIFIC AMERICAN by President Morton, whose recent exposure of the liquid air fallacies has already attracted world-wide attention.

THE REASON WHY.

American master mechanics were the first to appreciate and prove the advantages of building express engines in which the center of the boiler is placed well above the driving wheels; and it is certainly late in the day for an American journal of the pretensions of Engineering News to be in ignorance of the excellent and obvious reasons for this modern practice. In a recent issue our esteemed contemporary, speaking of the new English express engines (illustrations of which appear in our SUPPLEMENT of the 3d inst.), informs its readers that these locomotives "are of a most peculiar appearance, as *in order to clear the crank axles the boiler is pitched so high* (the italics are ours) that its top is level with the roof of the cab, and this necessitates a little, dumpy smokestack which seems to have no relation to the boiler." As a matter of fact, the cranks have nothing whatever to do with the height of the boiler, there being no less than 15 inches clearance between the bottom of the boiler and the connecting rod ends at the highest point of their revolution. Engineering News evidently is not aware of or does not appreciate the fact that it was Mr. Buchanan, late master mechanic of the New York Central Railroad, who first had the courage to place the center of the boiler two feet above the top of a pair of 7-foot driving wheels, in order to allow the use of a boiler barrel that should be larger in diameter than the space between opposite wheels. As tried in No. 999, whose boiler centerline was a fraction less than 9 feet above the rails, the experiment was eminently successful; for not only was a large tube heating surface secured, but the high center of gravity was found to give an engine that was less destructive to track and roadbed. Inside cylinders may be answerable for many troubles, but a high center of gravity is certainly not one of them, any more than is "a little, dumpy smokestack." This last felicitously named deformity we must further inform our contemporary is due to the fact that the shallow loading-gage on English railways will not allow the smokestack to take on more æsthetic proportions. The same defect in appearance (if defect it be) is noticeable in the big Schenectady engines built some six or seven years ago for the New Haven road, which, we believe, is hampered by some bridges and tunnels that are lower than is common in American practice.

The late A. M. Wellington himself was never friendly disposed to inside cylinders, and for the best of mechanical reasons; but to hear them thus maligned is enough surely to disturb the shades of that gifted and ever-to-be-lamented editor.

REPORT OF THE NICARAGUA CANAL COMMISSION.

The present Nicaragua Canal Commission, which was appointed under an Act of Congress of June 4, 1897, and is popularly known as the Walker commission, after Admiral J. G. Walker, retired, U. S. N., has submitted its full report to the President. A preliminary hearing was given last summer with a view to putting Congress in possession of sufficient data to enable it to legislate on the question during its late session; and while in the nature of things it was impossible, in the then incomplete state of the data, for the commission to give accurate information, it was evident that a serious disagreement existed among the members of the commission on certain fundamental questions relating to the feasibility and cost of the undertaking! The most serious divergence of opinion was on the question of cost, the ranking member and most distinguished engineer of the commission putting the possible cost at about $150,000,000; the Admiral placing it at about $125,000,000, and Prof. Haupt declaring that it could be done within $90,000,000.

In the report just presented, Admiral Walker and Prof. Haupt, who at the preliminary hearing were both ardently in favor of the immediate construction of the Nicaragua Canal, have compromised on a sum of $118,113,790 as representing the probable total cost. This is a jump on the part of the professor of over $28,000,000, or an increase of over 30 per cent on his original estimate of $90,000,000. As the latter gentleman has already said in committee, "the question of cost does not carry very much weight in my mind, even if it were $200,000,000," the astounding difference in his two estimates is easily explained. Col. Hains, who has always shown a conservatism becoming the stupendous nature of the undertaking, estimates the final cost as $134,818,308.

The commission was required to examine all routes heretofore proposed that had any merit, and any new routes that appeared to be feasible, so as to be in the position to present an exhaustive report on the entire region of canal possibilities. After mature deliberation the commission has recommended the Childs route from Brito on the Pacific to Lake Nicaragua, and the Lull route from the lake to Greytown on the Atlantic. The Childs survey was made as far back as 1852 by a distinguished canal and railway engineer of that name, and the Lull survey was carried through in 1873 by Commander Lull, U. S. A., who was sent to the isthmus by the government to re-survey the Childs route. All the members of the Walker commission, although at variance as to cost, are agreed in rejecting the unprecedented and perilous features of the Menocal surveys of 1887 to 1890, and returning to the original plans. As modified, these plans call for a single dam with regulating works at each end of the summit level. On the Pacific side the route follows the left bank of the Rio Grande, crosses the Western Divide to the valley of the Lajas, which river is followed to its entrance to Lake Nicaragua. From the lake the route lies in the bed of the San Juan River to near Boca San Carlos, where it leaves the river and follows its left bank in excavation to the San Juanillo, from which point it is cut across the alluvial land to Greytown. For a complete map and illustrations of the Nicaragua country, the reader is referred to articles published in the SCIENTIFIC AMERICAN of February 18, 1899, and the SUPPLEMENT of April 1, 1899. It is stated that the survey, which has been carried out by a strong force of about one hundred engineers, has brought to light more favorable physical conditions than were anticipated, particularly in the upper San Juan River, where the rock excavation is less than was indicated by the preliminary surveys.

No definite action can be taken by Congress at this time, as it must now await the report of a new commission, authorized at the close of the last Congress, which is empowered to investigate not only the Nicaragua but the Panama and any other possible route, and report as to which is the most feasible to construct and operate. It will probably be a couple of years before the final report of this commission can be made the subject of legislation.

BRASSEY'S NAVAL ANNUAL.

The stirring events of our late war have lent a special interest to the annual publications which deal with the development and statistics of the world's navies, and the recently issued volume of Brassey's Naval Annual, the thirteenth of its kind to appear, devotes two lengthy chapters to the Spanish-American war and the United States Navy. The present volume is somewhat larger than its predecessors, the rapid growth of the various navies causing the tables and diagrams of the ships steadily to increase in volume. There are thirteen very good plates from wash drawings of notable battleships and cruisers interspersed through the reading matter, the "Iowa" being chosen from our own navy for reproduction. There are also nine charts and diagrams, seven of which are explanatory of the naval operations of the war. About one hundred pages are given up to tabular lists of all the warships of the world, and these are followed by ninety plates containing plans of practically every important type of warship in the world at the present time. These plans are line drawings, prepared as far as obtainable from working plans, which show only the armor, armament and leading offensive and defensive features of the ships. We take this opportunity of expressing our indebtedness to this portion of the Annual for many of the small diagrams which have accompanied our articles on the navies of the world.

While upon this subject we would suggest that as the plates in the later editions of the Annual (to save space) are being produced in two sizes, full page and half page, it would be better to reduce the older ships to half page size and reserve the full page plates for the later and more important vessels. Thus among the plates of our own navy we find that while the "Texas," which is rated in this Annual as a third class battleship, is allowed a whole page with five drawings, our latest first-class battleships of the "Alabama" and the "Maine" classes are confined to two drawings of half page size. The same thing is noticeable in the British navy, where the old armored cruiser "Imperieuse" occupies as much space as the two cuts representing the powerful modern ships of the "Cressy" and "Formidable" classes.

From the opening review by Lord Brassey and the tables of comparative strength given in a later chapter, we find that Great Britain has 41 battleships built and 16 building, a total of 57, as against 32 built and 4 building for France, and 15 built and 6 building for Russia. The United States have 5 built and 8 building, all but one of which are of the first class; and it is a gratifying fact that we have more first-class battleships built and building than any other power but England. Of these the latter country has 34 building; France, 11; Russia, 10; Italy, 7; Germany, 9; and Japan 6. Of cruisers England has 137 built and building; France, 52; Russia, 28; Italy, 21; Germany, 24; the United States, 20; and Japan 18. Construction of huge battleships and cruisers whose displacement, speed, and fighting qualities steadily increase, goes on apace. If any one is disposed to doubt the necessity for making regular additions to our own navy, we would draw his attention to a statement which has recently issued from the office of Naval Intelligence, Washington, to the effect that the total tonnage of all the vessels now building or authorized for the British navy exceeds the total tonnage of all the war vessels of the United States navy, built and building, by more than 100,000 tons. We commend this statement of the Navy Department to the attention of those Senators who recently delayed for at least another year the modest addition which our last Congress proposed to make to the navy—modest in comparison with the wealth and responsibilities of a nation which is rapidly moving to the leading position among the great commercial nations of the world.

In reading the chapter upon the "Progress of Foreign Navies," one is impressed with the marked decrease in the number of unprotected cruisers which are being built, all the new tonnage being put into

ships of the armored class, either battleships or cruisers. Japan indeed is the only nation that is building protected cruisers on any considerable scale; a fact which may be largely explained by the excellent work which was accomplished by this type of vessel in her war with China. The rapid growth of the Japanese navy is one of the most remarkable naval events of the last decade of the century. The new shipbuilding programme provides for four battleships, six first-class and three second-class cruisers together with several smaller vessels, and all of the ships are being pushed to completion with as little delay as possible. The progress of the United States navy is described under a separate chapter written by Lieut.-Commander W. H. Beehler, of the navy, which will naturally be of extreme interest to all Americans. Lieutenant Beehler traces the growth of the navy from the time of the Civil War to the present day. The administration is outlined at considerable length; then follows a description of the personnel, with tables giving the rank and total numbers of the various officers with their rates of pay, whether at sea or shore duty, or on leave or waiting orders. The same is done with regard to the chief petty officers and the various grades of seamen and other subordinates.

The chapter explains in detail the means by which apprentices enter the navy and the course of training which they subsequently undergo, and this part of the article renders in condensed form a considerable amount of information which is not easily accessible to the public. Considerable attention is paid to the navy yards and stations and the private shipbuilding yards, while the last few pages of the article are devoted to description of the latest ships that are now being constructed for the navy.

The succeeding chapter, by G. S. Clarke, is devoted to the Spanish-American war. It contains excellent plates of Manila Bay, the island of Cuba, Santiago Harbor, and of the coast to the westward of Santiago, along which the running fight between the Spanish and American ships took place. There are also plates showing the number and location of the hits made on Admiral Cervera's fleet, and a few small diagrams illustrating the method of disposing our warships during the blockade of Santiago. The whole chapter of over fifty pages forms one of the best compendiums of the Spanish-American war that has yet appeared, and the lessons of the war as drawn by the author are conservative and just and in the main agreeable to the expert estimate of these events as generally made throughout the world.

The chapter on recent warship construction, written by the editor, assisted by Captain Orde Browne, is perhaps one of the most valuable in the whole work, and the table published on page 176, showing the comparative qualities of eight of the latest first-class battleships in the world, will form a subject of interesting study for every one who follows closely the subject of warship construction. The battleships taken are the "Formidable" and the "Duncan," of 15,000 and 14,000 tons displacement respectively, of the British navy; the "Iéna," 11,870 tons displacement, of the French navy; "Kaiser Friederich III.," 11,130 tons, of the German navy; the Russian "Petropavlovsk," of 10,960 tons displacement; the Italian "Benedetto Brin," of 12,564 tons; the United States "Maine," 12,500 tons; and the Japanese "Shikishima," of 14,850 tons displacement. Accompanying this table is another showing the energy of gun-fire per minute for each ship. The largest vessel in point of dimensions is the "Benedetto Brin," which is 413½ feet long, by 27 feet draught, and has the enormous beam of 78 feet. Evidently her model must be exceedingly fine, as she displaces only 12,564 tons as against 15,000 for the shorter and narrower and shallower British ship "Formidable." The Italian ship has the thinnest armor, only 6 inches on the belt; she has the most powerful fire energy, the total amount being 600,745 foot-tons per minute. The "Iéna" has the smallest energy, 431,423 foot-tons. With new guns and smokeless powder, the "Maine" is estimated at 560,513 foot-tons, or about the same as the Japanese "Shikishima." The fire energy of the British ships is, as usual, relatively less than that of the others, being for the "Duncan" class 489,706 foot-tons per minute. This is compensated, however, by the high speed of 19 knots with natural draught, which would be equivalent to about 21½ knots with forced draught.

There is a marked tendency in the latest ships to reduce the thickness of the armor and spread it over a larger area of the ship's side. In the British vessels of the "Formidable" class the belt is 9 inches, and the side armor above the belt is 9 inches. In the "Duncan" class it has been reduced to 7 inches; in the "Iéna" the belt is 13¾ inches, and the side armor 4¾ to 3 inches thickness. The "Kaiser Friederich III." has a maximum thickness of 11¾ inches in the belt; it has no side armor above the belt. The "Petropavlovsk" has a 15¾-inch belt; the "Benedetto Brin" has a 6-inch belt and 6-inch side armor above it; the "Maine" a 12-inch belt, with 7-inch side armor; and the "Shikishima" has a 9-inch belt and 6-inch side armor. All the ships carry 6 inches of armor for the protection of the secondary battery, except the "Maine" and the "Iéna," the former having 5½ inches for this battery, and the French no protection beyond that afforded by shields. The 5½-inch side armor of the "Maine" is, however, continuous, while the 6-inch armor on many of the other vessels is placed only upon the casemates. Looking the comparison over carefully, we have every reason to be satisfied with our own "Maine," which we think stands as the best all-round fighting ship in the table. We cannot but feel, however, that she would be greatly improved if Krupp steel was substituted for the Harveyized armor, and the weight so saved were allotted to a battery of four 8-inch rapid-fire guns, these four to take the place of four of the 6-inch rapid-firers in the present battery.

In the chapter on coast fortifications the author divides the ports of the British empire into three classes: commercial ports, naval or dockyard ports, and supply ports or coaling stations. He does not believe in the extensive fortification of commercial ports as such, and would confine the erection of strong fixed defenses to the naval dockyards and the coaling stations. Regarding commercial ports, defended by mine fields, protected by rapid-fire batteries, with the fields so arranged that the mines could be kept permanently in place, or so that whole system of mines could be laid down in a short time, the author considers that the former method would be impossible because intolerable, as shown by the inconvenience experienced by New York in the late Spanish American war. It is considered that to carry out the second of the above named methods would "require an amount of time which would more than suffice to assemble the armed defenders whose presence would secure the place against hostile molestation far better than obstructed channels or fixed batteries." Whatever may be the case with regard to Great Britain, the writer is mistaken in his estimate of the situation at New York, where a very effective system of mines was laid down in a comparatively short period of time and would, we believe, have proved an effective safeguard to the city had we confronted a more energetic and formidable foe. Moreover, the mines were laid long before our volunteer army was in a position to take the field. Under our present system it is evident that submarine mines must constitute for many years to come the most effective defense available for our maritime cities.

THE AUTOMOBILE TRIP FROM CLEVELAND TO NEW YORK.

The first attempt in this country to use a standard automobile carriage on a continuous high speed trip of several hundred miles must certainly be considered a triumph for the new form of locomotion. The Winton carriage which left Cleveland on Monday, May 22, reached New York at 5:30 P. M. on Saturday, May 27, having covered the whole distance of 707·4 miles in the actual running time of 40 hours and 4 minutes. This is an average running speed of 17½ miles an hour, and in view of the fact that long stretches of the road were in a poor condition, and that some sections are spoken of as being disgraceful in the extreme, this is a highly creditable performance. The fastest average for a continuous run was made between Cleveland and Buffalo, where the distance of 218 miles was covered in 11 hours at the rate of a fraction under 20 miles an hour. The carriage weighs 1,700 pounds, and is driven by a 6-horse power motor. It is made in three different sizes; and good illustrations of the type appeared in the recent automobile number of the SCIENTIFIC AMERICAN.

The fastest speed for a long-distance journey was that accomplished by the winning carriage in the recent automobile race from Paris to Bordeaux, when a petroleum-driven carriage covered the distance of 353 miles in 11 hours 43 minutes and 20 seconds, an average speed of thirty miles an hour. This was a truly sensational performance, but there are circumstances which bring it within the limits of comparison with the Cleveland-New York journey. For it must be borne in mind that the Paris-Bordeaux roads are of the very finest surface throughout, and the vehicle, unlike the Winton carriage, was a special racing machine equipped with a fourteen horse power engine.

By sacrificing everything to power it is quite possible to build an automobile that will cover a straight-away mile at the rate of 60 miles an hour; and it has recently been reported from Europe that this speed has been attained more than once. These sensational speeds however do not interest the public so much as the question of maintaining a high average speed with motor-carriages of the standard make. The recent trip from Cleveland to the eastern seaboard proves that economical and speedy long distance automobolism will be within the reach of the public in the near future.

PHOTOGRAPHY IN RELIEF.

A new method for producing reliefs by the aid of photography has been devised by M. Lemac, who in this manner has produced fine medallions from living persons. His process has been described at a meeting of the Société Française de Photographie as follows:

The model, which it is not necessary to powder or treat specially, is placed in front of a black background, presenting the profile to the camera. Two plates are successively taken, avoiding all displacement of the model between the two exposures. For these the source of light should have as small dimensions as possible, a cartridge of powdered magnesium being preferred; this should be maintained in a plane perpendicular to the axis of the objective and slightly nearer the latter than it is to the model. During one of the poses the model is lighted about three-quarters in front, and for the second, three-quarters to the side. Negatives are obtained on films, which are then placed exactly over one another. In this way the most salient points of the face are represented by an intense black, these having received the maximum of light in one or the other exposure; the less lighted portions are gray, and the hollows, having been each time more or less in shadow, appear as transparent places in the negative. With this combination a print is made upon a paper which permits of easy retouching, such as platinum paper. This print is then retouched in order to bring out the hair and drapery. If letters are desired on the medallion, these are drawn with Chinese white or India ink, according to whether they are to be raised or depressed in the medallion.

The outline of the plaque or medallion is traced in India ink, according to the shape desired. This proof in black and white is then reproduced to the desired size, giving a negative from which are made the proofs in relief.

For low reliefs, proofs are made on a sheet of bichromated gelatin in the usual way, but to obtain high relief, one proceeds in the following manner: A thin layer of gelatin is flowed upon a sheet of a spongy substance which swells easily in water. The gelatin is sensitized with bichromate, and after drying, is exposed under the negative last obtained, and then submitted to the action of water, which washes out the portions shielded from the action of light, causing depressions, while the unexposed and impermeable parts are swelled out by the action of the water, thus producing a high relief, which corresponds to that of the model. Upon the relief so obtained fine plaster of Paris is flowed, and the hollow mould obtained is retouched. This constitutes the final mould for the reproduction of proofs. This process is not difficult to carry out by one accustomed to photographic manipulation; the time occupied in retouching the black-and-white print as well as the plastic mould is not more than one hour for a medallion-head of natural size.

THE BIRTH-RATE IN EUROPE.

Scientists and statisticians of France have been for some time occupied with the question of the decrease of the birth-rate in that country. This naturally leads to the investigation of the birth-rate of the other countries of Europe, in order to find out whether France is the only country going down the scale. For this purpose the tables published by Signor Bodis, a prominent statistician of Italy, are of value; these tables have in fact been made the base of various investigations as to the movement of population. Below is the order in which the countries of Europe are classed in decreasing series, according to their mean birth-rate:

1. Russia in Europe
2. Hungary
3. Servia
4. Roumania
5. Austria
6. German Empire
7. Italy
8. Spain
9. Finland
10. Portugal
11. Holland
12. England and Wales
13. Scotland
14. Denmark
15. Norway
16. Belgium
17. Sweden
18. Switzerland
19. Greece
20. France
21. Ireland

Thus we find that Russia has the largest percentage of births, and France and Ireland the smallest.

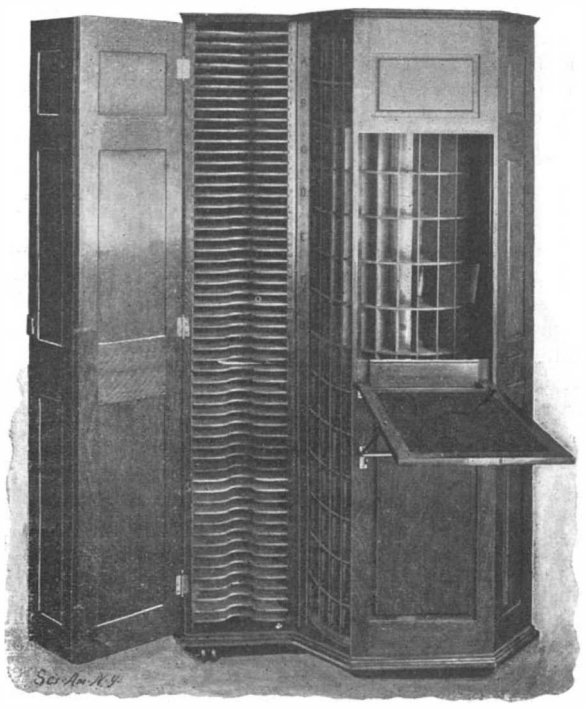
To find out whether in any of these countries the birth-rate is on the increase or decrease, the figures for each for different years are examined, and we thus find that in all except five the movement of natality is on a decrease more or less rapid. M. Vauthier, analyzing the figures obtained by Signor Bodis, draws the following conclusion as to the diminution of the number of births:

The country of Europe in which the decrease is most striking is England, including Wales, whose coefficient of decrease is 0·306 per 100; Scotland, whose mean birth-rate is nearly the same, decreases but 0·027 per 100; and Ireland, whose birth-rate is much smaller, decreases only 0·0233 per 100. Somewhat after England and Scotland, but before Ireland, are found Holland and Germany, having a coefficient of decrease of 0·0244 per 100, followed closely by Belgium (0·0239). Then, passing by Greece (0·0209), one reaches France, whose natality decreases annually by 0·0179 per 100. After France comes Russia (0·0158), Sweden (0·0147), Switzerland (0·0128). Last are found, having less than 0·01 per 100, Denmark (0·0078), Austria (0·0077), Pomerania (0·0033) and Hungary (0·0024).

As to the countries in which the birth-rate is on the increase, we find the following series: Italy, by 0·0083 per 100; Spain, by 0·0040; and lastly Servia and Norway, with coefficients of 0·0017 and 0·0012 per 100, being thus nearly stationary.

A SIMPLE CABINET FOR FILING PAPERS.

In the accompanying illustration we present a novel cabinet by means of which correspondence, blanks, documents, clippings, and the like, may be readily filed away and alphabetically indexed. The cabinet comprises essentially two parts, a rectangular portion and an octagonal portion. Within the rectangular portion, a box-section rotating on trunnions is mounted, which box-section has an open front and is adapted to receive a number of removable shelves, numbered from top to bottom. A folding-door is provided, which, when the box-casing faces the octagonal portion with its open



A CABINET FOR FILING DOCUMENTS.

front, closes both the rectangular portion and an opening in the octagonal portion.

Within the octagonal portion and adjacent to the rectangular portion, an upright is mounted upon which is inscribed one-half of the letters of the alphabet, the other half being inscribed upon a second upright also secured to the octagonal portion, but at the right hand side of the opening closed by the door.

In the octagonal portion a revolving cabinet is mounted, divided into pigeon-holes in horizontal alinement with the letters on the uprights. The letter "A" for example is adjacent to the upper row of pigeon-holes, and the letter "N" likewise, the two letters serving to index all the pigeon-holes in the upper row. The documents indexed by the letter on the left hand upright will be at the left hand side of the revolving cabinet; while the documents indexed by the letter on the right hand upright will be at the right hand side of the cabinet. At the top and bottom of the revolving cabinet, at the end of each vertical row of pigeon-holes, the twenty-six letters of the alphabet are inscribed.

In filing away papers belonging to "Walter Brown," for example, the cabinet is turned until the letter "W" at top and bottom is brought into view, and in the pigeon-hole at the junction of the vertical column "W" and the horizontal line "B" "O," the documents are filed and placed nearest the letter "B." Under such an arrangement, it is evident that the filing of documents may be accomplished so that no difficulty is experienced in searching for any particular paper.

In front of the octagonal portion a drop-section is hinged, which can be lowered to form a desk.

The patents on this cabinet are controlled by Mr. Cyrenius A. Layton, of Wapakoneta, Ohio.

Electrolytic Cleaning of Metal.

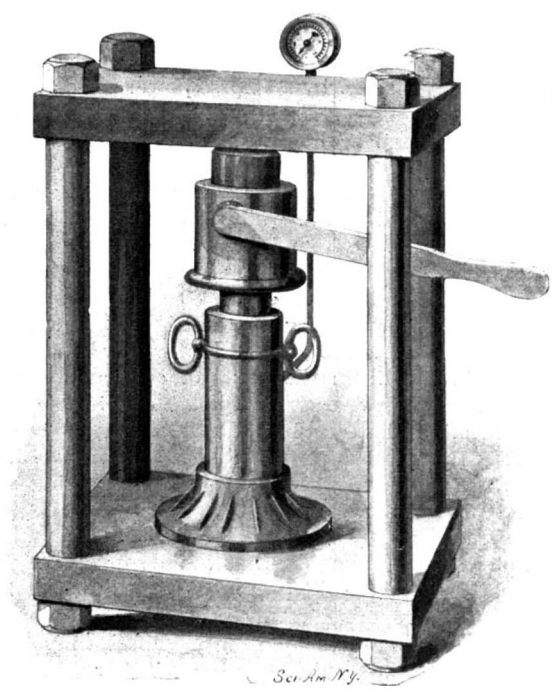
Mr. C. B. Burgess contributes to The Electrical World some excellent notes on the use of electrolysis in cleansing metallic surfaces. The notes have special reference to the preparation of the surfaces for electroplating. The author points out that if the article to be cleaned is suspended in a sodium chloride solution and used as an anode, the metal will be attached and hence cleaned to a certain degree. The anode reaction will, however, have little or no effect on substances of an oily or greasy nature, but the chemical reactions at the cathode afford all that may be desired in this direction. With the above named electrolyte, sodium is liberated at the cathode, immediately uniting with the water, forming sodium hydroxide and hydrogen, which rises to the surface. The reducing properties of the so-called nascent hydrogen thus formed are well known, and whether by the hydrogen alone, or by aid of the sodium, any oxide, sulphide, chloride, or similar compound on the metallic surface serving as the cathode will be quickly reduced to the metallic state. The sodium hydroxide formed will attack the grease or oil, producing saponification exactly as is done in the electroplater's lye vat. In most cases, the chemical action at the cathode will in no way affect the metal itself, but will act only on the foreign substances present, thus allowing polished surfaces to be cleaned without destroying the finish. The electrical energy necessary to effect the cleaning of articles of iron or copper as they come from the polishing room may be taken as approximately equal to that used for the electro-deposition. Although the current density must be considerably greater for cleaning than for plating, the time is much shorter. Current density has a marked effect upon the rapidity of cleaning, and the disappearance of foreign substances in no wise follows Faraday's laws. The following figures, taken from some observations made by Mr. H. A. Smith, illustrate this very clearly. The measurements were made to determine the effect of current density upon the rapidity of removal of a film of grease from an iron surface, such as it acquires from a greasy polishing wheel. The electrolyte was a nearly saturated solution of sodium chloride:

Current per square foot.	Time necessary for cleaning.
20 amperes	15·00 minutes.
40 "	3·50 "
140 "	0 75 " about.

With a solution of potassium hydroxide a current density of 80 amperes per square foot cleaned the iron almost instantly. Some of the advantages of the electrolytic method of cleaning over that commonly used in an electroplating plant are the following: There is less complication from the fact that the cleaning vat may be of similar construction to the plating vats, and connected to the 'bus bars in the same way. There is a considerable saving in labor and material in dispensing with the hand brushing. After once wiring an article there is no need of touching it with the hands, for it may be transferred directly from one tank to another. The oxides and other metallic compounds may be removed simultaneously with removal of grease and dirt, thus avoiding the use of a cyanide or an acid dip. A metal which has a brightly polished surface may be cleaned without destroying the polish.

AN IMPROVISED HYDRAULIC PRESS.

The mechanical engineer, and specially the mining engineer, is often in need of a hydraulic press for the purpose of testing materials, for making briquettes, or for similar purposes. Our engraving shows a very simple hydraulic press which can be made by any one who has a hydraulic jack. Two wrought iron plates 12 inches square and 2 inches thick are bored to receive upright rods, one at each corner. These rods may be of any desired length up to 5 feet, and should be about 2 inches in diameter. The height should be regulated by the size of the jack and the class of work which is to be accomplished with the aid of the press. By the use of blocks of wrought iron or steel, it is possible to regulate with great ease the distance through which the pressure is exerted. The hydraulic jack may be provided with a gage which indicates pressures varying from 2,000 to 4,000 pounds to the square inch. It would be possible to make the top and bottom plates of cast iron, provided they were reinforced by diagonal ribs. We are indebted to Alexander Roy



A SIMPLE HYDRAULIC PRESS.

a mining engineer, for this suggestion. Mr. Roy has used a press of this kind in making briquettes for testing purposes.

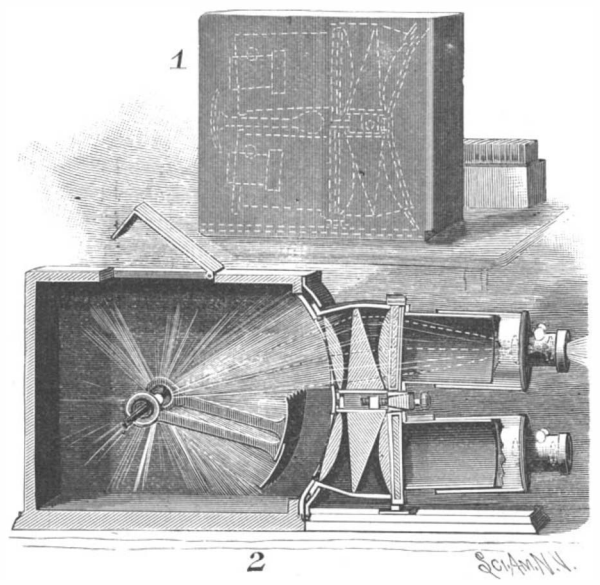
IN Tasmania the trade in axes and saws has been almost entirely monopolized by Americans. It is now the intention to carry on international competitions between teams of axmen and sawyers, using British and American tools, with the object of proving which country manufactures the best implements.

A NEW FORM OF STEREOPTICON.

A multiple dissolving-view lantern has been invented by Dr. Samuel E. Woody, 600 West Broadway, Louisville, Ky., which includes various improvements in construction, by which the light is so refracted that the picture from each of the two optical systems appears on the same spot of the screen.

Referring to Fig. 2 of our engraving, it will be observed that two condensers are mounted at the end of the light-casing, the upper being fitted to slide in a segmental guideway on the light-casing so that it can be adjusted relatively to the lower, by means of a wedge interposed between the frames of the condensers. By reason of this adjustment a proper registration of the two pictures projected by the two optical systems is obtained.

Each condenser is provided with two plano-convex



A NEW FORM OF STEREOPTICON.

lenses, having a prism interposed between them, so that the rays of light passing to the first lens are refracted by the prism to the other lens adjacent to the slide-holder. The two lenses of each condenser are inclined to each other, and the interposed prism refracts the rays of light at a proper angle.

The apparatus is provided with a shutter held movably in the light-casing between the light and the condensers. By operating the shutter the rays can be made to pass through one or the other of the condensers.

In the modified form shown in Fig. 1, the light-casing, in addition to the ordinary function, serves as a receptacle for the condensers, the slide-holders, and the adjustable tubes carrying the objectives, thus facilitating the transportation of the apparatus. In order to obtain this compact arrangement, the bottom of the light-casing is formed with a dovetail groove adapted to register with a similar groove in an extension hinged to the outer end of the bottom, and forming a cover for the open end of the casing when the several parts are stored. In the registering dovetail grooves a support slides which carries the stereopticon parts. In using the device the extension is swung down and the support carrying the stereopticon is slid out, reversed, and reinserted in its proper operative position.

Interesting Discovery in the Tower of London.

It would really seem impossible to make any new discovery in the Tower of London, which has been examined so many times by architects and antiquaries. Some unusually interesting discoveries have just been made in the process of laying the foundation for the erection of a new guard-room near the White Tower. The workmen cut the Roman wall of the second century and found a number of perfectly preserved flue tiles for the diffusion of hot air from the hypocaust.

These tiles are excellent specimens, measuring 15 inches in length, 6½ inches in width, and 4½ inches in depth. According to a cable dispatch to The New York Sun, while removing the mud from the subway leading from the river and the moat, the workmen discovered a number of iron and stone shot, left, it is believed, at the time of the conflicts between the royal troops and the rebels under Wyatt, in 1554. The shot are thickly set in a conglomerate of mud and gravel, mixed with human bones and bits of armor, showing firing with deadly effect at close quarters.

The Fish Commission Expedition.

The United States Fish Commission is about to send out one of the most extensive scientific expeditions ever arranged by the Commission. The expedition will sail on the "Albatross" in charge of Prof. Agassiz to explore portions of the Pacific Ocean. Some of the islands to be visited are the Marshall, Society, Friendly, Fiji, and Gilbert groups. It is expected that the trip will require eight months, and will leave San Francisco in August.

An Emotional Curve of Literature.

It seems as though psychology is now invading every stronghold of science, literature or art. A graduate student at Columbia University, Mr. Gerrard, has submitted an interesting original thesis entitled "Emotional Expression in Literature," and the results of this method are very interesting. He notes carefully his own emotions while reading literary works and then studies out what passages caused the emotions. These passages were then copied off or cut out until he has a very large number of clippings and memoranda, says The Sun. He noted the number of emotions and emotional elements for each hundred words in the various works or by the several authors. He grouped the clippings in different ways as similarity of themselves or as the emotions they excited suggested, and so eventually perceived what he calls the laws which govern the production of emotions by language or the expression of emotions in written speech. He says in his introduction:

"This work is the outcome of a desire to find the elements used in expressing ideas and emotions in literature; to learn how these elements are used, and to see if, the elements serving as a basis of valuation, some method could not be devised whereby the strength of literary works could be measured. . . . It was early noted that descriptive work used different elements than did narration or character interaction. . . . This discovery of the elements was extremely trying work, since one in seeking must be ever on the alert, must know exactly when the emotion comes to him, and must try to locate the exact part of the passage in which the effect was to be found. This necessitated a high degree of mental and emotional sympathy with the work under consideration, together with enough self-control and introspection so as to be able to judge without being carried away by the work. Once the elements were discovered, the laws governing them began to appear one by one.

"The value and use of the elements has been tested in other ways. A very acrid speech by a Southern Senator deprived of a very few adjectives became extremely pacific."

Of his literary elements he says: "Man receiving sensations from all his senses at one time may unite them and represent the united sensations in one expression; or he may unite them with other stored stimuli and produce an expression resulting from hundreds of stored stimuli. Such an emotion would in literature find expression in a discourse, while several sense impressions from the eye, ear and finger combined would, perchance, produce a noun or a verb; while each sense impression might find expression in an adjective or an adverb. . . . It will be noted that the strength of the ordinary figure of speech is due to the fact that in it the condensation of a larger whole into a smaller one is strongly felt. A verb idea is put into an adjective, or a paragraph idea is put into a verb. A proverb is a condensed drama, a joke a comedy in miniature. Each paragraph was once a whole literary work; each perfect word contains a condensed play. . . . A dramatic moment is a larger whole than is a paragraph. . . . To show the emotion and emotional changes in a work of literature, graphic curves have been made as follows: Taking 100 words as a unit, I have found the number of nouns, verbs, clauses, sentences, paragraphs, or dramatic moments per 100 words. . . . Th se curves show us at a glance in what part of a work anyone element dominates; thus one finds the adjectives, and nouns, dominate in the beginning of 'Marjorie Daw,' while at the climax of the story the verbs greatly preponderate, as again nouns predominate in the anti-climax."

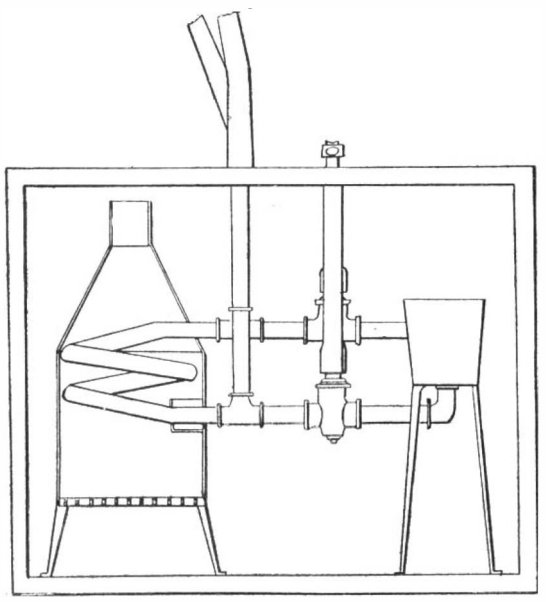
Mr. Gerrard represents graphically, in his thesis, by his curves, the emotional measurements of "Pippa Passes," "Camille," "Magda," "Hamlet," "Desdemona," "Red Riding Hood" and many other works and characters of literature.

A New Polar Expedition.

There are already four polar expeditions under way, or almost ready to start, and to these must soon be added that of Capt. Bernier, a Frenchman. His course will be toward Franz Josef Land, steering for the part lying to the east of Cape Mary Harmsworth, pushing on as far north as possible, and he will then disembark with all the provisions, dogs, reindeer, sledges, etc. He intends to pass the winter at Petermann's Land, which is probably an island lying in about 83° north latitude and 58° or 59° east longitude, that is about 420 miles from the pole. At the first opportune moment he intends to make a dash for the pole. If possible he hopes to cover the 420 miles in 100 days, which is good traveling in this part of the Arctic regions. He expects to return from the pole by a route which will permit of reaching Spitzbergen and he thinks he will reach Dane Island, where Andreé started in his balloon, toward the middle of autumn. If he reaches this point, he will have to spend the winter there, as steamers run between Norway and Spitzbergen only during the warm season. He has an alternative plan of operation by way of the River Lena, and which the "Jeannette" followed in 1881.

THE BRICKILL FEED WATER CASE.

On May 19, Mr. George E. Howard, special master in a suit brought against the city of New York, by the heirs of William A. Brickill, to recover money saved to the city by the use of a patented feed-water heater for



BRICKILL'S ORIGINAL HEATER.

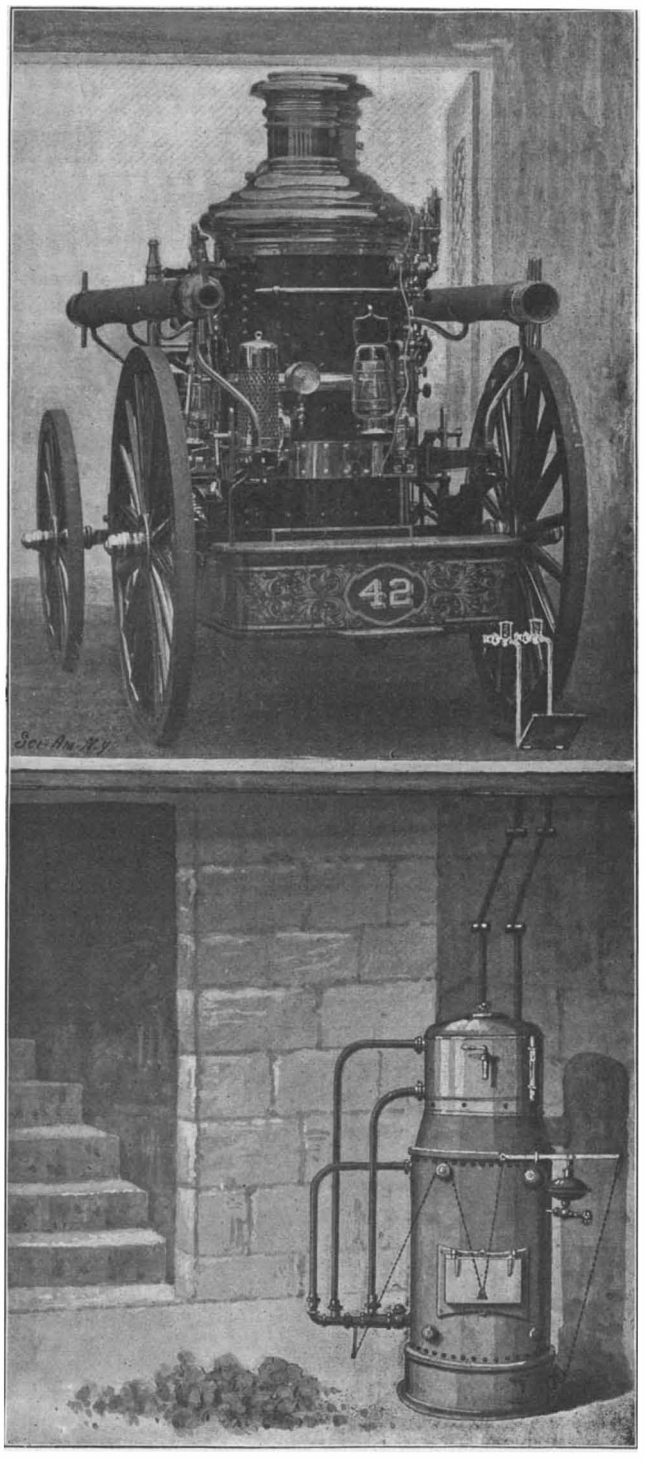
steam fire-engines, filed his report in the United States Circuit Court. The master awards the complainants $894,633, of which sum $194,716 is interest. This ends one of the most interesting legal battles for the defense of patent rights which has ever been fought. The case has been in the courts for twenty-nine years, and it is to be hoped that it is now definitely settled.

William A. Brickill was foreman in the New York Fire Department. He had been an enthusiastic fireman in the old volunteer days, and when the city established the regular paid fire department, he was retained as an engineer. He was a skillful mechanic, and devoted a good deal of his spare time to perfecting fire apparatus. In 1868 he invented and patented a feed-water heater for steam fire-engines, by which water could be kept very hot in fire-engines without fires being kept lighted under the boiler.

Mr. Brickill left the Fire Department and asked that the city pay him for the use of his patented device. The authorities contended, however, that he did the work while in the employ of the city and that he was doing nothing more than his duty. The patentee entered a suit for damages for infringement of his patent, and the suit dragged wearily on, so that at the end of ten years he had spent all his savings in litigation, and at the end of seventeen years the patent expired. He offered to settle with the city for $50,000, but this was refused, and it is probable that the city will now be mulcted in a large sum.

The device is most interesting, and the decision is important from a legal point of view, as it affects the right of the inventor to the fruits of his invention. It has been decided by the courts that employers are not entitled to the inventions or patents of an employé, unless there is a special agreement to that effect, which was not the case in the present instance. An employer, who has in his pay a skilled workman engaged to devote his time and services in devising and making improvements in articles manufactured by the employer, is not entitled to the conveyance of any patents obtained by the employé, unless there is a distinct agreement to that effect.

Nowadays no engine house where a steamer is located is properly equipped unless supplied with a heater. It is necessary to keep the engine room constantly warm in cold weather to guard against frost, so that some form of heating apparatus is required, and Brickill's invention calls for an attachment to such a heater which would at the same time supply water to the fire-engine boiler very near the boiling point, in order that when an alarm is turned in, the engine can start to the fire, and by the time the scene of the fire is reached, a sufficient pressure of steam has been raised which will permit of working the pumps. Our small diagram shows the original device of Mr. Brickill. Naturally it has been much improved upon as the device shown in our engraving represents an approved form of heater for steam fire-engines. The heaters are usually placed in the basement and are usually made in sizes which can supply either one or two engines. The heater is automatic, coal or coke being supplied to the fire through a self-feeding mechanism. Damper regulators keep the temperature steady and uniform; they can be adjusted so as to maintain any required pressure from the boiling point upward. The steam capacity is from 25 to 50 pounds of steam. The heaters may also be placed on the same floor as the engine, but in the majority of cases they are placed in the basement directly beneath the engine as shown in our engraving.



IMPROVED FORM OF FEED WATER HEATER.

The circulation of hot water in the boiler of the fire engine also tends to prevent the deterioration of the boiler. The pipes usually come up through a trap in the floor, and valves are provided so that the forward movement of the engine immediately closes the valves in the pipes attached to the engine, and also to the heater, and changes the circulation of the water from the engine to the tank on the heater, and opens the damper on the heater when the action of the regulator will at once close the draft. Other devices have been provided, such as valves which are operated by the foot as the engineer mounts the tailboard. If desired, the engine can be run to the scene of the conflagration without lighting the fires, and steam can be rapidly raised if it is found the alarm is a true one. This, however, is not done much in large cities.

Director of Allegheny Observatory.

Prof. F. L. O. Wadsworth, of the Yerkes Observatory of the University of Chicago, has been appointed Director of the Allegheny Observatory. He succeeds Prof. J. E. Keeler, who recently went to the Lick Observatory. Prof. Wadsworth will take charge on January 1, next. He has been connected with the Yerkes Observatory since its opening in 1897, as instructor in astrophysics. He came to the University in 1894, from the Astrophysical Observatory, in Washington.

TESTING SODIUM SULPHITE.—To test sodium sulphite for its chief adulterations, proceed as follows: By adding the few drops of barium chloride solution to the solution of the sodium sulphite to be tested, a white precipitate results. Same must be soluble in hydrochloric acid. If it is not, sodium sulphate is present. If phenol-phthalein paper moistened with sodium sulphite solution is dyed red, sodium carbonate is present.—Deutsche Photographen Zeitung.

PHILOSOPHY OF EXPLOSIVE WAVE ACTION.

BY HUDSON MAXIM.

In the SCIENTIFIC AMERICAN of April 8, immediately following the bursting of the 10-inch gun at Sandy Hook, I published an article expressing my views as to the probable cause of that disaster. In the Automobile Number of the SCIENTIFIC AMERICAN I illustrated, with diagrams, how different methods and densities of loading and of ignition may set up violent wave action in guns.

In the SCIENTIFIC AMERICAN SUPPLEMENT of May

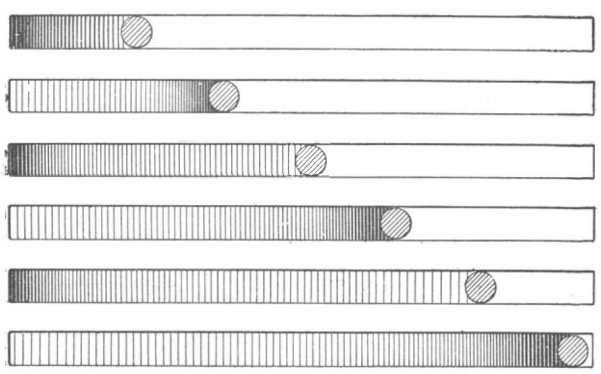


Fig. 1.

20, I took up the subject again, chiefly to reply to and correct some misleading statements made by Mr. Hiram S. Maxim, concerning the Maxim-Schüpphaus smokeless powder and other matters. Supplementing the above articles appeared an excellent contribution by Mr. Fred. H. McGahie on Wave Action in Guns, in the SCIENTIFIC AMERICAN SUPPLEMENT, May 27. Those interested in the subject will find sufficient data in the above contributions to establish the fact beyond a doubt, I think, that the cause of the explosion of the gun was due to wave action, and was not due to any inherent fault of the Maxim-Schüpphaus smokeless powder which was employed.

All of the conditions favorable to wave action were present when the gun burst, and these conditions are very clearly presented in the following paragraph, page 248, Report of the Chief of Ordnance, of 1894:

"The conditions favorable to wave action appear to be length of chamber, quickness of the powder, high density of loading, ununiform distribution of the charge, and end ignition. In our system of large guns three

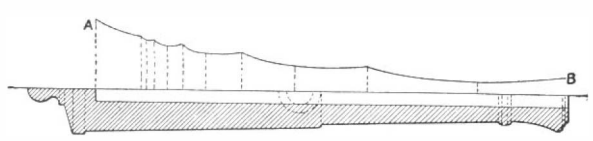


Fig. 2.

of these conditions are always present, and it is probable that more or less wave action always occurs, though it may not result in abnormal maximum pressures. And when the charge does not occupy the whole length of the chamber abnormal results seem likely to occur, the more likely as the powder is quicker."

In the present article I shall endeavor to show something of the philosophy of explosive wave action.

The subject of wave action was thoroughly investigated by M. Vieille, and his determinations were published in the Memorial des Poudres et Salpètres, Tome III., 1890. Vieille, however, was not the first person to give this matter rational treatment. By referring to the Appendix M, to the Report of the Chief of Ordnance, United States Army, 1879, we find that Dr. W. E. Woodbridge went about as far toward a rational solution of the problem as was possible with the means at hand at that time.

Dr. Woodbridge says:

"It is evident that a difference of tension amounting to 3,800 pounds in the distance of three inches will not allow the gases to remain in quiescence, but must give rise to vibrations of great force, and alterations of tension, such as are represented in the diagrams. . . . The effect of an enlargement of the space during the vibrations such as actually occur will evidently be to

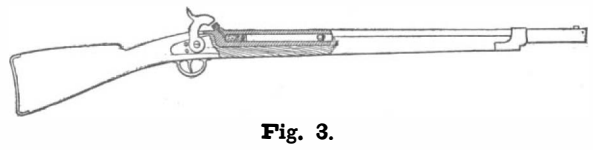


Fig. 3.

increase the amplitude of the vibrations and to diminish their frequency and force. The amount of this effect, and the number of vibrations occurring before the ball leaves the gun, will depend, other things being equal, on the weight of the ball. The figures above are designed to illustrate the character of the variations of tension occurring while the ball is leaving the bore. (See six diagrams, Fig. 1.) Adopting another mode of illustration, and representing tension by perpendicular distance from a horizontal line, the wave line, *A B* (Fig. 2), will denote the maximum pressure sustained by the different parts of the bore. The supposed limits of the cavity during the successive vibrations are given in vertical lines."

Persons familiar with the old style muzzle-loading musket are aware of the necessity of getting the ball well down upon the powder charge. If, from the gun being foul, or from other cause, the ball should stick in the bore, say a foot above the powder charge, and the gun be fired, it is likely to burst. To illustrate this, let us refer to Fig. 3, showing a side elevation of an old-fashioned musket with the powder charge, and a portion of the barrel in section, and showing the bullet stuck in the bore some distance forward of the powder charge. Here we have a similar condition to that presented in a modern cannon, charged with a single bag of powder placed near the breech plug and ignited at the rear.

Upon ignition, the powder charge will rocket along the bore, while the rapidly burning grains strew the chamber, the main portion of the charge being thrown with great violence with the dense products of combustion upon the ball, tamping themselves by their inertia into the space immediately behind the ball. Before the projectile is displaced to any considerable extent, the pressure directly behind it will mount very high, which will cause the grains to burn with greatly accelerated rapidity. The enormous pressure resulting will be greatly in excess of the pressure at the rear of the powder chamber. This will cause a wave of explosion to rebound from the ball and rush backward through the powder chamber to the breech of the gun. This wave, meeting the outward-rushing gases laden with burning powder, will throw them back upon themselves, and impinging upon the immovable breech block, cause a repetition in much exaggerated form of that condition just described as taking place behind the ball. The explosive wave, if it does not blow out the breech block or burst the gun, will again rebound to rush forward through the bore to overtake and impinge again upon the projectile before it has had time to leave the gun, again mounting the pressure very high immediately behind it.

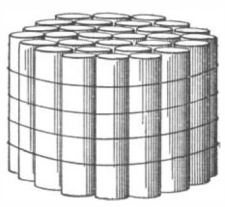


Fig. 4.

There are two ways in which explosive compounds are consumed, namely, surface combustion and detonation. Gunpowder is burnt in the first way, and dyna-

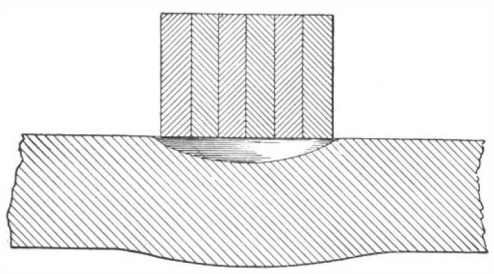


Fig. 5.

mite in the second. Detonation means the breaking up of the chemical arrangement of the molecules composing the compound, by a wave action transmitted with great velocity through the body of the compound. With gunpowder under service conditions, in guns, detonation is practically impossible. To cause the detonation of a grain of any standard smokeless powder, such as are employed in large guns, would probably require a pressure, instantly applied, of more than 100 tons to the square inch, while the pressure to which it is usually subjected in guns is from 15 to 17 tons.

It is probable that no gun is strong enough to allow the pressure to mount to a sufficient height within the

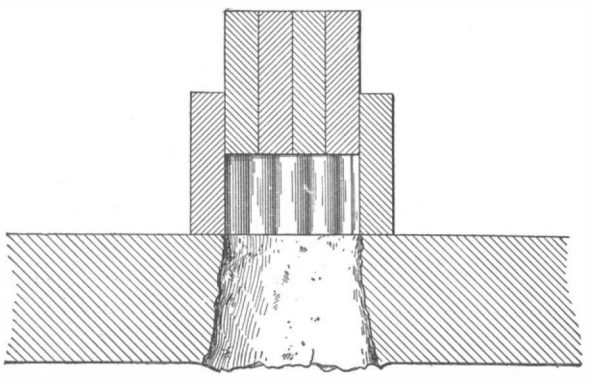


Fig. 6.

bore to detonate a service powder charge before the bursting of the gun; and it is probable that if the granulation be coarse enough, the strongest piece of modern ordnance could be burst in this way without the complete consumption of the grains; and some of them would be blown out in a partially consumed condition, with the pieces of the walls of the gun. Although dynamite is exploded in an entirely different manner from gunpowder, yet we may draw valuable conclusions from the action of the gases set free by the detonation of dynamite, as to what high velocity means with dense gases.

If a dynamite cartridge, set on end upon the ground, be exploded from the bottom, the wave of detonation moving upward will detract from the downward effect of the explosive upon the earth. If, however, the cartridge be exploded from the upper end, a much larger hole will be blown in the earth. When dynamite is detonated adjacent to a body offering great resistance, the body of the explosive, being instantly converted into incandescent gases, will rebound from the resisting body with great velocity, and the destructive effect upon the latter body will be less if the detonative wave moves from the body, than if it moves toward it. If two bodies of dynamite be placed adjacent to each other and detonated simultaneously, the gases of the explosion will meet in the space which separates them to be thrown out with greatly increased velocity in a lateral direction.

Under the advice of Prof. Charles E. Monroe, the

Fig. 7.

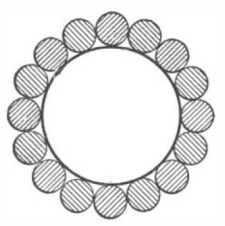


Fig. 8.

celebrated high explosives expert, and the inventor of jovite, some experiments were conducted in the destruction of safes and safe deposit vaults some years ago. The following data is obtained concerning these experiments, from a letter of the Secretary of the Treasury, 1894.

It was found that a package of dynamite cartridges, tied together, as shown in Fig. 4, and placed upon the steel wall of the safe, would, when exploded from the bottom, only serve to slightly indent the wall of the safe (Fig. 5).

When, however, the same quantity of dynamite was tied about a tin can, as shown in Fig. 7, and in section, Fig. 6, and plan, Fig. 8, the effect of the explosion detonated from the top was to blow a 3-inch hole through the wall of the safe, Fig. 6. This greatly increased effect was due to the fact that the gases of the explosion (Fig. 6) met in the space formed by the tin can, which imparted to them greatly accelerated velocity under great density. The direction of the movement of the united gases being toward the safe, instead of simply indenting it, blew a hole completely through.

When the products of combustion in a gun are thrown violently backward and forward by wave action, the velocity and inertia factors serve to run the pressure up very high at different points along the bore.

How Large Fossils are Preserved.

Each summer the field expeditions sent by the American Museum of Natural History go to the great fossil beds of Wyoming and Kansas, where in past geological ages were the great fresh water lakes, in and about which lived the extinct animals whose skeletons they are seeking. Here, says The Evening Post, they begin by prospecting along the bluffs or over the beds of hard clay in which the bones are found. When one is found protruding above the surface the clay is carefully cut away, but sufficient is left to cause the fossil bones to be firmly embedded in it. They are usually broken into many fragments, and if they were laid completely bare, as was formerly the custom, there would be great danger of losing some of the pieces, and there would be considerable difficulty in determining the relative positions of the rest. The new method of handling them is to leave them embedded in enough of the original clay to hold them together and to cover the whole with a plaster cast. This is boarded up and shipped with wet rawhide around it, which shrinks as it dries and binds the whole firmly together. These blocks weigh from 100 to 1,500 pounds. They are then crated and shipped to the museum, where the matrix is removed, and the bones are put together at once as they are removed, thus avoiding the difficulty of solving a dissected puzzle. A complete photographic record is kept of every stage of the proceedings, so that an adequate idea of the location of the bones in situ is obtained. One of the many specimens thus unearthed and preserved is part of a skeleton of a huge herbivorous reptile, called a camarasaur (Cope) or brontosaur (Marsh). Of this skeleton the museum has two of the dorsal and nineteen of the cordal vertebræ and parts of the pelvis and leg bones.

To most people the interesting thing about this skeleton is the fact that the bones show unmistakable evidences of having been broken and gnawed by the teeth of some other animal, presumably one of the flesh-eating reptiles whose bones are found in the same clay beds. It is hard to picture such a scene of conflict. It might be likened to a fight between an elephant and a tiger, if the elephant was 80 feet long and 16 feet high and the tiger in proportion.

Correspondence.

Tide and Wave Drainage.

To the Editor of the SCIENTIFIC AMERICAN:

Whatever relates to the prevention of yellow fever in Cuba is of interest not only to Cubans but to the people of the United States, for there is the prolific hotbed from which the seeds of the disease come to spread devastation among us.

Much can be done by attention to ordinary sanitary precautions, but this alone, without purification of the foul water of those harbors in that tropical climate, will be insufficient.

The curious combination of an inclosed lake and a long, narrow inlet connecting it with the ocean is the characteristic of the harbors of Cuba where yellow fever prevails in its more deadly form.

This formation would not be so conducive to impurity in the inclosed water if it were not for the low range of tide which prevails there, the difference between high and low water usually being about a foot only. The sea water which enters at high tide pushes the foul water back, and as the tide falls the pure water runs out again, leaving the bulk of the foul unchanged.

As a means of correcting this evil we beg leave to propose the following plan. To provide for somewhat similar conditions, there has been in operation for years, at Virginia Beach and other places on our coast, a device which, with some amplification, would accomplish the desired object in Cuba. It consists of an inclined plane of stout timber erected on the margin of the ocean where waves strike in full force. The foot of this slope is placed at a suitable height to catch the waves, which are carried by their own momentum into a canal in rear, through which the water is then conducted to any point desired.

Along the coast near the mouth of a harbor a sufficient length of these inclined planes might be constructed, and from them the pure sea water would flow into, and around, the harbor to its head, in volumes only limited by the size of the plant. The flow would be constant, excepting when the sea was becalmed, and it would drive out before it every particle of foul water in the harbor.

The cost of this canal, in comparison with one of equal size whose banks were to be subjected to hydrostatic pressure, would be light, for the elevation of the water need be only what was required to produce a current. The height of the embankment between the canal and harbor need be but little greater than ordinary high tide storm; tides might be allowed to overflow it. No puddling would be required; a simple bank thrown up from the excavation would be sufficient.

Considering its utility, the first cost of this plant would be moderate, and that of its subsequent maintenance very small indeed. The losses of the people of the United States by one yellow fever epidemic would build a hundred of them. WM. W. BLACKFORD.

Lynnhaven, Va., May 15, 1899.

Proposed Cable to Iceland and Greenland.

The following, dated Copenhagen, April 27, 1899, has been received from Vice and Deputy Consul Blom: The meteorologists in Europe have for many years desired a telegraphic connection with Iceland, Faroe Islands, and Greenland. Daily telegraphic reports from Iceland would be of the utmost importance to the weather service, as well as to the large fishing interests in the North Atlantic. I understand that the British fishing interests have recently petitioned the government to grant a yearly subvention to the proposed cable. The Danish government looks favorably upon the plan, but is of the opinion that it should be realized by private individuals. The Great Northern Telegraphic Company, Limited, of Copenhagen, is willing to lay and work the cable, provided it is guaranteed a certain sum from the various governments and other parties interested. The royal Danish meteorological office, in Copenhagen, has issued circulars to kindred institutions throughout the world, requesting them to subscribe to daily weather bulletins from Iceland and Faroe Islands; the matter is also being seriously considered by other bodies, especially in Great Britain, and the prospects for a realization of the enterprise are promising.

Adaptation of Leaves to the Intensity of Light.

The term "photometric" is proposed by Prof. J. Wiesner for those leaves which assume a definite position in light, either in order to obtain as much illumination as possible or to screen themselves from too much light; those which do not possess this property being "aphotometric." Photometric leaves, again, may be "euphotometric" or "panphotometric," according as they adapt themselves only to the maximum of diffused light or to both direct and diffused sunlight. The former are characterized by assuming a fixed position, at right angles to the direction of the strongest diffused light, while the latter have no such fixed position. The vegetation of forests and those plants which grow in deep shade present the most frequent and clearest examples of "euphotometric" leaves.—Biologisches Centralblatt.

Miscellaneous Notes and Receipts.

Improvements in Acetylene Burners.—In order to prevent the danger of an explosion in acetylene burners, it has been proposed to lead the gas on its way to the end of the burner through a few small chambers filled with glass wool (spun glass). Owing to the fact that spun glass acts like a filter, the acetylene is, before burning, freed from all impurities which might have been carried along. Besides, these spun wool filters also serve the purpose of preventing a falling back of the flame and rendering it harmless even in case an explosion should occur through some cause or other.—Neueste Erfindungen und Erfahrungen.

Blackening Ornaments of Iron.—To give iron ornaments a black-brown to black color, proceed in the following manner: The articles are treated with corrosives, cleaned of all adhering grease and placed in a 10 per cent solution of potassium bichromate, dried in the air and finally held over an open, well-glowing, non-sooting fire for 2 minutes. The first coloring is usually black brown, but if this process is repeated several times, a pure black shade is obtained. Special attention has to be paid to removing all grease, otherwise the greasy spots will not be touched by the liquid, and the coloring produced will become irregular. Benzine is employed for that purpose and the articles must not be touched with the fingers afterward.—Chemiker Zeitung.

Hygienic Value of Paints.—Regarding the effect of various paints upon bacteria, Dr. Heimes has recently delivered a notable lecture before the Greifswald Medical Society. It does not appear to be an unimportant matter for the sanitary conditions in a building with what kind of paint the walls are covered. Heimes conducted the following experiments: He took equally large pieces of oak, poplar and pine wood, and of iron and cement plates, and covered each piece with oil paint, size paint, lime paint or enamel paint, as well as with a few proprietary compositions. After the paint had dried perfectly, the plates were coated with cultures of various disease-inciting bacteria. In this condition the plates were laid in an incubator, in which an ordinary room temperature was maintained. From time to time a little was scraped off from the surface of the plates in order to examine them as to the amount of live bacteria present. The result was that upon oil paint coatings the bacteria were found to die off quicker than on articles coated with other pigments. On enamel paint the bacteria die more slowly, and still slower on lime and size paint. This heterogeneous behavior is probably not due to the chemical properties of the paints, but to the different physical qualities, especially to the fact that the liquids containing bacteria dry more slowly or quickly upon the various paints. Prof. Loeffler, who attended the lecture, attached considerable practical importance to the result, and recommended the use only of oil paint in hospitals, schools, barracks and other buildings.—Farben Zeitung.

Treatment of Driving Belts.—The Werkmeister Zeitung gives directions on the best treatment of driving belts, whose faultless working is of great importance in every factory. The good drawing of a belt increases with the friction between belt and pulley. Hence it is obvious that the belt must surround as large a portion of the pulley as possible. For this reason crossed belts always pull better than open ones. If in any way practicable, open belts should cover at least almost half the pulley. If the circumference of one pulley be very small in proportion to the other, thus allowing the belt to cover only a small portion of the smaller pulley, a sliding of the belt frequently takes place, especially if the distance between the two pulleys be slight. It is plain, continues the Werkmeister Zeitung, that a slow running of the engine makes a strong stretching of the belts necessary. For this reason, a tightening-pulley is frequently placed midway between the two pulleys, so as to avoid a repeated resewing. If a large power is to be transmitted at little velocity, a broader belt should be employed than would be necessary with greater velocity, or else two belts are made to run on top of each other.

If one does not care to tighten the belts still more or use one of the many belt lubricants, the best makeshift is to cover the pulley with sail cloth. This is done by cutting the sail cloth so exactly that it is difficult to get it on the pulley. By thoroughly moistening the sail cloth on the pulley with warm water it clings more closely to the pulley, as the water causes it to shrink. It is still more practical in the long run to fix instead of the canvas a leather strip of corresponding breadth on the middle of the pulley, by having a few holes bored into the rim of the pulley which are tightly filled up with wooden wedges, in order to be able to nail the strip of leather on it. This process is said to have proved useful with ordinary proportions of the size of the belt to the effect of power to be transmitted. If all is unavailing, the belt is too weak, and must be replaced by a broader or double belt. Of great advantage in such cases are the wooden belt-pulleys, which increase the driving power.

Science Notes.

It is said that the construction of the dam across the Nile at Assouan, Egypt, will not submerge the temple at Philæ. The actual level of the water behind the dam will be a little above the present high-water mark, so that the floor of the temple will still be dry.

It is said that some 9,000,000 acres of land in Italy, the cultivation of which has been abandoned because of malaria, are to be developed by the aid of American capital. Land of this nature can be reclaimed by drainage and proper attention to sanitary laws.

An English railway company has recently completed a train for the use of the royal family, the cost of which was $40,000. There are five cars, and each is lighted by electricity, the dynamo being axle-driven and supplemented by a storage battery in the baggage compartment.

It has been decided that the Fisheries and Forestry exhibit of the United States at the Paris Exposition shall be utilitarian only. An exhibit of natural fish will be avoided, but tinned, preserved and dried fish and fishing tackle will make the Department of Forestry and Fisheries one of the most attractive sections in the United States Division at the Exposition.

At last the Electrolytic Salts Company have received a report on the "process" of extracting gold from sea water. The professor whom the directors employed reports that the process was fraudulent. The directors are said to have recovered a considerable sum from the originator of the swindle, which, together with the sale of the machinery, etc., has realized enough to pay 20 per cent dividend to the stockholders.

It is said that automobile vehicles are to be used by the Pittsburg Express Company, in connection with its trolley express cars. This company will do business on all the traction lines in the vicinity of Pittsburg. It expects to operate eleven baggage cars and a large number of automobile delivery wagons. The baggage cars will have six-foot sliding doors on either side. The baggage can be taken up at any point along the line.

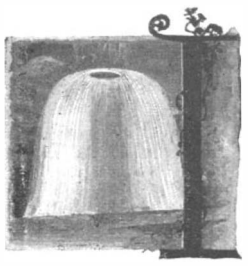
M. Berthelot has examined many classical specimens of ancient mirrors in different localities. They seem to have been made by blowing a thin-walled bulb of glass and pouring melted lead into a watch glass shaped portion of the thin bulb and manipulating it so as to spread the metal into a lining layer about one-tenth of a millimeter thick. The glass had to be made very thin, so as not to crack on contact with the melted lead.

Fifty acres of Adirondack burnt lands have been replanted this spring with white pine and other conifers by the New York State College of Forestry of Cornell University. Wood choppers were turned into expert tree planters, and at the same time a nursery has been established, with enough seed to furnish 3,000,000 seedlings, which when two years old will be set out and will be sufficient to cover 2,500 acres. It is expected that the college will plant at least 500 acres each year.

Brigadier-General Greely, Chief of the United States Signal Corps, has invited proposals for furnishing the army with three electric horseless carriages, and experiments will be carried out with them near Washington. Gen. Greely thinks it will be possible for these carriages to pay out wire promptly between two points so that telegraphic and telephonic communications can be readily opened. If the experiment is successful, carriages will be used for other purposes by the Signal Service.

Prof. Dewar has recently devised a new method of testing the contamination of air. A short time ago he exhibited before the Royal Institution two samples of liquid air in glass tubes; one was made from air which had been washed to purify it from dust, soot, carbonic acid and other impurities. This when condensed was a pale blue liquid; the other sample was made by condensing the air of the lecture room in which the audience was assembled and was an opaque, blackish fluid, resembling soup in appearance. It would appear as if condensed samples of air might afford an easy means for comparing different kinds of contamination. The American Architect suggests that it would not be difficult to provide a novel but a highly efficient kind of ventilation in military hospitals and other places where the natural air-supply is bad and the necessity for a better one very pressing. As the process would also cool and dry the air, it might serve an additional purpose in tropical countries. The paper goes on to state that it would not be "wholly impracticable to ship to yellow fever hospitals in Havana, supplies of New Hampshire air bottled, so to speak, on the spot, and delivered cool and fresh to the patients." This can never be accomplished, however, until some means have been provided for transporting liquid air to considerable distances without enormous losses, caused by its return to its former state. At present Mr. Tripler has not, we believe, carried liquid air more than six or seven hours' journey from New York. It has, we believe, been successfully carried to Boston and Washington from Mr. Tripler's laboratory in New York.

THE MANUFACTURE OF HIGH GRADE LINEN LEDGER PAPER.



a series of articles published in the SCIENTIFIC AMERICAN of March 19, April 30, and October 15, 1898, we described and illustrated the process of manufacturing paper from wood pulp. Paper of this kind is used for an endless variety of purposes which includes (mentioning them in the order of their quality, and commencing with the cheapest) "wrapping paper;" cheap or "bogus manila." for manufacture into bags; "best grade manila;" "news papers and hanging papers," and "book papers." These are made entirely from wood, spruce and poplar being the particular varieties employed.

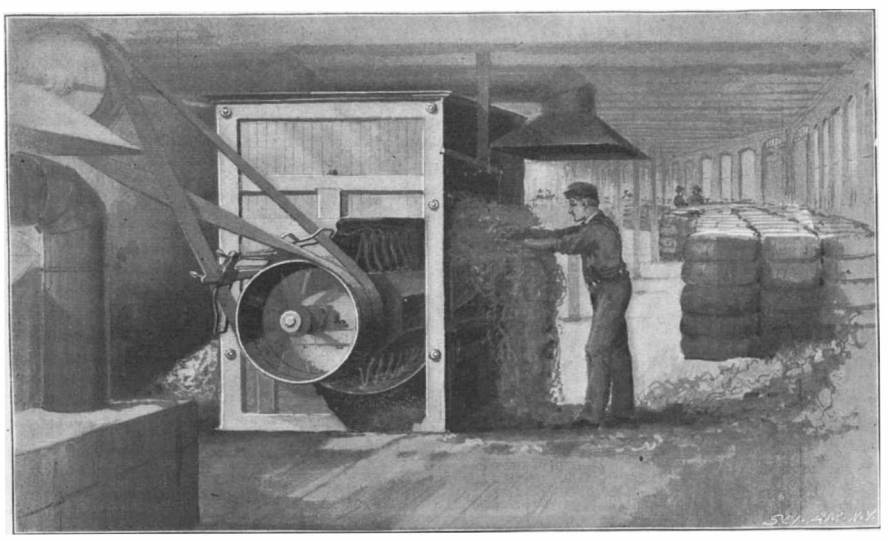
The highest class of paper is known as "fine writing paper," and under this head is included note, bond, bank note, tracing, bank folio, and ledger paper. Much of this is made from a mixture of rag and wood fibers, while the very finest paper of all is made entirely from linen rags and some new cotton. The present article describes the process of manufacturing the finest grades of linen ledger and record paper as carried out at the mills of the Byron Weston Company, of Dalton, Mass., a concern which has been devoted exclusively to the manufacture of this article for the past thirty years.

Before describing the manufacture in detail, it should be explained that in the production of these high grade papers it is necessary to secure great purity and cleanliness throughout the whole process, both in the materials and in their manipulation. Particular attention must be paid to the quality of the water, as in the case of the mills now under consideration, where, although good spring water is available, it was thought best to sink artesian wells and secure a supply entirely free from impurities due to surface drainage. As compared with the cheaper grades, ledger paper requires more time in its manufacture, the total time consumed from the sorting of the rags to the final packing of the finished sheets being six weeks, as against so many hours required in the preparation of the wood pulp papers. The features which are essential in ledger paper, mentioned in the order of their importance, are: 1st, strength; 2d, color; 3d, finish or surface; 4th, erasing and rewriting qualities; and 5th, ability to stand changes of climate without being sensibly affected. The subject of tests is mentioned at the close of this article.

The raw materials consist of new linen clippings from the factories of Belgium, England, Ireland, and France, new cotton from the shirt factories of the United States, and old linen, known as "Italian old linen," from Italy. The last named is thoroughly washed and disinfected and is sealed by the United States consul in Italy before it is shipped to this country. About 2,000,000 pounds of linen and cotton fabric is used up in these mills every year, the proportions being 1,300,000 pounds of high grade linen to 700,000 pounds of new cotton clippings. The cotton is introduced because it has been found by long experience that the proper combination of linen and cotton produces a paper superior to that made from all linen or all cotton.

THE THRASHING ROOM.—The material is first taken to the thrashing room, where it is placed in a closed box (Fig. 5), within which is a drum provided with a number of V-shaped iron beaters. Above the beaters, and extending longitudinally above the drum, is fixed an iron bar, while below it is a curved iron screen. The drum rotates at a speed of 150 revolutions a minute, and by means of the beaters drives the dust through the screen into a dust-box and separates the good rags from the refuse. The refuse or "waste" is put through another thrasher and is then sold to the makers of certain cheaper grades of paper, while the "waste" from the second thrashing is sold to the makers of bag paper.

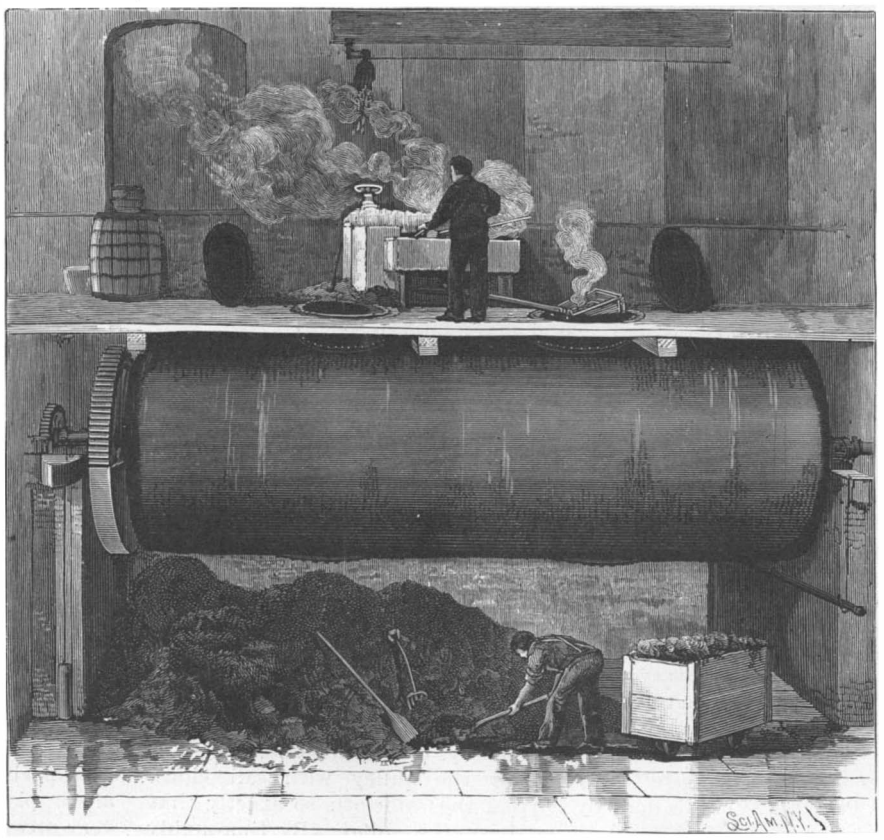
RAG ROOM.—From the thrashers the material is dropped into carts, wheeled to the elevators, and carried up to the rag room (Fig. 7), where from seventy to one hundred girls are engaged in carefully dressing and cutting the rags by hand to the required size, which in nearly all other mills is done by machinery, or a rag cutter. The operators do their work at two long tables which extend down each side of the room. Standing before each girl, and affixed to the table, with its cutting edge facing the table, is a common scythe blade, as shown in the illustration. On the table is a wire screen. The dusted rags are thrown upon the screen, where they are carefully turned over and scrutinized. All foreign substances, such as jute or silk fabrics and all colored rags, are carefully removed. The latter would require chemical treatment, and it is the object of the company to use as little chemicals as possible in preparing the high grade of paper which they turn out, for the reason that such treatment would weaken the fiber and impair its lasting qualities. During the process of cutting, the girls cut the rags to the required size (about four inches in length, or the size of the palm of the hand) by drawing them, a handful



5.—Thrasher, for Cleaning the Rags.

at a time, down the scythes. The cut rags are thrown into baskets and then returned to the table for a second examination. There is a third inspection by the "overlookers," and the rags are finally looked over by the superintendent before being weighed and taken to the dusting room. Although the work done in the rag room might seem to be merely preliminary to the actual work of manufacture, it is actually of the first importance; for careless inspection would result in the introduction of poor or positively harmful material into the paper that would destroy its color, finish and durability.

DUSTING ROOM.—The dusting is done in a closed box in which is a rotating shaft, provided with a number of arms that are arranged spirally upon it, and serve to thoroughly beat the rags and carry away the dust and fine particles of fabric which they contain.



6.—Rotary Lime Boilers.

MANUFACTURE OF LINEN LEDGER PAPER.

In this operation the new and old linens and the cottons are mixed in the proper proportions. After they have been thoroughly cleaned they are ready for transportation from the "Rag Mill" to the "Making Mill."

ROTARY BLEACH.—The first operation in the making mill is that of bleaching. This is done in a large horizontal boiler (Fig. 6) about 6 feet in diameter and 25 feet long, which rotates on a pair of trunnions. The rags are dumped in through a couple of manholes, a solution of lime is run in, live steam is admitted through the trunnions, and the whole mass is boiled, while rotating, for about twelve hours.

RAG ENGINE ROOM.—When the boiling is complete and the vegetable oil, grease, etc., have been thoroughly removed, the rotary bleach is stopped, manholes up, the covers are removed, and the rags are dumped onto the floor and removed in hand carts to the rag engine room. Here they are thoroughly washed with pure spring water, which is drawn from four artesian wells (see initial letter cut) that yield a supply of over 1,000 gallons a minute. The washing engines are similar in construction to the "engine beaters" described in the articles above mentioned on the manufacture of wood pulp. They consist of an oval tank about 3 feet deep, on one side of which is a swiftly revolving drum, which carries on its periphery and parallel to its axis a series of iron blades. The lower half of the drum revolves in close proximity to a curved bed-plate, in which is fixed a series of blades similar to those on the drum. When the tank has been filled with rags and water, the drum is started and the mass is drawn in between the drum and the bed-plate and well drawn out, the friction and rubbing assisting the water in thoroughly cleansing the rags. The pulp slowly circulates round the tank and is again and again drawn in between the drum and the bed-plate, the operation continuing for a space of twelve hours. Fresh water is kept flowing into the tank at one point and the impure water is drawn off through strainers, which allow the water to pass, but hold the pulp. Just before the conclusion of the process a weak solution of chlorine is introduced into the tank. From the washers the pulp is next dropped into a set of drainers (Fig. 3), large brick vaults 10 feet by 30 feet by 15 feet high, which are provided with floors of porous tile through which the water is allowed to drain away.

ENGINE BEATERS.—The bleached rags are now known as "half-stuff," for the reason that they are neither rags nor fiber, being only partially unraveled. In order to thoroughly separate the fibers, the "half-stuff," as soon as it is thoroughly drained, is taken out of the drainers and wheeled in carts to the engine-beaters, which are similar in construction to the washing engines already described, except that there are more knives in the bed-plate and roll. The material is manipulated in the engine-beaters for about eighteen hours; and in this operation great care is taken not to cut the fiber. To this end the knives are much blunter than those used in the wood pulp process, the object being to draw out the rags into fiber and preserve the valuable features of great length and strength of fiber which characterize this high grade linen ledger paper. To give a good color to the paper, a little blue (ultramarine) and red (cochineal) are added in the beaters, with a little resin to size the interior of the fiber and bind the fabric of the paper.

From the beaters the pulp is dropped through copper pipes to the "stuff chests"—large wooden tanks—in which it is mixed with water and agitated by long revolving arms, which reduce the water and fiber to the proper consistency.

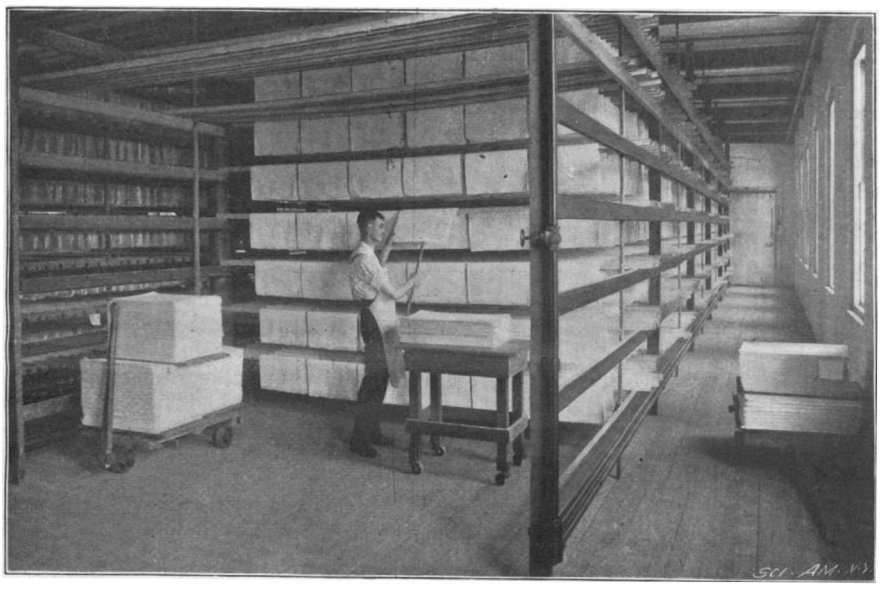
MACHINE ROOM.—From the stuff chest the pulp is pumped up to the "machine room," where it is carefully screened, to take out all foreign matter in the way of hard substances, such as knots or matted fiber, and it is then run out into sheet form on the Fourdrinier machine (Fig. 1).

The pulp first passes into a "flow-box," from which it issues in a broad shallow stream or film onto an endless wire cloth, which has a slight inclination to assist the forward flow of the pulp. The cloth is about 70 inches wide, and the stream of pulp, which in appearance and consistency is not unlike watered milk, is kept from flowing over the edges of the cloth by two endless rubber guides or "deckle straps" which lie upon and travel with the cloth. In order to interlace the fibers, which are floating separately in the water, the wire cloth is given a lateral oscillating or shaking motion, which entangles or interlocks the fibers much as the warp and woof of textile fabrics are interwoven in weaving. As the pulp flows forward, the water drains through the wire cloth, being assisted in this by suction boxes, which bear against the under side of the cloth, and are exhausted by suitable suction pumps. The wire with its layer of pulp now passes under the "dandy roll," which imprints the water mark while the mass is still soft, and then under two successive rolls which

squeeze out some of the moisture. The fiber is next caught up on an endless felt, and passes between a series of rollers which serve to squeeze out part of the remaining moisture. The sheet then begins to travel over and under seventeen successive rolls, at the end of which it is trimmed by having the "deckle-edge" cut off, is slit into sheets of the desired width, and is run through a bath of animal size.

The Byron Weston Company pay the greatest attention to the preparation of this size, as upon its quality and the care with which it is applied depend very largely the quality of the finished record paper. Upon the quality of the sizing depend the ruling qualities of the paper, its erasing qualities, its ability to stand changes of climate and temperature, and very largely its ability to stand continual handling without cracking. The animal size is prepared from rawhide shavings made from the hide of the East India buffalo. The rawhide, which comes to the mill in shredded form, is carefully washed in spring water and boiled at a low temperature, and the resultant liquid is drawn off into vats for further treatment by a secret process. The tank of size stands at the end of the drying cylinders, and after the paper is slit to the proper width, it is run down and through the size, and is then automatically cut to length and laid in piles by the "lay boy."

DRYING AND SEASONING LOFT.—It will be remembered that in the wood pulp process the paper is dried in passing through the steam-heated rolls of the Fourdrinier machine. In the linen ledger paper process, on the other hand, the paper comes from the machine damp with the size, and in order to allow the size to work thoroughly into the interior of the paper and to secure a better seasoning effect, the paper is allowed to dry by being hung in a loft, which is kept at an even temperature. The paper is hung up, four or five sheets



8.—Loft Drying.

together, in "spurs" on the loft poles (Fig. 8), and about fourteen days are allowed for seasoning.

FINISHING ROOM.—The sheets are next taken to the "jogging room," where they are straightened out and arranged in piles ready for the "finishing room," where they are placed in hydraulic presses and subjected to a pressure of 350 tons. They are left in the press for twelve hours and are then taken to the "calenders," which consist of three or four superimposed rolls, with surfaces made alternately of cotton and iron, between which the sheets are passed for the purpose of imparting the smooth finish characteristic of record paper. In this mill it is the object to secure a uniform finish on both sides which shall be smooth but without having any "greasy" appearance. The paper goes through the rolls five or six times, being passed through sometimes with the wrong and sometimes with the right side up.

Each sheet is then carefully inspected by girls, who hold it up to the light and look at it on both sides to detect any imperfections. Next follows an inspection by the foreman and finally by the superintendent, after which the sheets are counted and put up in reams of 480 sheets each. The edges are then trimmed exactly square, and the paper is tied up in reams and labeled for the market.

Every day specimens of the output are brought to the main office to be tested. The tests are made for writing, erasing and rewriting, finish and color, tensile strength and resistance to tearing. The tensile strength is tested on a special machine by clamping the sheet of paper over a 1½-inch hole and subjecting it to pressure with a 1 inch piston and noting the load under which it gives way. Twenty-four pound folio must stand 75 pounds pressure, 28 pound demy, 90 pounds, and 40 pound medium, 100 pounds pressure. These pressures are almost exceeded before the paper gives way.

As an instance of the remarkable density of the paper and the thoroughness with which the sizing had penetrated its texture, we saw the numerals from 1 to 10 written and erased eight times in succession in the same place on a piece of ledger paper without the ink running or spreading on the erased surface.

In concluding our description of this very complete plant, mention should be made of the motive power, which is illustrated on our front page engraving. It consists at both mills of two vertical Hercules turbines of 150 horse power each, running under a head of 23 feet, and a Corliss engine of 300 horse power. Both turbines and the Corliss engine are belted to a shaft which runs the entire length of the mill. A coupling on this shaft enables the company to use 150 or 300 or 600 horse power according as one or both turbines, or one turbine and the engine, or both turbines and the engine are coupled up.

The plant of the company includes two distinct mills, the Defiance and the Centennial. Each mill is complete in itself, and while the description of the process of manufacture above given refers to the Defiance Mill, it would apply equally well to the Centennial, which is the earlier structure of the two.

7.—Rag Room—Cutting and Assorting.

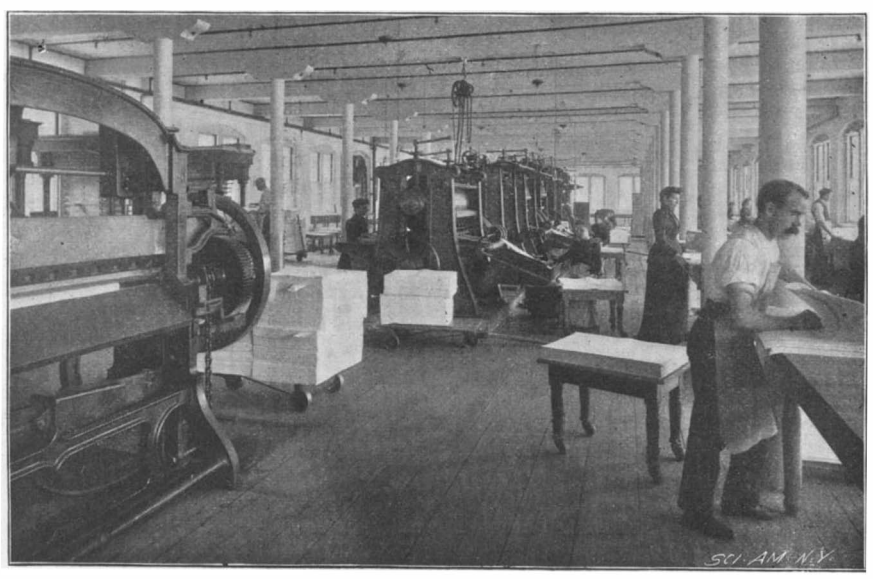
Some Interesting Inventions.

A barrel is a very awkward thing to handle, even with the trucks which are especially designed for carrying them. An Alabama inventor has devised a truck which consists of a pair of curved gripping jaws, somewhat resembling blacksmith's tongs. The levers operating the jaws form the handles of the truck. In practice the truck is run up to the barrel, and the jaws are clamped around the bottom. A clamp holds the lever arms firmly together until it is desired to release them for unshipping the barrel.

Hunters and campers who have used sleeping-bags find that they are comfortable and keep out wet and dampness, but a Canadian inventor has made what really seems to be a substantial improvement upon sleeping-bags. His invention consists of a rigid frame which is collapsible when not in use, and covered with some material intended to withstand the weather. The whole top can be thrown up by means of hinges. At the upper end of the lid is a small opening which is covered with a similar hinged lid. In cold weather this lid may be closed. In mild weather it may be fastened at any desired point. Ventilation is provided through holes under the projecting edge of the large flap.

One of the most perverse things in the world is a refrigerator cover. It is necessary to have the refrigerator stand well away from the wall in order that the cover may lie back against it when ice is being put into the refrigerator, or articles of food taken out. A Missouri inventor has devised a lid retainer for iceboxes, which permits of having the icebox pushed up against the wall and will hold the lid when it is thrown against the catch. It consists merely of a post extending upwardly from the rear part of the icebox and a detent pivoted to its upper end in such manner as to engage the forward edge of the box lid when it is thrown back.

A novelty is an electric fan worked on the principle of the nickel-in-the slot machine. When it is desired to operate the fan a nickel is dropped into a slot back of the fan, and a refreshing current of air is obtained until a certain predetermined amount of current has been used and the current is cut off. Many persons are deterred from having electric fans owing to the considerable initial expense, and by the fact that they can be used only three or four months of the year. The inventor considers that fans would be more generally used if the breeze could be supplied by expending a small sum.



9.—Finishing, Trimming, and Counting.

MANUFACTURE OF LINEN LEDGER PAPER.

A Case of Triple Personality.

The Pathological Institute of the New York State Hospitals for the Insane (Boston Medical and Surgical Journal, February 23, 1899) has recently reported a case of great scientific interest occurring in the department of the institute devoted to psychology and psychopathology. The case is a remarkable one of amnesia, the patient being a clergyman about twenty-six years old, who fell out of a wagon, and, striking upon his head, became unconscious. When he recovered from the stupor, it was found that he had completely lost his memory and that his personality was lost with it. His mental condition was that of an infant, and in the course of education to which he was subjected he developed a new personality, totally different from the old. He next manifested the phenomena of alternating personality—for instance, falling asleep in his secondary personality and awakening in possession of his primitive personality, and vice versa. Neither personality was at all conscious of the other. The patient thus had two consciousnesses, which he possessed at different times, but between which there was absolutely no communication. The problem was how to unify this double consciousness. This was attempted by preventing him from lapsing into profound slumber, keeping him in a condition between sleeping and waking, and the result proved successful. As a consequence he developed a third personality, which was conscious of the other two personalities, and this finally filled every gap in his memory. Dr. Van Giesen, the director, speaks of the case with satisfaction, and expresses the opinion that it shows an advance in the domain of psychology.

A WRITER in Uhland's Wochenschrift says: Perhaps the first industrial exposition on record was held in 1569 in the Rathhaus of Nuremberg. A catalogue published at the time thus states the purpose of the exposition: "It shall bring before the public all innovations in the trade of the whole world in modern times, together with domestic art-productions."

BRUGSCH BEY has lately described a comic papyrus which is unique. The artist lived in the period of the XXII. Dynasty, and has painted burlesque scenes in which cats and rats conduct themselves like human beings. For instance, a rat attired as a great lady was served by a cat who is clothed as a slave and is presenting a mirror to the mistress.

Life in a Winter Bee Cellar.

BY GEORGE E. WALSH.

When the cold days of October and November chill the air to a freezing temperature, the honey bees go into their winter quarters, and enter upon their long period of hibernation. The mystery of the winter sleep which overtakes so many of our animals, insects, and reptiles is studied to the greatest advantage in a modern bee-cellar, where the little honey gatherers can be examined at leisure in the various stages of somnolence that so closely resembles death. In the last twenty years science has made such revolutions in apiculture that it is possible now to get a glimpse inside of a hive of bees at almost any time without disturbing its inmates.

With the instinct of self-protection the wild bees always built their homes in hollow trees or posts where they could huddle together for mutual warmth when autumn came, but in spite of this the mortality was so great among them that their numbers did not increase rapidly. Some winters they were slain by the thousands and whole swarms would be frozen to death. The farmers who first attempted to cultivate the acquaintance of the bees for the honey they could induce them to raise always expected to lose more than half their colonies in particularly severe winters.

In the North the apiarists generally have large bee-cellars where the little insects are kept through the cold winter months. These cellars are models of sanitary construction, for in its artificial home the honey bee is very susceptible to little diseases that never bothered it in its wild state.

The bee-cellars are constructed so that perfect drainage is obtained, for moisture in a bee-cellar means death to its inmates. Then some simple but effective ventilation system is adopted. The temperature of the cellar must be kept low, just above the freezing point, throughout the winter months. Heat is supplied for very cold weather by hot air or an ordinary stove. A thermometer is always kept in the cellar to see that an even temperature is maintained.

In this cellar the bees are brought from their summer stands as soon as the weather is cool enough to warrant the change. The summer hives are carted to the cellar, and one piled upon another in tiers reaching to the roof. Between each tier there is a small space to permit the owner to reach any particular hive, and between each hive a strip of wood is placed to separate them sufficiently to allow a free circulation of air. It is quite a question of science sometimes to keep the right temperature for all the bees, because the outer hives must of necessity be exposed to cold draughts more than those inside, but the apiarist is supposed to overcome this difficulty by the peculiar arrangement of his heating apparatus, and by additional protection for some of the exposed hives in the shape of a straw covering. A current of cold air is sometimes artificially forced through the cellar.

The temperature of the cellar is so low that the bees are in a semi-hibernating condition all winter. It would not be profitable to the apiarist to raise it so that they would be stirring around, for bees, like all other hibernating creatures, are very hungry when they wake up from their long sleep. In the midwinter thaw, which nearly always visits us in January or February, the weather often becomes so mild that the bees wake up of their own accord, and show a decided propensity to fly about. They imagine that spring has arrived again, and if they have the chance, they fly about. The owner does not discourage this desire for exercise, but approves of it, and gives the insects all possible encouragement. A little flight in the middle of the day gives them fresh air, and enables them to void their intestines, which reduces their chance of serious diseases.

But in this midwinter flight many of the bees sometimes get lost, or, becoming chilled and benumbed, in their return trip to the cellar they drop down in the grass and die. Thus in bee-keeping districts it is not at all uncommon to find bees crawling about in the grass in the middle of winter. It may be concluded for certain that they are from some neighboring hive from which they have strayed too far. Frequently the bees fly about in all directions, apparently looking for flowers, but, not finding any, they return to the hive without having once lighted. It is probable that they have become so disgusted with the country that produces no flowers with nectar in their chalices that they prefer to return to their warm hive, where at least food can be found.

This food given to the bees in the winter is not as desirable as honey. It is generally compounded of cheap glucose, sugar, and water. The bees do not even like pure sugar as well as honey, but they will eat it in the absence of their favorite nectar. Considerable of this food has to be given to the bees in their winter quarters. It is put in the artificial comb, and artificially capped where the bees can reach it when they require it. If this food should give out unexpectedly in the winter, the bees would quickly starve to death unless it were replaced.

The bees cluster together in the hives in their winter quarters like bats hibernating in a cave. They cling so closely together that they look like a big mass of inanimate insects. Occasionally a leg or wing will move to show that they are alive. Those in the center of this swarm are kept very warm by the heat imparted to them from the bodies of the others, and they are frequently the liveliest of the whole lot. They will wriggle and squirm around sometimes so that the whole mass will vibrate. It would seem as if their sleep was a little restless, rendered so probably by a too high temperature.

The bees on the outside of the mass are so far gone in their slumbers that they can be picked up with impunity and examined. There will be no attempt to sting the hand that lifts them unless the warmth from it furnishes them with new life. Their hibernating period ends just as soon as spring begins to warm the air, and then they grow restless and anxious to get out of their winter quarters.

The first consideration is to see if the queen is all right in each hive. Sometimes it is difficult to find the queen in the midst of the newly awakening horde of insects, but it is an easy matter to discover signs which indicate her presence. For instance, if the brood and eggs are numerous and in good condition, he knows that the queen has successfully performed her duty; but if there are no eggs and sealed grubs visible, the colony is in a critical condition, and something must be done very soon. The modern hive with its movable frames and artificial combs enables the apiarist to act quickly, so that a queenless colony may sometimes be strengthened. Going to a colony with a queen and plenty of brood, the apiarist takes out one of the movable frames of brood, and puts it in the hive without a queen. This soon works magic results. The few surviving members of the depleted colony take it upon themselves to hatch out the new brood, with the hope that a new queen can be raised by them. The loss of a queen is so discouraging to a colony of bees that the little insects will lose all ambition, especially in cold weather. In the summer time a queenless colony can receive a new queen by the introduction of a new one by means of the artificial queen cage.

All of the modern devices and improvements in bee culture help to simplify an industry that has taken rapid forward strides in the past quarter of a century.

There is as much science in apiculture to-day as there is in tilling the soil for intensive farming. The bee-keeper is supplied with almost as many implements as the farmer. The hive itself is a wonderful piece of mechanism. The Langstroth hive, ingeniously devised and patented by Dr. Langstroth about thirty years ago, is the foundation for all of the modern hives, which are simply modifications of the original. These hives are manufactured by machinery, and they are so cut and arranged that they can be shipped in sections to any part of the country, at little cost, and then be put together by a boy. They are usually sold in lots of a dozen or more, with the sections cut in single pieces of wood, grooved and creased, so they can be bent around and locked as easily as one would put a picture puzzle together.

The Langstroth hive and frame created the first and probably the greatest revolution in bee-keeping. The movable frame is a device by which the inside of the hive can be removed by sections, and without disturbing the bees in other parts of the hive. Thus the comb honey in one section can be removed, while the bees are scarcely aware of it. The next greatest invention was the centrifugal honey extractor. This extractor enables the apiarist to take from the natural honey comb all of the honey without disturbing or breaking the comb. Then the bees proceed to fill it again with a new crop of honey. Thus the apiarist keeps stimulating the bees to greater effort to fill the combs before the season is over. The comb foundation was another great invention. This foundation saves the bees many hours of work. Broken, dirty, and brood comb can be taken and placed in the hive by means of the comb foundation, so that the bees will make a full one much quicker than if they had to lay the foundations of an entirely new one. The modern method of introducing Italian queen bees in the hives is probably fully as important in its results as some of the foregoing inventions, and it should be classed high among the factors that have brought larger profits to the apiarists in all parts of the country.

The Electricity Building at the Paris Exposition.

The building which will be devoted to the electrical exhibits of the Paris Exposition will be a most remarkable structure. It is so florid and ornate that it resembles no other building ever constructed. It will undoubtedly be the most striking building which is seen on entering the grounds. The façade has a richly ornamented portico, and directly in the middle is an enormous fountain which masks three-quarters of the central part of the facade. It is what is known as a "Chateau d'Eaux," and consists of a deep niche with steps at various levels over which water will flow, and a group of sculpture will terminate it. The building will be made of staff and will be brilliantly treated in color.

Archæological News and Notes.

The great glory of Chesterfield House, London, is a marble staircase, each step of which is formed of a single block of marble more than twenty feet long.

The death is announced of Mr. Charles Edward Drury-Fortnum, who is well known as an antiquarian. In 1888 he presented his splendid collection of plaster and Renaissance art objects to the University of Oxford. He was a great authority on gems, bronzes, and majolica.

An important work is soon to be begun at Spalato, in Dalmatia. This will be the building of a central museum in which the collection at present scattered among four buildings will be brought together, including the objects found at Salona and in the Palace of Diocletian.

The English archæologist, Mr. Phillips, has offered Signor Baccelli, the Italian Minister of Public Instruction, the sum of $12,500 for the carrying out of investigations in the Forum. The money will be largely used in expropriating the houses now standing about the ruins of the Basilica.

The plan for reviving the business in the Palais Royal at Paris is under consideration. If this is done, the quiet of the garden in the center of the buildings will be destroyed and it will be turned into a thoroughfare between the great boulevards and the quarter of the Louvre, thus sweeping away one of the oldest landmarks in Paris.

The architect, M. Redon, who has charge of the Louvre, has resolved to restore the Tuileries Garden to the condition in which it was in the days of La Nôtre. As the palace does not exist to-day, it is impossible to say whether the old artificial style will be more pleasing or not. It is an interesting experiment, however, and well worth trying.

Heinrich Kiepert, probably the greatest authority on the geography of antiquity, recently died at the age of eighty-one years. He was professor at the University of Berlin. His "Atlas of Hellas" began to appear in 1840. His greatest work is his "Map of Asia Minor." He also published a general atlas of the world, which is one of the best modern German atlases.

It is proposed to erect a statue at Vendome, in Touraine, France, of Marshal de Rochambeau, who commanded the French forces serving in the American Revolutionary war. The Historical Society of Philadelphia has subscribed $1,000. It is hoped and proposed that Philadelphia, Boston, and New York each will subscribe $1,000, and that a like sum be raised in France by subscription.

In Paris, May 1 is supposed to be inaugurated by the discharge of the cannon in the Palais Royal, the powder being ignited by the sun. This year, however, the function was delayed several days owing to bad weather. The cannon is of considerable historical importance. According to The English Architect, it was presented in 1786 by Rousseau and was well known to Camille Desmoulins.

Dr. Ernest Steinmann, the well known art writer, has just made some interesting discoveries in the Vatican. The Stanze of the Vatican contain the wonderful frescoes executed by Raphael and by his pupils. Before the great master had demonstrated his wonderful ability by painting the School of Athens, some of the other artists attempted to paint the walls. Remnants of these early paintings have now come to light. They are of no great importance in the history of art, but they suggest that the whole of the walls of the Stanze were covered with a series of paintings which may have helped Raphael or rather given him ideas of the great work which followed. There is considerable conjecture as to this however, as Raphael was too much of an originator to be very much helped by the work of inferior men, although he did not hesitate to assimilate the ideas of the masters of all time.

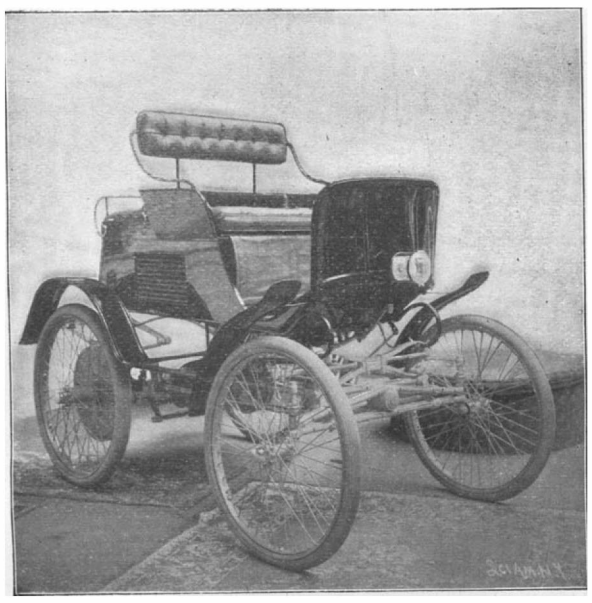
Students of architecture may have often wondered how the two towers of Nôtre Dame, at Paris, were not of the same size. A writer in one of the English magazines has found a rather curious explanation. It appears that when the cathedral was built it was the cathedral of a suffragan bishop, who was not entitled to two towers of equal height, and for centuries the Bishop of Paris was suffragan to the Bishop of Sens.

Explorations are proceeding rapidly in the Forum, Rome, and following upon the expropriation of the site of the Basilica Æmelia comes the good news that the ugly seventeenth century church of San Lorenzo, in Miranda, which has disfigured the beautiful temple of Antoninus and Faustina, is to be taken away, so that the remains of this imposing temple will now be revealed in all their beauty. The columns are the largest of their kind in Rome, being fifty feet high and ten in number. The three large steps of the portico which descend to the Via Sacra have now been entirely cleared of rubbish, so that not only is the majestic flight of steps which led up to the temple actually seen for the first time for at least fourteen centuries, but the actual width of the Via Sacra in front of it is likewise for the first time actually made known.

WAVERLY ELECTRIC RUNABOUT AND COLUMBIA ELECTRIC EMERGENCY WAGON.

At the Electrical Exhibition just closed at Madison Square Garden, there were shown several neat-looking electric vehicles by the Indiana Bicycle Company. Among them is an electric runabout designed mainly for two persons, but finished at the back, over the rear extension of the body, with cushions for seating one or two others, intended as an emergency seat. Such construction avoids the over-heavy appearance sometimes noticed in other similar vehicles.

As will be seen in the illustrations, one showing a



THE WAVERLY RUNABOUT.

front and the other a rear view, the framework and running gear is somewhat peculiar, built of steel bicycle tubing on what is called the bridge or truss plan.

The front portion of this double tubing is bolted to the front truss-shaped axle and permits the body to tilt slightly when the vehicle is on a side hill. At each end of the trussed axle are vertical crooked axles bending outward horizontally at their lower ends on which the front wheels run, and connected at the upper ends with the steering rod, which rises through the front part of the carriage, where it is jointed so that the handle may be in a horizontal position. In the rear view it will be observed that the method of applying the power is from a single motor shaft by pinions meshing into two large gear wheels on the main axle covered with metal casing. The motor shaft is hollow and runs through the center of the armature of the motor, and contains within itself differential gear for allowing one wheel to turn faster than the other. The brake band is applied to this motor shaft in a very simple way, and is operated by a small foot lever located near the dashboard.

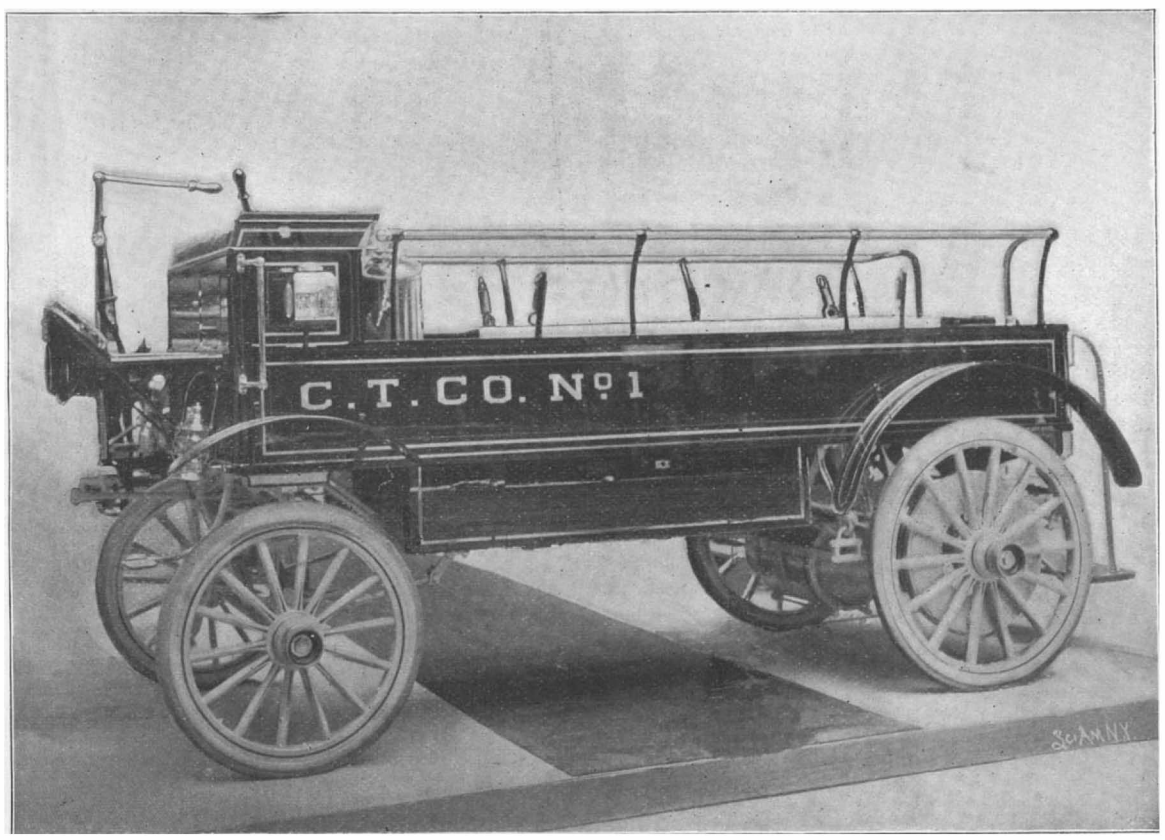
The controller is under the front seat, and the operating lever is on the left hand side. This is arranged with a movable press button on the end, which, when pressed inward, enables the current to be reversed for backing the vehicle. In addition to the controller there are one or two small resistance coils attached to the underside of the bottom for equalizing the sudden application of the current in starting or in changing the speed.

The storage battery employed is of special construction, made by the company, and yields a good percentage of current put into it. In this vehicle it weighs 500 pounds and has a capacity sufficient to run the vehicle a distance of about 30 miles on a fairly level road. The motor yields 1½ horse power under ordinary circumstances, but will give more when pushed. An electric dash lamp is on the front. This style of vehicle is quite popular in the West and contains the elements of strength, lightness, economy, and capacity.

The large illustration shows a new style of an electric emergency wagon exhibited by the Columbia Automobile Company (formerly the Pope Electric Vehicle Company), built for the Consolidated Traction Company, of Pittsburg, Pa. This vehicle is designed as an emergency and repair wagon for street railway service, carrying a crew of four or five men at a speed of ten miles per hour for eighteen miles, this distance, however, being much in excess of the requirements in this particular class of work. It carries a full equipment of all appliances and tools ordinarily required on wagons of this type—fire extinguishers, extension ladders, stretcher, lanterns, and a complete kit of linemen's tools and apparatus. The illustration shows the stretcher hung on springs over the aisle space. The batteries, of the chloride type, weigh 1,400 lbs., and are carried in trays beneath the main body, and are removable at the side. The total weight is 4,500 lbs. Wooden wheels, 42 inches in diameter at the rear and 36 inches at the front, with solid tires, are used.

An interesting feature of the running gear of this vehicle is that no reach connection between the front and rear axles is employed. The place of the reach is taken by a combination of pieces, forming a truss which reaches from the front axle backward and upward against the body, bracing it against direct head-on strains. A single reduction of gearing is used on this wagon. The entire driving mechanism, motor, balance gear, and driving shafts, forms a compact unit which is rigidly held in alignment by the rear axle and rear cross tube. A 5 horse power Westinghouse motor is used. The motor frame is enveloped in a water and dust proof casing covering all parts except the driving pinions, which have a separate housing. The steering lever is mounted just back of the dashboard and operates the front wheels parallel together in the usual way. On the left is the controller lever, and behind the seat will be noticed a fire extinguisher. The body is finished with Tuscan red, black mouldings, gold stripe edged, with fine line of black, fine line of yellow surrounding panels an inch from gold line. The running gear is yellow with black stripe. The wagon can be turned around in 40 feet, which is a comparatively small circle, considering the dimensions, which are width over all 6 feet, length over all 15 feet, height 6 feet 7 inches.

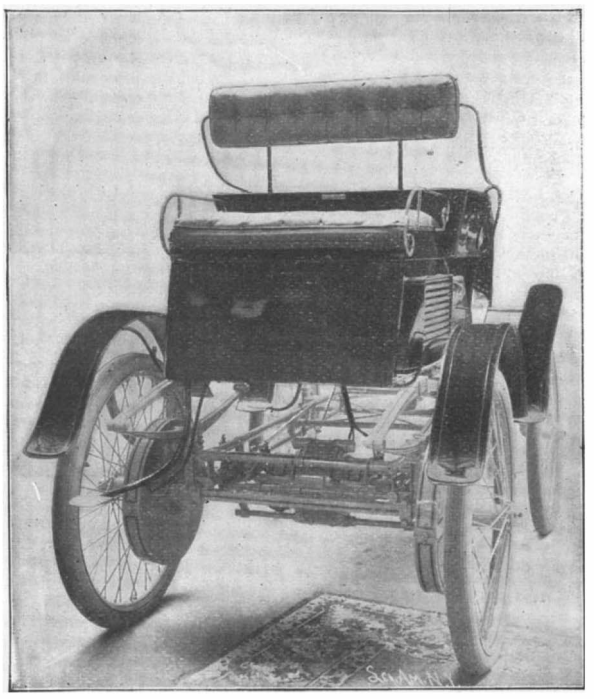
It will evidently be much more economical for trolley companies, having a constant supply of electricity at hand, to possess a vehicle of this character than to maintain a team of horses. It would also be a useful vehicle for small towns to possess where it is desired to establish fire service.



AN ELECTRIC EMERGENCY AND REPAIR WAGON.

Manufacture of Marmalade in Scotland.

In reply to inquiries by a California company, Consul Higgins, of Dundee, says: The manufacture of marmalade forms a considerable industry in this city. It is made in two kinds, known to the trade as "marmalade" and "home-made marmalade." In the former case, all the white substance adhering to the skin is retained, while in the quality known as "home-made" this is carefully removed and the outer skin but sparingly used, giving the preserve the appearance of a jelly. The skins are cut in quarters by hand, and parboiled in barrels arranged in a line and having a steam pipe running along the top, from which branches pass down the center of the barrels. Seeds and fibrous matter are removed by machinery. Bitter oranges only are used, and come from Spain. In the best qualities, pure sugar is used; in the cheaper varieties, inferior sugar mixed with glucose in a proportion varying from 3½ to 7 pounds for every 100 pounds of sugar. The cost of a 15 horse power boiler is $973. This will supply heat to six pans, from which 5 or 6 tons a day can be turned out. Jam-boiling pans of 60 pounds pressure cost $67; of 90 and 120 pounds pressure, $76 and $85, respectively. These are of the same size, the additional cost being due to the heavier copper for the high pressure. A small horizontal engine with governor costs $171; chipping machine for skins, $124; pulping machine, $110; machine for "home-made" marmalade, $124; shafting,



MOTOR AND DRIVING GEAR OF THE WAVERLY ELECTRIC RUNABOUT.

hangers, and drums, $42. These prices are on board steamer at Dundee.

The June Building Edition.

The SCIENTIFIC AMERICAN Building Edition for June is an unusually attractive number of this interesting periodical. A fine Colonial house at Holyoke, Mass., is the subject of the colored cover. The new Hudson Park in New York city occupies the first page; then follows a selection of houses and churches, accompanied by interior views and plans. The restored Independence Hall, at Philadelphia, makes an excellent page. The literary contents of the number are up to the standard.

The Current Supplement.

The current SUPPLEMENT, No. 1223, has many articles of unusual interest. The front page is taken up by six handsome engravings of "Scenes in Matanzas." The "Relation of External Agents in Plant Reproduction" is a lecture by Stewardson Brown. "Earth Worms" is an article by M. C. Holmes. "The Wehnelt Interrupter for Induction Coils" describes an interesting form of apparatus. "A Thousand Days in the Arctic" is a review of Frederick G. Jackson's experiences in the Arctic regions as leader of the Jackson-Harmsworth expedition. The passage relating to the meeting of Nansen is given in full. Among the other articles are "The Commercial Development of Germany;" "The Progress of Submarine Navigation," with 18 illustrations; "Rapid Blue Print Processes;" "The 'House in the Woods' at The Hague;" and "Enameling as an Industry," complete this very interesting paper.

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RECENTLY PATENTED INVENTIONS.

Electrical Apparatus.

ELECTRIC ARC LAMP.—Paul Mersch, Paris, France. Solenoid-coils are employed having cores movable therein, with which one carbon-holder is directly connected. The other carbon-holder is so connected with the first holder that it moves in a direction opposite thereto. The solenoid-coils are electrically connected in parallel with each other and with the carbons. As the carbons wear away, a steadily-increasing main current will pass through the solenoids until their magnetic effect becomes sufficiently powerful gradually to attract the cores, which will, accordingly, transmit their motion to the carbon-holders so as to bring them nearer together, this movement of the holders being never more than necessary to take up the wear of the carbons.

TELEPHONE-TRANSMITTER.—James H. Spencer, Manhattan, New York city. The transmitter comprises a disk which is slightly dished on both faces and which is of considerable thickness, so as to be but slightly flexible. Clamps are provided, which are curved to bear only on two points of the disk. A button is carried by the disk and another by the transmitter-frame. By holding the disk securely and by connecting one of the buttons rigidly with the disk, sufficient vibration is given to the button readily to transmit sounds to the receiver. By forming the transmitter with a heavy disk the instrument is rendered more durable.

Mechanical Devices.

SUGAR-CUTTING MACHINE.—Gustav Stoff, Berlin, Germany. This invention provides a machine which automatically cuts rods of candied sugar into pieces of certain lengths, the rods being fed by spring-pressed rollers to a pair of rotating cutters, each having blades arranged tangentially in order to cut the rods into pieces. The inventor has endeavored to provide means for regulating the pressure of the feed-rollers at pleasure by providing universal joints between the top feed-roller and its driving-shaft, and by providing a chute by which the stump, or last piece of sugar rod, may be separated from the cut pieces.

SCREENING-MACHINE.—Joseph M. Elder and Oliver W Dunlap, Bloomington, Ill. The machine devised by these inventors is especially designed for screening the moist and sticky clay used in the manufacture of bricks. In an inclined frame an endless screen is mounted, which is composed of pivoted sections, and which has motion in an upward direction. A discharge-chute is arranged between the runs of the screen and has its lower end terminating adjacent to the lower screen-carrying wheels, whereby the refined material is discharged between the sections of the screen.

MACHINE-DRILL SHARPENER.—James J. Brossoit, Butte, Mont. The sharpener comprises an anvil reciprocated by a hammer provided with swages for the flanges of the drill-shank. A cam-arm is adapted to engage the top edge of the hammer to lock the hammer in place so that the flange-swages are caused to clamp the drill. A reciprocating end swage at an angle to the other swages is adapted to operate on the end of the drill. By means of this device one workman can sharpen a large number of drills in a very short time.

Miscellaneous Inventions.

MINING-HAMMER.—Frederick R. Waters, Ouray, Col. To construct the head of a hammer so that it can be used for removing as well as driving a drill is the purpose of the present invention. To this end the hammer-head is provided with a central transverse groove extending across its outer side and adapted to fit upon or receive the body of the drill.

TURBINE WATER-WHEEL.—John Sharpe, Gravenhurst, Ontario, Canada. Leading to a tank are two flumes, each carrying and communicating with a casing. Gates command the flumes, which are respectively movable into the casing to open the flumes. A stem connected with each gate passes through a guide-bar extending between the casings. A lift is used in connection with the stems of the gates, and is raised and lowered by mechanism to operate the gates.

FLOUR-BOLT.—John Charles, Charlton, Md. This invention provides improvements whereby the gyratory movements of the superposed sieve-boxes, may be caused to compensate one for the other to avoid the jar which would otherwise result, and also to reduce to a minimum the wear on the eccentrics and shafts and their bearings. The invention, although primarily useful in flour-bolts, is also serviceable in scalpers, graders, separators, and like machines.

HOT BLAST BOX.—Sidney E. Bretherton, Silver City, New Mexico. By means of this invention the waste heat of slag can be utilized for smelting purposes. The box is horizontally mounted in the upper part of inclosing walls, and has a longitudinal partition, with inlet and outlet openings. A series of vertical tubes extend through the compartments, open through the top and bottom walls of the box, and constitute draft-passages for the hot currents from the subjacent slag. The inventor claims that by means of his device a larger furnace-capacity is obtained, that tuyères keep open better, and that the slag derived from the matte is exceedingly clean and free from values.

DEVICE FOR FASTENING CURTAINS TO VEHICLE-TOPS.—Nels J. Bottger, Clyde, Kan. This device consists essentially of a peculiarly-formed clasp and buckle which, when locked together, cannot accidentally become disconnected, but which however, can be readily locked and unlocked. The latch consists of a skeleton frame formed with spurs, a tongue projecting from the upper central portion, and a lip projecting from its lower portion. An auxilary tongue is secured to the frame in the rear of the first-named tongue. A backplate is provided upon which the spurs of the body are bent after having been passed through the curtains. The auxiliary tongue serves the purpose of preventing the curtain from becoming accidentally disconnected from the top of the vehicle.

MOLD FOR PISTON-PACKING.—Frederick Van den Bosch, Parker's Landing, Penn. This inventor has already received letters patent for a piston-cup or packing-ring composed in part of vulcanizable material, the cup or ring being particularly adapted for such pistons as are commonly used in deep wells, and, therefore, subjected to great strain or wear. The present invention comprises improvements in the mold and in the means for temporarily clamping its detachable parts together, as required for imparting the desired shape to the cup or ring and holding it duly confined while being vulcanized.

FRUIT OR VEGETABLE PRESS.—Julia A. Ware, Salida, Col. The object of this invention is to provide a vessel or receptacle in which fruit or vegetables may be cooked, and to provide means whereby the vessel or receptacle may be utilized as a press or a strainer for potatoes or other vegetables, or for making wines or jellies. The device comprises a vessel in which a strainer is supported. In the strainer a hollow plunger moves. From side to side of the plunger a cross-bar extends with which a rod is connected having a lever for operating the plunger.

TOY.—Napoleon E. Beaudoin, Jersey City, N. J. This toy consists of a pan, in the center of which a post is adjustably mounted, which post is adapted to receive a base block upon which a United States flag is secured. By dextrously jolting the pan, the player strives to throw the base-block and attachments thereon upwardly, so as to lodge the base-block on the post—a feat which requires no little adroitness.

LOCK FOR PRINTERS' GALLEYS.—William C. Barnes, 1733 Q Street, Washington, D. C. The lock comprises a foot and a side locking stick, or member so constructed and applied to the galley that it may be quickly adjusted to any point between the side surfaces. The foot-member has adjustable and clamping engagement with the side member and is adapted to engage with the foot of the matter set up and with the side of the galley. A clamp is provided for the two members which may be readily tightened up or loosened.

BUTTER SHREDDER.—Vallie G. Tice, Spring Creek, Penn. To mold butter which has been in cold storage requires an increase in temperature, which often injures the quality and the flavor. The object of the present invention is to provide a device which prepares the butter so that it may be worked into prints without raising the temperature. The mechanism used for this purpose comprises a rotating disk having radial slots and one or more toothed knives upon which the butter is placed and upon which it is shredded by the rotation of the disk.

PERMUTATION-LOCK FOR TOY SAFES.—Charles Rossignol, Paris, France. The lock consists of a bolt supported in the door and lock-casing and carrying screw-threaded knobs, which operate ratchets having screw-threaded shanks and notched bosses. Springs used in connection with tongues are adapted to prevent a retraction of the bolt, unless the notches register with the tongues. Lettered disks are employed to indicate the correct position of each notch.

SURVEYOR'S PLUMB-BOB.—Isaac A. Martin, Ouray, Col. The novel features of this invention are found in the means provided for drawing up the suspending-cord within the bob. The means in question consist of a spring-operated reel controlled by a system of gearing. In using plumb-bobs in surveying, it is often necessary to shorten or lengthen the suspending cord quickly. By means of a device of the character described, this result can be attained.

EXTENSION-TABLE.—John T. La Turno, Grand Tower, Ill. The table comprises two separable sections. Arms are pivoted to swing in the arc of a circle at the central portion of the table and carry extension-leaves rigid with the arms so as to be capable of moving from an inclined position to a horizontal position. Inclined projections carried by the table-sections are arranged successively to raise the extension-leaves as the sections are moved apart. Any desired number of auxiliary leaves can thus be automatically and successively placed in position upon drawing the table-sections to the desired length of extension.

LACE-FASTENER.—Anna Hanson, Jackson, Mich. To provide a fastening device especially adapted for use in connection with shoe-laces, which device will be independent of the lace and the shoe to which it is applied, is the purpose of the present invention. The fastener has two sections hinged together, one of the sections having a cavity and recesses in its opposite sides. Through these recesses the bows of the lace may be passed. The other section has a slot adapted to receive the standing parts of the laces. A catch removably holds the sections engaged with each other.

BEDSTEAD-FASTENING.—Frank A. Hall, Montclair, N. J., and Edward F. Tilley, Brooklyn, New York city. This invention relates to bedstead-fasteners in which the side rails of the frame are joined to the posts by means of coacting hooks and pins, and in which the fastening is made rigid and unbreakable by constructing the two parts so that there is produced between them a binding action in addition to the connection of the hooks and pins.

LOTION.—Charles E. Grapewine, San Diego, Cal. This lotion, for use upon the skin, is of a semifluid or cream-like consistence, and consists of cooked and defibrated lemon and salt, the proportions used being one-half pound of salt to one gallon of the lemon ingredient. The lotion is produced from the oil, the starchy substance of the pulp, rind, and seed, and the juice contained in the lemon, these ingredients being thoroughly mixed and cooked with the addition of salt.

Designs.

PLOW-UPRIGHT.—Henry H. Straughan, Dillon, S. C. The upright has a base from the rear end of which rises vertically a wing, the upper end of which terminates in a threaded tenon. Another wing rises from the front end of the base-wing and is bent back, then forward, and finally down.

TOOL.—William W. Brownell, Lake Placid, N. Y. This tool is a hammer having two sets of claws, one in front of the other. The claws are adapted successively to engage the nail to be drawn, thus giving two degrees of leverage.

CLOTHES-FORK.—John A. Olson, La Grange, Ill. The fork consists of two pieces of spring wood fastened together at one end. The fork prevents the scalding of the hands in removing clothes from wash-boilers.

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

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Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

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(7670) H. H. G. writes: I wish to show the number of people in a room. This room is only lit up by gas light. It is not necessary to show the features or other portions of their anatomy. A dark spot on the picture will suffice. Can this be done by photography, and how long an exposure is necessary? Can it be done by gas light? A. Of course a photograph can be taken which will show the number of people in a room unless some are behind others. An exposure of 4 to 10 minutes by gas light will probably be necessary to do this. The time necessary depends on the brightness of the gas. Why not try a flash light?

(7671) H. K. says: Will you kindly give us through your columns the formula of a solution for coloring steel both brown and blue, to give it the same appearance as is given to gun barrels? A. We recommend you to purchase a copy of the Scientific American Supplement, No. 830, which contains an article entitled "Gun Wrinkles," which deals with the blacking, browning and bluing of gun barrels.

(7672) H. S. asks: Will you kindly answer in Notes and Queries the following questions concerning the high frequency coil described in Supplement, No. 1087? 1. Approximate amount of No. 31 wire needed. A. About 1 pound of No. 31 wire is required for secondary of high frequency coil. 2. Meaning of the words "Between wires of different polarity" at the top of page 17378. I do not see how two such wires can be close enough to need extra insulation. A. Potential would be better than polarity in this phrase. 3. Number of amperes such a transformer will consume. A. A No. 8 wire will carry 30 to 40 amperes. Hence the primary will stand 100 amperes without overheating.

(7673) P. P. Company ask: Does an electrical meter register a greater number of watts when a motor is pulling a two horse load with 90 volt current than it does when pulling the same load with 110 volts, the motor being wound for 110 volts? A. Yes; the motor works at best efficiency only when fully loaded and fully supplied with current.

NEW BOOKS ETC.

Report of United States Commissioners of Fish and Fisheries. 1898. Washington. 1899. Pp. 350.

This volume contains photographic illustrations of the exhibits at the Tennessee and Omaha Expositions, illustrations of the hatcheries at various points, a report of mackerel investigations, statistics regarding the yield of the numerous localities, pictures of peculiar fishes on the coast of Southern California, an extensive report on the oyster beds of Louisiana by H. F. Moore, another report on "The Shad Fisheries" of the Atlantic coast of the United States by Charles H. Stevenson, and a report of the investigations in Mississippi, Louisiana, and Texas. There are also numerous engravings of new fishes.

The Photo-Miniature, a magazine of photographic information, has just begun publication in New York city, Messrs. Tennant & Ward, 289 Fourth Avenue, being the publishers and Mr. Tennant the editor. Periodical photographic literature is already so enormous that it is very hard to welcome even the little stranger to which we have referred. While we do not see the need for the publication of another photographic journal in America, we have no hesitation in saying that "Photo-Miniature" is a very handsome publication. The number is given up to an excellent treatise on lenses and is well illustrated, and the idea is, we believe, to devote an entire number to a single subject, as in the present case, where lenses are treated. The subscription price is $2.50 per annum.

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Milk cooler, W. A. Nash	625,982
Mill. See Feed mill. Quartz mill.	
Mill for grinding bone carbon, etc., E. Lister	626,028
Mill spout, D. Parks	625,984
Mould. See Tank mould.	
Motor. See Explosive motor. Railway motor. Wave motor.	
Mowing machine attachment, J. Mussell	625,981
Mud guard, Dunlop & Oatway	626,018
Mule, self-acting, J. Ramsden et al	626,094
Music rack and leaf turner, sheet, G. E. Scott	626,192
Musical instrument, stringed, J. S. Young	625,996
Nail forming machine, S. L. Reed	625,804
Necktie holder, H. A. Littig	625,889
Nest, hen's, J. B. Williams	626,119
Nesting box, J. Herfert	625,975
Noodle machine, C. Buerk	625,739
Notion box, H. O. Hyatt	626,067
Nut lock, W. J. Purvis	626,093
Oils, refining, C. de La Roche	625,933
Ordnance on ships, apparatus for firing, M. J. Caudros	626,002
Ores, apparatus for treating, M. F. Leech	626,173
Organ attachment, S. Howard	625,770
Organs, adjusting and transposing device for automatic, M. Clark	625,744
Packing for bottles, etc., H. A. Leak	625,780
Packing, piston rod, J. Badeker	626,129

(Continued on page 384)

Padlock, permutation, J. A. L. Snyder	625,989
Pan. See Dust pan. Self-basting pan.	
Paper making apparatus, P. S. Sinclair	625,941
Paper pulp, refining engine of Jordan type for grinding, S. R. Wagg	625,818
Patterns, marking out, J. Marsden	626,182
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Pen wiper, I. N. Weitzel	626,197
Perambulator, reclining, C. B. Jones	626,025
Photoreproduction process and apparatus, J. T. Bentley	625,734
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Piano sounding board, E. Zoega	625,824
Picker. See Fruit picker.	
Picture exhibitor, A. Peterson	625,939
Piles, driving, T. A. Kearns	625,978
Pin. See Safety pin.	
Pipe. See Tobacco pipe. Water and steam pipe.	
Pipe wrench, J. J. Rhinelander	626,037
Pitman, N. D. Stanley	626,106
Plaiting machine, J. D. Hatcher	625,761
Planter, seed, J. W. Clark	625,743
Planter, seed, W. J. Kerr	625,774
Plaster block, M. G. F. Buckley	625,869
Plow, C. W. Reed	626,095
Plow, disk, E. M. Heylman	625,764
Post. See Fence post.	
Potato digger, J. Hist	625,766
Press. See Glass press. Printing press.	
Printing and registering machine, Ohmer & Kelch	626,084
Printing, art of and apparatus for making ready forms for, J. W. Osborne	626,031
Printing on cards, apparatus for stencil, F. Ellam	625,876
Printing press, J. C. Molloy	626,076
Printing press inking apparatus, B. Huber	625,771
Propelling mechanism, boat, P. R. Trethewey	625,942
Propelling mechanism, vessel, A. Stathakis	625,907
Propulsion of vessels, pneumatic, W. Carr	626,140
Pruning shears, S. E. O'Dell	625,896
Pulley, self-locking sling, J. H. Burkholder	625,924
Pumping engine, single expansion plunger, A. H. Reeder	625,900
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Quilting frame, L. D. Shinn	625,854
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Rack. See Music rack.	
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Roller. See Land roller.	
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Rotary engine, W. Haddock	625,950
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Valve, compressor, F. G. Hobart	626,064

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Valve, gas engine throttle, F. I. Hitchcock 625,767
Valve regulator, G. W. Lambert 626,171
Valves, electromagnetic mechanism for actuating engine, E. W. Naylor 625,792
Vapor burning apparatus, A. Kitson 625,775
Vat. See Tanning vat.
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Weighing vessel, liquid, J. Reusing 625,901
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Winch, power, H. P. Hansen 625,974
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Wire stretcher, H. C. Pratt 625,987
Wood holder and carrier, Hanson & Reinnholm.. 625,927
Woods, producing artificial, D. Lynn 625,979
Wrench. See Pipe wrench.

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Battery plate, T. T. Lewis 30,909
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Belt, E. J. Deitsch 30,922, 30,923
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Bicycle rear fork, F. P. Burnham 30,914
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Bottle, A. P. Blyth 30,877
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Can, oil, S. Davis 30,879
Can, tea or coffee, T. F. McCormick 30,878
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Check, G. J. Bremer 30,872
Chimney hole cap, H. H. Ladd 30,905
Fabric, textile, D. Howarth ..... 30,927 to 30,929
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Faucet body, I. Levy 30,893
Fence post, J. H. Boddie 30,913
Fence, wire, J. H. Srofe 30,912
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Garment supporter, E. I. Rosenfeld 30,919
Gas burner, A. A. Strom 30,901
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Lamp, vapor, F. G. Frankenberg 30,904
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Nut, split, T. L. Paine 30,898
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Railway rail, E. J. Waelty 30,911
Rubber dam clamp, E. N. La Veine 30,883
Scale lever, I. C. Koehne 30,886, 30,887
Scoop, wire, W. O. Smith 30,890
Shoe, J. H. Romsey 30,925
Show case, J. T. Robin 30,889
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Staple, J. La Prelle 30,896
Stove, E. G. Germer 30,908
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Beer, lager, B. Stroh Brewing Company 32,977, 32,978
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Boots and shoes, Jordan, Marsh & Company 32,971
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Chemical preparation for certain named purposes, Draper & Palmer 33,002
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Cigars, E. Seidenberg, Stiefel & Company 32,974, 32,975
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Coffee, roasted, Steinwender-Stoffregen Coffee Company 32,985
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Hames, Consolidated Hame Company 33,008
Horse boots, Gilliam Manufacturing Company 33,007
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Sewing machines and attachments, New Home Sewing Machine Company 33,010
Skins, finished calf, Ayer Tanning Company 32,972
Smoke in furnaces, chemical compound for preventing, J. M. Wilson 33,004
Starch, laundry, Eagle Starch Company 32,990
Sirup, laxative, A. E. McBee 32,996
Sirup, maple, Arcadia Maple Company 32,986
Whisky, G. F. Heublein & Brother 32,979, 32,980
Whisky, A. B. Sheaffer 32,981

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"Milo," for cigarettes and smoking tobacco, J. W. Surbrug 6,944
"Persperine," for toilet powder, T. W. Johnson 6,944

PRINTS.

"A Winner," for cigars and cigarettes, H. Traiser & Company 141
"Feder's Pompadour Skirt Protector," for skirt protectors, J. W. Goddard & Sons 143
"The Best What Gives," for beverages, J. Graf 142

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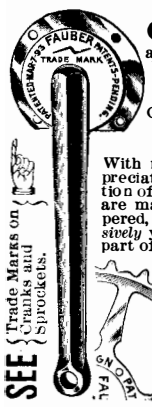

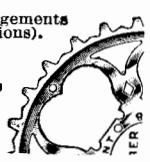

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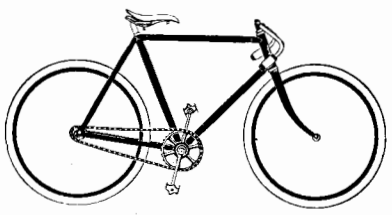

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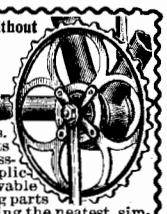

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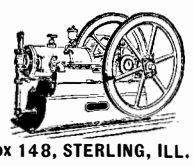

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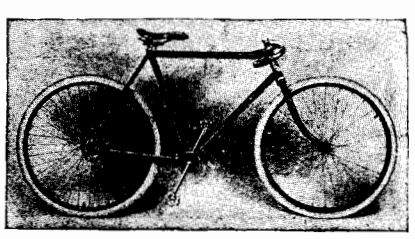

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