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NEW YORK, FEBRUARY 9, 1907.

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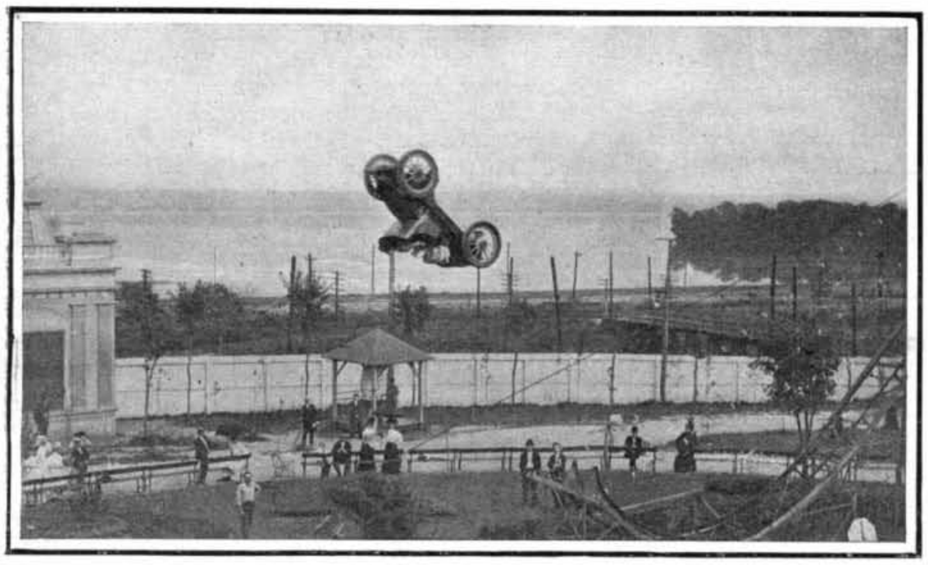
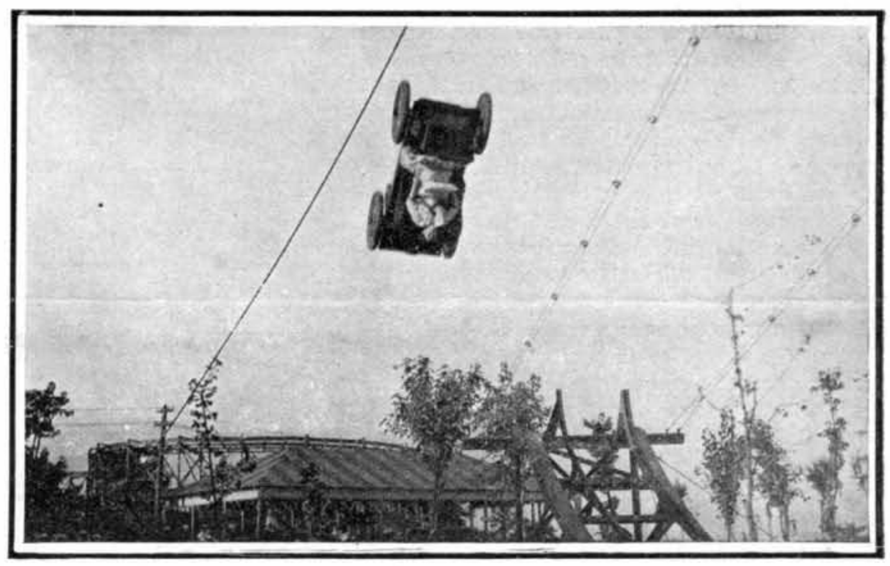
Strapping the Performer to the Seat.

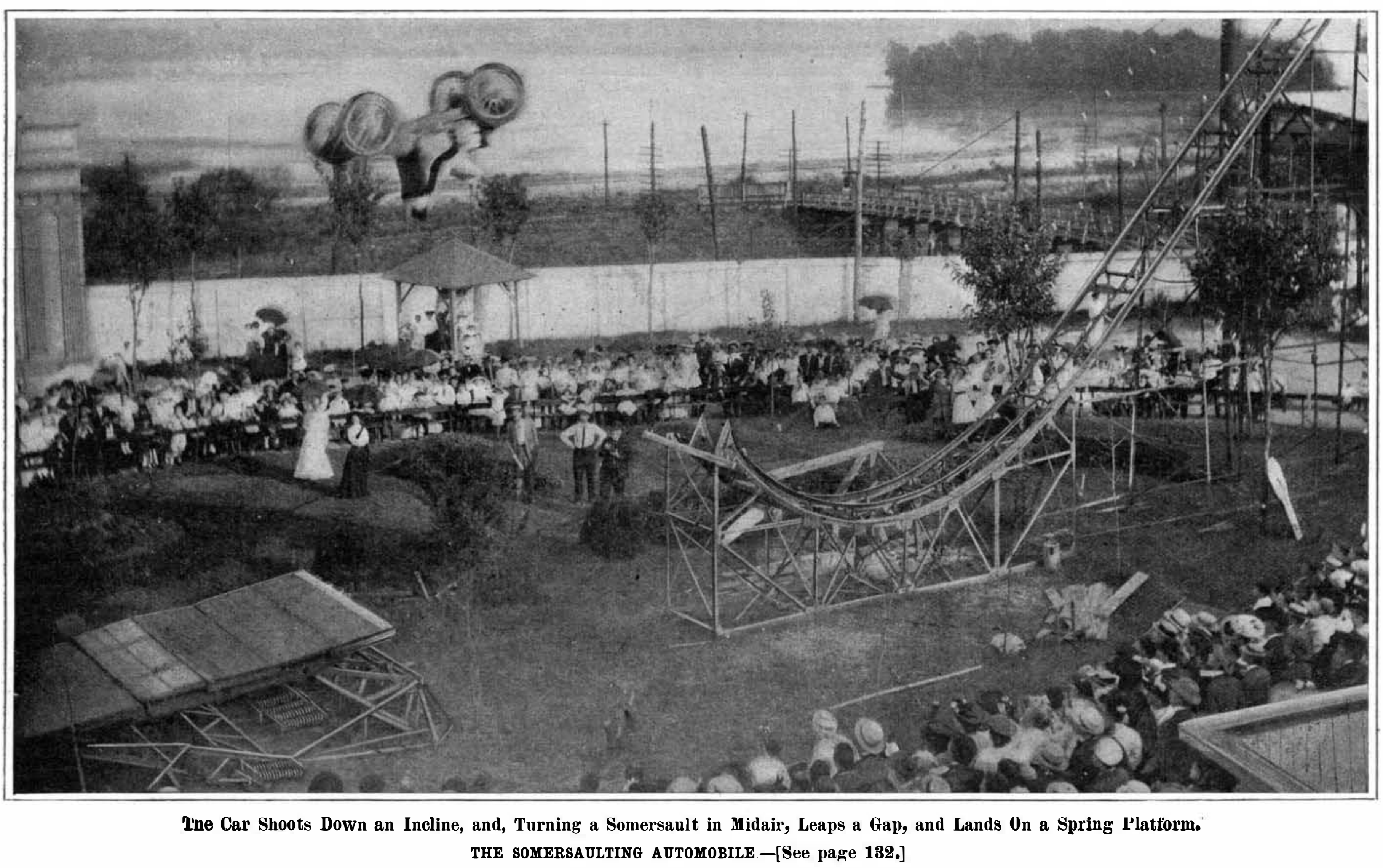
The Start—Just After the Clutch Has Been Released.



The Rear of the Car Has Swung Over and the Front is Rising.



The Performer's Head is Stationary While the Car Swings Over It.



The Car Shoots Down an Incline, and, Turning a Somersault in Midair, Leaps a Gap, and Lands On a Spring Platform.

THE SOMERSAULTING AUTOMOBILE.—[See page 132.]

SCIENTIFIC AMERICAN

ESTABLISHED 1845

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MUNN & CO., 361 Broadway, New York.

NEW YORK, SATURDAY, FEBRUARY 9, 1907.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

THE "CASUALTY LIST" OF AMERICAN INDUSTRIES.

Statistics are "dry"; but sometimes they are wonderfully illuminating, and occasionally, by means of a tabulated list, a fact will be brought home to the public with a convincing force, which could be gained in no other way. At the dinner held in New York to inaugurate the opening in this city of the First International Exposition of Safety Devices and Industrial Hygiene, Gov. Hughes made the startling announcement that the number of people killed or wounded in the various industries of the United States, amounts to 500,000 every year! And yet, if we bear in mind what a large number of people fall victims annually to the carelessness with which our railroads are operated, it should not surprise us that in the whole range of our industrial activity the total number of accidents should reach the stupendous figure of half a million.

It is characteristic of the shortsightedness, the absence of perspective, the lack of a sense of proportion, which marks the average individual, that there should be such a wild outcry against the slaughter of a great war—an event which may occur once in ten years—when, as a matter of fact the killings and woundings of battle are insignificant compared to the day-by-day carnage and mutilation which occur in the prosecution of the so-called peaceful arts.

And this tragedy is rendered all the more terrible when we learn that by the outlay of a certain amount of money and the expenditure of a reasonable amount of well-timed forethought and protective provision, most of our industrial accidents could be absolutely prevented.

That the subject has never excited its proper amount of shame and pity, is due to the fact that the accidents are scattered throughout the year and spread over a territory as wide as the United States. The killing of a few industrial workers in Seattle will arouse local pity and indignation in the State of Washington; but it will be read with only a passing glance in the daily dispatches of a Florida newspaper. Yet if all the accidents of the year should take place on one particular day and in one particular city, say in New York, and if, on the first of January of each year, we should learn that, on the day preceding, half a million people had been killed or wounded in this city in the pursuit of their peaceful avocations, we would then realize the full horror of the situation.

As is usual in matters affecting the safety of life and limb of the individual citizen, we in the United States are, in respect of this matter of preventing industrial accidents, far behind European nations. It is in the endeavor to educate the public to an appreciation of the gravity of the situation and show them how much can be done, and is being done elsewhere, to safeguard the industrial classes, that the present International Exposition is being held in the Museum of Natural History in this city, where a wide variety of appliances for the protection of the artisan are being exhibited. Many, if not the majority of the devices, consist of comparatively inexpensive attachments for preventing contact of the operative with the more dangerous parts of the machine. Of such kind are the shields which cover swiftly-revolving emery wheels, to catch the flying fragments in case the wheels should burst under the high speed at which they are run; the casings built around the gears and pulleys of lathes and other geared machines, with which accidents have been so shockingly frequent in the past; and safety shields and stops which, while they do not prevent the operative from properly observing the action of the machine, render it absolutely impossible for the hands to be caught and maimed by the moving parts.

The fact that such lavish sums are given in this country for charitable purposes proves that our large industrial casualty list is not due to lack of kindliness of heart. It is rather to be explained by the fact that we are in a general way too careless of life and limb, and that, for the lack of properly advertised statistics on the subject, we have never realized how widespread and pitiful is this tragedy of our modern industrial life. Prevention is ever better than cure, and the promoters of the present exposition of safety devices are inaugurating one of the most commendable philanthropic works in the history of the country. To a certain extent the evil can be remedied by legislation; but a quicker remedy can be found in the voluntary adoption on the part of our industrial concerns of those inexpensive means by which our annual casualty list would be immediately reduced.

SATISFACTORY FOUNDATIONS FOR PANAMA DAMS AND LOCKS.

In view of the attack which is being made in more than one quarter against the selection of the Gatun location for the construction of a dam and locks of unprecedented size, it is gratifying to learn from the report of the Isthmian Canal Commission in relation to the new borings of the Gatun dam that the latest investigation shows the foundation both for the dam and for the locks to be satisfactory. The report states that one hundred and twenty-seven holes have been bored at Gatun lock site, covering an area of 1,200 by 5,000 feet. All were carried well below the lock walls, and sixty-six to a depth of fifty feet or more below sea level; and they all show that lock walls will rest on firm and suitable soft rock. Thirty-six borings made, covering an area of controlling gates for spillway, all show safe foundation in soft rock. Three lines of borings, sixty-three in number, all extending to rock, have been made across Valley Chagres, covering the dam site. Pervious material is found in only four holes, and these below the 200-foot level. Ten borings have been made below the foundations of the Pedro Miguel lock walls, all showing rock suitable for foundations. Test pits at Gatun and Pedro Miguel so far all show harder material than cores from borings.

The investigation which the commission has continued has thus far led to no disclosure of extraordinary difficulties, requiring changes of previous plans. The continuation of surveys has for its object the complete adaptation of the design of locks and other features of the plan to the existing surface and subsurface conditions. There is nothing in the later examinations made affecting the practicability or permanence of the Gatun dam.

The borings show below the surface soil what is termed "indurated clay" or "chopped sand and clay." The chopped material is, however, different from the indurated clay and "seems to be a sort of hardpan or conglomerate, either of which will make a good foundation." "The borings and exposures of the material in the French work at the drydock at Cristobal establish" that the indurated clay "makes an entirely satisfactory foundation for the proposed lock structures."

Mr. Stevens, the chief engineer of the canal, states that besides indurated clay, there is what is called blue clay and sand, clay, gravel and fine sand, etc. This is not so hard as the indurated clay, but is in every respect an equally good and sufficient foundation for locks, etc. Mr. Stevens believes that this material is "as good as the indurated clay and good enough in any case" to form a satisfactory foundation.

THE PANAMA CANAL CONTRACT.

The two most important events that have happened in connection with the construction of the Panama Canal since the recent visit of President Roosevelt to the Isthmus, have been the opening of the bids for the construction of the canal and the recent presentation of the report of the Isthmian Canal Commission in relation to the new borings which have been made along the site of the Gatun dam and locks. The most surprising fact developed at the opening of the bids was the wide disparity between the percentages for which the contractors offered to do the work. It will be remembered that under the terms of the contract the present plant of the government will be taken over by the contractor, who will act practically as the agent of the government, and that the contract is to be given to the firm which offers to do the whole work at the smallest percentage of the estimated cost of the canal, always presupposing that the contractors are otherwise satisfactory to the government. The bidders offered to do the work for a percentage which varied from 6.75 to as high as 28 per cent of the total cost. The remarkably low bid of 6.75 per cent was made by a firm of which the junior member is not considered to be acceptable to the government, and, as matters now stand, the senior partner is seeking to associate with him one or more individuals or firms that will meet the government requirements. At the same time, in a statement recently issued from the White House, the public is informed that the President is highly gratified with the rapid progress which is being made under existing conditions, about half a million cubic yards having been taken out of the Culebra cut during the past month, while the amount of excavation is steadily increasing.

It is evident that the government is even at this late day considering the construction of the canal under its own supervision by the engineers of the United States army, as an alternative to its being built by contractors under the present chief engineer of the commission. We have always felt, and do still strongly believe, that contract construction will be found to be the most speedy and economical, in spite of the fact that an amount equal to at least 6.75 per cent of the cost of the canal must be paid to the contractor. The advantage of contract construction is shown in the statement from the White House above referred to when it says: "The real object in contracting the work is to have assembled a large number of the best specialists in each class of work." It is this advantage which has led to the placing of all great engineering works, whether for State or municipal improvement, or the extension and improvement of railroads, with responsible contracting firms. There is every reason to believe that the economies in time and cost usually secured in carrying through these great works will be also secured if the same policy is followed at Panama. There is no reason why the considerations which render it expedient for New York city to build its $160,000,000 water supply system by contract should not hold good for the construction of the $140,000,000 canal at the Isthmus. We do not advocate construction by contract because of any doubt of the ability of the army engineers to handle the work successfully; for we doubt if, anywhere in the world, there is to be found a body of men so well qualified by technical training and wide experience as this fine body of professional men. It is through no fault of theirs that work done by the government is, or at least is popularly supposed to be, usually more expensive than work done by contractors under the supervision of civilian engineers.

SHOULD THE STEEL MAKERS SUBSIDIZE OUR SHIPBUILDERS?

There is much good sense in the suggestion made by Mr. Alexander R. Smith, in a recent pamphlet on American shipping, that the powerful corporations engaged in the manufacture of steel and iron should combine for the purpose of offering for a fixed period a substantial bounty for the construction in the United States of ships built of American steel. It is suggested that such action should be taken simultaneously with the passage by the government of the Merchant Marine Commission's Shipping Bill, or of some other measure of equal effectiveness; and the author believes that upon the passage of such a measure by Congress, coincidently with the announcement of such a bounty to be paid by the steel concerns on steel ships built in this country, the rapidity of the increase of our foreign-going tonnage would be immediate, and so great in its proportions as to practically create a new industry.

The suggestion is not by any means novel or untried. For many years German syndicates have paid large bounties on exports of manufactures, with such success that the policy has recently been discontinued, only because it had operated so successfully as to be no longer necessary for the encouragement of the manufacturer or the advancement of trade. If our American steel concerns should take the initiative, and announce the institution of a system of bounties, it is believed that such a step would stimulate Congress to pass the pending shipping bill.

The considerations upon which the above suggestion is made are that in the United States there are probably half a dozen steel-manufacturing corporations whose aggregate capital exceeds $2,000,000,000, and whose net earnings probably now exceed $200,000,000 annually. During the fiscal year ending June 30, 1906, the value of our exports of iron and steel was over $160,000,000, and it is admitted that in many cases the articles of export were sold at a reduction considerably below the prices obtained for the same articles in the United States. This, it is claimed, is tantamount to a bounty paid by the producers of those articles for the purpose of securing and holding a foreign trade regarded as of value and benefit to such producers. It is considered that the amount of that bounty, or lower price, is considerably in excess of the bonus of from $3,000,000 to $5,000,000 a year, which it is suggested should be offered for a period of ten years by a combination of the steel and iron manufacturers. Such a bonus, based upon the tonnage of steel ships built in the United States for our foreign trade, would establish an industry in the United States which might conceivably raise our merchant marine to that leading position which it held in the middle of the last century.

WHY THE BIG ONE-CALIBER-GUN BATTLESHIPS ARE BEST.

In a letter recently written by President Roosevelt to the chairman of the House Committee on Naval Affairs, advocating the construction of two 20,000-ton battleships of the "Dreadnought" type, the President presents a powerful and convincing argument in favor of big ships, and offers much valuable information upon a greatly misunderstood question. The facts and arguments of his letter are based upon a masterly discussion of the subject in a recent report by Lieutenant-

Commander William S. Sims, who has been mainly responsible for the recent remarkable development of the marksmanship of the United States navy. The report is published in its entirety in the current issue of the Supplement for the benefit of those of our readers who wish for a more complete statement of the arguments in favor of the high-speed, all-big-gun, uniform-caliber, battleship than it is possible to give in the present article.

The report is based upon recently acquired information regarding the events of the battle of the Sea of Japan, which Lieutenant-Commander Sims considers to be absolutely reliable. We may summarize his deductions by saying that he favors the "Dreadnought" type of battleship in respect of its size, of its high speed, and of its use of large guns of uniform caliber. Furthermore, he proves that not only is a battleship of this type more efficient per unit of displacement, but that it costs considerably less per unit of fighting power and is considerably more economical to maintain.

In proving the superiority of the 12-inch gun, Lieutenant-Commander Sims states that experience has shown that the percentage of hits per round is greater with large than with small guns. The danger zone, or the space within which a ship will be hit, is, at 6,000 yards range, 100 per cent greater for the 12-inch than for the 6-inch gun. The latest reports of Japanese fire in the battle of the Sea of Japan state that 19.6 hits per cent of rounds fired were made by the 12-inch guns, and that this was twice as great as the percentage obtained with the smaller guns. The Japanese fired 50 pounds of small-caliber projectiles for every pound that reached the enemy; but they fired only 5 pounds of 12-inch shell, for every pound that got home. Add to this the fact the 12-inch shell has a bursting charge of 38 pounds as against a bursting charge of 4 pounds for the 6-inch shell, and the superiority of the 12-inch gun is strongly established. Another powerful argument in favor of using only one caliber of gun is the modern system of fire control, with which such accurate shooting has been obtained in our own and the British navy. Accuracy of gun fire has come to be regarded as the most vital element of all in the fighting efficiency of a warship. At the longer ranges it is necessary to have an observing party for each caliber of gun, whose duty it is to check the accuracy of the sighting bar by observing the splash of the projectiles. If the ship carries two or more calibers of gun, there must be a duplication both of the observation party and of the fire-controlling apparatus. A most important point brought out by this report is that "interference," of which we have heard so much recently, is not a question of the influence of the flash of the guns so much as of the disturbance of the atmosphere, or "the refraction of the lines of sight by heated gases." Before a gun, adjacent to another gun which has just been fired, is discharged, it becomes necessary to wait until the hot gases of the first discharge have cleared away, and hence, the frequent firing of a numerous battery of small, rapid-fire guns seriously interferes, by the heating of the atmosphere, with the fire of the more important large-caliber guns. This is especially true of the after pair of 12-inch guns, across whose line of sight the heated gases will pass as the ship moves forward. Hence, there is bound to be a decided advantage in mounting a smaller number of high-powered guns of uniform caliber; since the ultimate object of warship design is accuracy of fire, or the getting home of a maximum number of hits of maximum destructive effect within a given time.

Another important advantage of the "Dreadnought" type of ship established by Lieutenant-Commander Sims is the fact that in the case of two fleets of equal total displacement, in one of which that total is made up of ten 20,000-ton battleships, and in the other of twenty 10,000-ton battleships, the advantage of concentration of broadside fire would lie altogether with the fleet of "Dreadnoughts." For the fleet of ten big ten-gun ships, which would be strung out in a comparatively short line of battle, would be able to offer a broadside of thirty-eight 12-inch guns per mile, as compared with a broadside of only twenty-one 12-inch guns per mile, offered by the longer line of ships of the mixed-battery type, carrying only four 12-inch guns apiece. The effect of this would be that the portion of the four 12-inch gun, old-type battleship line, which was immediately opposite the fleet of ten 12-inch gun, modern battleships, would be enormously overmatched, at a range of 6,000 yards, by the superior number of 12-inch guns opposing it, and its higher speed would enable the big-ship fleet to maintain that range indefinitely.

Compared on the basis of comparative cost, the all-big-gun, one-caliber battleship costs less than the four-big-gun, multiple-caliber, smaller ship, when both are compared on the same unit basis. Thus, although the big battleship can concentrate 80 per cent more guns within a given length of line of battle, the first cost is only 50 per cent greater per unit of concentration, while, measured on the same basis, the size of the crew required to fight the big ships is about 50 per cent less. Another important economy is secured in respect of the annual cost of maintenance; for the cost of maintaining ten 20,000-ton ships would be less by about $10,000,000 per annum than that of maintaining twenty 10,000-ton ships mounting the same total number of 12-inch guns.

Upon no question affecting modern tactics do the results of the battle of the Sea of Japan speak with greater emphasis than that of the value of high speed; for it now appears that the Japanese ships had an advantage of speed of between 6 and 7 miles an hour, the Russian fleet maneuvering at about 9 knots, and the Japanese at between 15 and 16 knots. This enabled Admiral Togo to place himself at that range (about 6,000 yards) at which he found that he could inflict a maximum amount of damage on the enemy, while yet keeping outside the extreme range at which the Russians were able to do any effective shooting.

COMPARATIVE TEST OF ALCOHOL, KEROSENE AND GASOLINE AS AUTOMOBILE FUELS.

The first practical demonstration of the use of denatured alcohol as a fuel for automobile use was made last week by a Maxwell touring car, which was run from New York city to Boston on 40¾ gallons of the new tax-free alcohol. In order to make a direct comparison, two identical cars, the motors of which were run on kerosene and gasoline respectively, accompanied the alcohol-driven machine. The test was made under the supervision of the Automobile Editor of this journal and representatives of the Automobile Club of America and the American Automobile Association. It yielded considerable interesting data as to the consumption of gasoline, kerosene, and alcohol in an ordinary two-cylinder, opposed-type engine when used to drive a car at an average speed of about 15 miles an hour over roads covered with snow of from 4 to 10 inches depth.

The start was made from New York at 9:10 A. M., January 28, and the cars reached Boston together at 1:15 P. M. January 30. The trip was thus made comfortably in two and one half days, despite the fact that the weather was rather cold and the ground was covered with about a foot of snow.

As is well known, the Maxwell engine is of the double-opposed-cylinder type, having a bore and stroke of 5 inches and a compression of about 60 pounds. It drives the live rear axle through the usual 3-speed sliding gear transmission, propeller shaft, and bevel gears. Individual spark coils with vibrators, fed by six cells of dry battery, supply the high-tension ignition current. All valves are mechanically operated; the cooling water is circulated without a pump on the thermo-siphon principle; and the entire engine and gear box form a unit, suspended at three points. On account of the low compression, it was not expected to show much efficiency with denatured alcohol as a fuel, for this substance requires a compression three or four times as great as does gasoline, in order to equal or surpass it in thermal efficiency. Used in an engine with the proper compression and having a long stroke, a thermal efficiency of 31 per cent has been obtained as against 20 to 23 per cent with gasoline. The main object of the test was to demonstrate that a modern gasoline car can be run successfully on alcohol or kerosene if necessary, and to bring out the relative cost of operating it on either of the three fuels. In order to start the engines, when cold, it was found necessary to prime with gasoline. The one that was run on kerosene was provided for this purpose with a special pipe extending from the dashboard to the inlet pipe, and at first it was necessary to run it a couple of minutes in this way, until it had become warm. In the case of alcohol, by squirting a little gasoline into the hot-air jacket around the cylinder, to which is connected the air inlet pipe of the carbureter, the engine could be readily started and would continue to run on alcohol. The power developed by the engine, when running on the new fuel, seemed fully equal to that developed when it was run on gasoline, and the pulling qualities of the engine when its speed diminished under load were remarkable, being the nearest approach to a steam engine that we have thus far observed. Despite the fact that it was the most heavily loaded (weighing 2,750 pounds, as against 2,520 and 2,270 of the kerosene and gasoline cars), the alcohol machine opened the way through the snow and kept well ahead of the other cars. There seemed to be nothing lacking in power and speed. The kerosene car, too, showed good power and speed, especially the first day. Later on the heavy carbon deposit which undoubtedly formed in the cylinders owing to incomplete combustion, caused the engine of this car to knock badly under a load, apparently from pre-ignition. The spark plugs on this car were provided with spark gaps, as a result of which they operated with little or no trouble. That the kerosene was not vaporized properly but was burned in excess in the raw state could readily be seen from the heavy, ill-smelling smoke that was emitted. Because of the lubricating qualities of the kerosene, the driver was able to run his car half of the distance without the use of lubricating oil in the cylinders. On account of its low cost and other desirable features, kerosene would no doubt come into wide use, especially for commercial work, if some form of carbureter were introduced that would thoroughly gasify the liquid. Even with a greatly increased consumption, on account of its low cost, it was the cheapest of the three fuels used. The car running on this fuel averaged 7.4 miles per gallon, as against 6.13 of the alcohol car and 10.1 of that run on gasoline.

The total fuel consumption of the three cars—gasoline, kerosene, and alcohol—for the 250-mile journey was 24¾, 33¾, and 40¾ gallons respectively. At the prevailing prices of these three fuels, viz., 20, 13, and 37 cents per gallon, the total fuel expense of each car was $4.95, $4.39, and $15.07. This would make the cost per car mile $0.019, $0.0175, and $0.0603 in the order named, and the cost per ton-mile $0.0169, $0.0139, and $0.0448. From the latter figures it is seen that at the present time the use of denatured alcohol as fuel in an ordinary gasoline automobile engine fitted with the regular carbureter costs nearly two and one-half times as much as the use of gasoline, and over three times as much as the use of kerosene. In order to be on a par with gasoline at 20 cents a gallon, alcohol must be purchasable at 22 cents a gallon and must be used in a specially constructed engine giving 10 per cent more thermal efficiency than does the gasoline engine. Already, one month after the new alcohol law has gone into effect, the denatured spirit made by the addition of 10 parts (by weight) of wood alcohol and ½ part of benzine to every 100 parts of 90 per cent grain (ethyl) alcohol, can be purchased through dealers in this city for $0.36 a gallon in 5-barrel lots. A decided, increased demand has already occurred for the spirit for use in the varnish and similar industries, and when once it begins to come into use as a motor fuel, with the largely increased demand that will then occur, the price will no doubt drop to approximately the same figure as that at which gasoline can be purchased to-day. Because it lacks the dangerous and ill-smelling qualities of gasoline, wealthy automobilists may yet prefer it to this fuel even though the expense be greater.

A description of some of the foreign carbureters which have been designed for alcohol motors, as well as much information regarding the theory and practice of this type of engine, will be found in the new book "Industrial Alcohol," which we will publish during the present month.

THE CURRENT SUPPLEMENT.

The current Supplement, No. 1623, opens with an article by William Mayner on the Rudolf Virchow Hospital, which is, perhaps, the finest institution of its kind in Europe. Something of the size of the institution may be gathered from the fact that it numbers fifty-seven buildings. Following the publication of the plans and specifications for constructing a 100-mile wireless telegraph set in Scientific American Supplement No. 1605, and the location and erection of a suitable station for housing and operating this installation, printed in Scientific American Supplement No. 1622, Mr. A. Frederick Collins, in the current Supplement, describes how the set may be installed in the station to the best advantage, and finally, how the instruments may be properly adjusted and tested. An historical account of the eolipile, an ancient steam generator, is given by Mr. S. J. Berard. The epoch-making paper on the art of cutting metals read by Mr. Frederick W. Taylor before the American Society of Mechanical Engineers contains no more important chapter than that on the "Chatter of the Tool." This chapter will be found published in the current Supplement. The English correspondent of the Scientific American writes on a novel engineering achievement in burying a river to a depth of 120 feet. Mr. W. H. Dugdale writes instructively on some early vicissitudes in engineering. Some practical hints for concrete constructors are given. The third installment on new incandescent electric lamps is published. The well-known aeronaut Carl E. Myers writes on the progress in airships and on forms of gas bags. A very good article is that on the tactical value of the "Dreadnought" type of battleship, the arguments being based upon the results of the battle of the Sea of Japan.

TELEPHONE STATISTICS.

Figures of the amount of business connected with telephones made public to-day, indicate that there were 5,071,500,000 exchange telephone talks and 133,600,000 long-distance or toll communications in the year 1906 in this country. On December 31 there were 7,107,835 instruments in use, 1,436,236 miles of toll wire, 2,385,742 miles of underground wire, 11,373 miles of submarine wire, and an aggregate of 6,080,282 miles of wire devoted to telephone service. The stations number 2,715,367, the total circuits 1,407,900, and the employees 90,000. These figures show a growth in six years of 171 per cent in number of employees, of 239 per cent in the number of stations, and of 349 per cent in the total number of miles of wire.

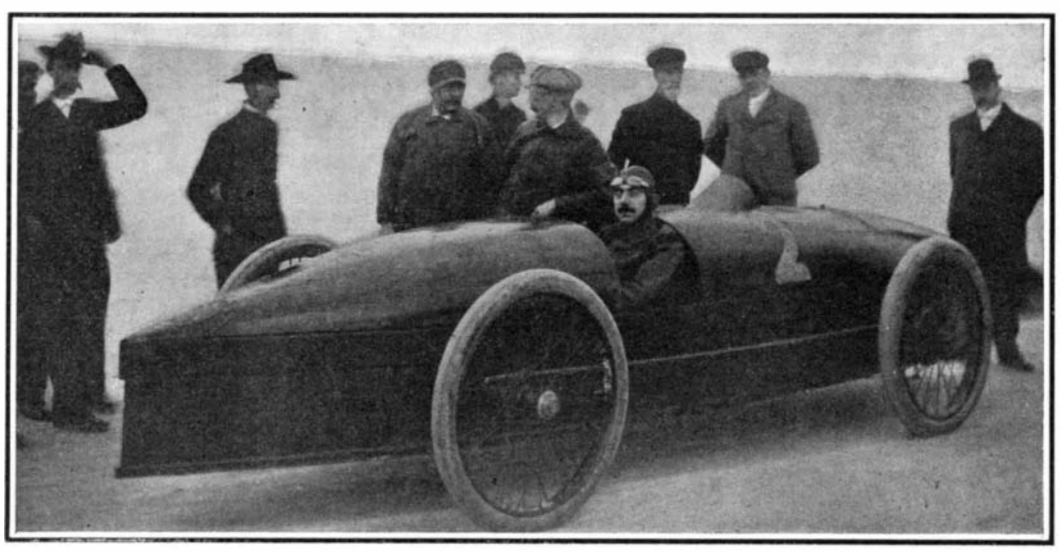
THE ACCIDENT TO THE STANLEY STEAM RACER.

The accident which happened to the Stanley steam racing car on January 25 at Ormond Beach, Fla., while its driver, Marriott, was endeavoring to beat last year's record of a mile in 28 1/5 seconds, is described graphically by Mr. George H. Curtiss, the motor-bicycle builder, in the appended letter:

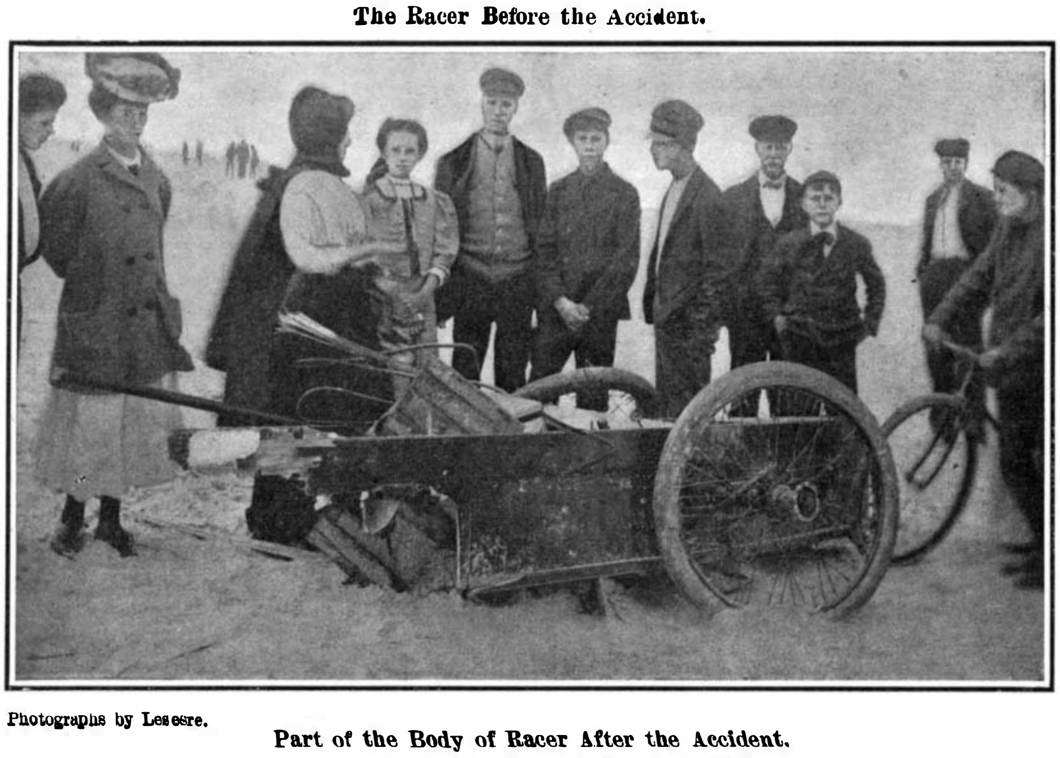
The Boiler of the Racer After the Accident.

"We were obliged to crate up our 8-cylinder, owing to the buckling of the frame, and were out with one of our double cylinders with a tandem attachment, with which we were to try the mile (two on) immediately after Marriott. Mr. Waters (who was to ride the rear seat in our tandem trial) and myself were just back of the starting line as the "Bug" came to the tape which began the mile. As is commonly known, these steamers come to the start with a very high pressure of steam, saving it until the line is reached, then opening wide the throttle and fairly shooting over the line. This sudden spurt, together with the flat boarded surface of the bottom of the car and the fact that all the weight of the car is well back, taken in conjunction with a slight depression in the beach, formed, in my opinion, the true cause of the accident. The slight depression in the course gave the car (which was provided with light springs) a toss-up. The sudden application of power assisted in raising the fore part of the car, which, as I mentioned, is very light. The floor then acted as an aeroplane—the car *glided*, with the rear wheels only on the beach. It then swerved sidewise, and when the front wheels again came in contact with the ground, it was headed toward the sea, and the wheels of course went down and the car rolled over and over, breaking to fragments. The boiler kept on going, and rolled several hundred feet farther than the balance of the car, the escaping steam giving the appearance of a meteor rushing through the surf.

"I have heard Marriott speak of this tendency of the car to glide, and as we actually saw the car rise, there is no doubt about this point. I have often noticed in starting a powerful motor cycle, with throttle open, the front wheel is raised clear of the ground. If any further attempts at speed are made with four-wheelers, the weight should be farther forward, the power applied more gradually, and no body should be used. None of these troubles showed in our 40-horse-power motor cycle. Not having springs, it stayed on the beach in good shape, and handled as easily at 120 miles an hour as at sixty or seventy miles."



The Racer Before the Accident.



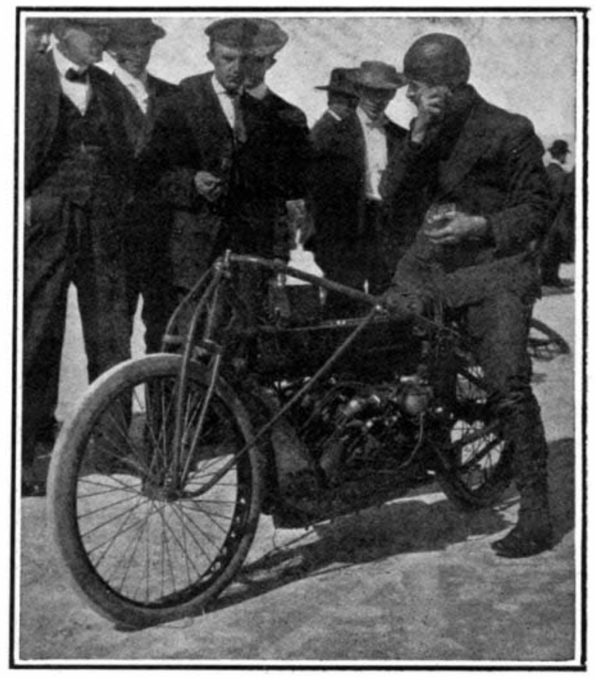
Photographs by Lessere.

Part of the Body of Racer After the Accident.

THE ACCIDENT TO THE STANLEY STEAM RACING CAR AT ORMOND BEACH.

THE FASTEST AND MOST POWERFUL AMERICAN MOTOR BICYCLE.

What is unquestionably the most powerful, as well as the fastest, motor bicycle ever built in this country made its appearance at the races at Ormond Beach recently; but, owing to the breaking of a universal joint and subsequent buckling of the frame, this machine made no official record. It was built by Mr. G. H. Curtiss, a well-known motor-bicycle maker, with the idea of breaking all records. The machine was fitted with an 8-cylinder air-cooled V-motor of 36-40 horse-power. The motor was placed with the crankshaft running lengthwise of the bicycle and connected to the driving shaft through a double universal joint. A large bevel gear on this shaft meshed with a similar one on the rear wheel of the bicycle. The total weight of the complete machine was but 275 pounds, or 6.8 pounds per horse-power. In an unofficial mile test, timed by stop watches from the start by several persons who watched through field glasses a flag waved at the finish, Mr. Curtiss is said to have covered this distance in 26 2-5 seconds, which would be at the rate of 136.3 miles an hour—a faster speed than has ever been made before by a man on any type of vehicle. Unfortunately, before this new mile record could be corroborated by an official test, the universal joint broke while the machine was going 90 miles an hour. Fortunately, it was brought to a stop without injury to its daring rider from the rapidly-revolving driving shaft, which was thrashing about in a dangerous manner. Later on, the frame buckled, throwing the gears out of line, and the official test had to be abandoned. With his 2-cylinder machine, Curtiss rode a mile in 46 2-5 seconds in a race with Wray on a 2-cylinder 14-horse-power Pugeot motor bicycle, only to be beaten 2 seconds by the latter in a subsequent race, wherein a speed of about 80½ miles an hour was obtained. With one of his single-cylinder machines Curtiss made a mile in 1 minute 5 3-5 seconds on January 21.



A 40 H. P. Racing Motor Bicycle Fitted With an 8-Cylinder V Motor.

India for Automobiles.

India is rapidly taking a leading place in the exploitation of the automobile industry in foreign fields. Reliability trials were held at Mysore, in southern India, during the Christmas holidays. These were followed by a general motor car exhibition at Calcutta from January 21 to 30, at which all the leading European manufacturers were represented.

One cause of the popularity of the motor car in India is the number and extent of good roads, some of them hundreds of miles in length. A perfect highway runs from Bombay to Delhi, 900 miles, over which the trials were made in 1904.

From Peshawar, farther north at the frontier of Afghanistan, a fine road extends all the way to Calcutta, a distance of 1,500 miles. These and similar roads are known as the grand trunks, and were built and maintained as military highways before the advent of the railways. These highways of travel are kept in perfect repair. Others equally as good are spread throughout the country, and in some of the states ruled by native princes particular care is given to the roads. One enterprising prince, the Maharajah of Gwalior, has caused a motorists' road guide of his state to be published, with maps, lists of rest houses, and other information.

The high-class and high-priced cars which in any country must be considered as luxuries, have found their best customers among the native rulers, whose example has been followed by the rich Parsee merchants and financiers of Bombay, and in a modest degree by some of the officials of the Indian government. Gradually the use of motors has spread until they have ceased to be looked upon as luxuries, and are now regarded as necessities by a growing number of persons who are able to invest from $1,000 up to $5,000 in a motor vehicle. At first it was found necessary to employ English chauffeurs, and this is still done by the owners of the finest cars, but it is now possible to obtain competent native drivers at very moderate wages.

The Indian Prince, Maharajah Gaekwar, who recently visited this country, is the possessor of sixteen automobiles, motoring being his favorite pastime. He owned one of the first fifty automobiles manufactured.

The total length of railways now working in Mexico is 13,507 miles, and most railways report increases in their traffic returns. With the exception of the opening of the Matamoras branch of the National Railway of Mexico there was but little railroad construction of importance in 1905, but during the last year—1906—there was considerable activity, notably the extension of the Southern Pacific system from Guaymas in Sonora south along the Pacific coast to Mazatlan and Tepic, and eventually to Guadalajara. This, together, with the extension of the Mexican Central to Colima and Manzanillo will give better access than hitherto to the Pacific coast.

MACHINE FOR RECORDING THE VIBRATION OF SHIPS.

BY DANIEL M. LUEHRS.

A machine, scientifically known as a pallograph, is the invention of a German engineer, Herr E. Otto Schlick, and was built by the writer. The records or cards are instantaneous records of the displacement due to vibration of that part of the ship at which the instrument is placed. When the instrument is set up and working, one pen records the vertical, one the transverse, and another the longitudinal vibrations. At the same time a break-circuit clock records half-second time signals, by means of an electric spark from an induction coil piercing the paper. The revolutions of the engine, or engines if a twin-screw steamer, are also recorded at the same time and in the same manner; the breaking of the circuit being done by a contact block, fixed to the engine shaft and revolving with it, passing under a brush and breaking contact at the instant one of the pistons of the engine is at the top or bottom of its stroke. This is important, in order that one may know the exact position and direction of motion of the various pistons, and the propeller at which the maximum vibrations occur.

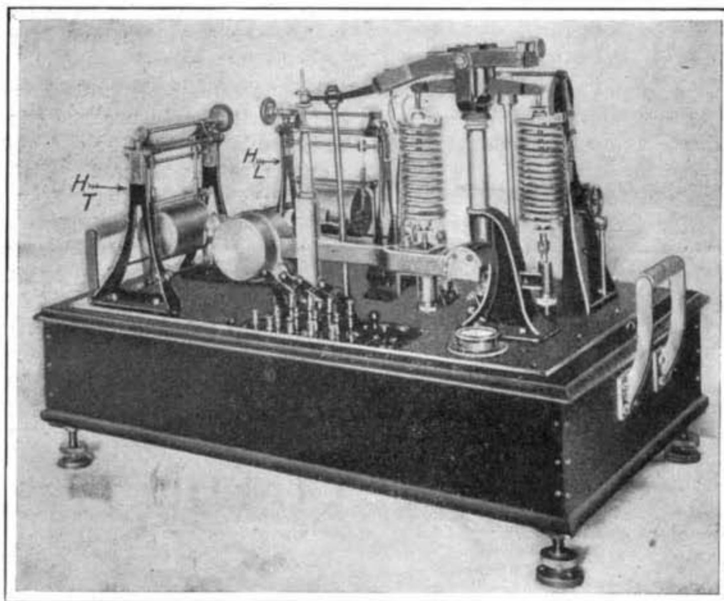


Fig. 1.—THE SCHLICK PALLOGRAPH.

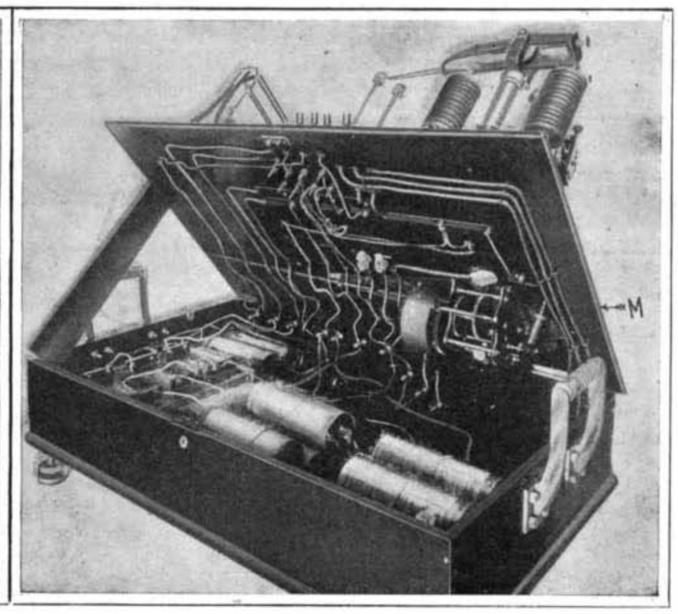


Fig. 2.—THE TOP RAISED.

Vibration in a vertical direction is recorded by the apparatus shown in Fig. 3. This consists of an arm R having at one end, B, a knife edge bearing on agate, and at the other a weight A. This arm is suspended

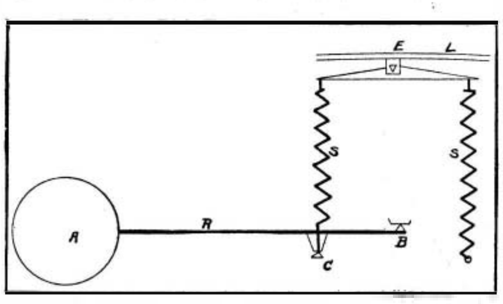


Fig. 3.

in a horizontal position by the springs S and S. The point of suspension C is below a line joining the center of the weight A and the knife edge B. This is so adjusted that when the weight moves down, and thus increases the tension of the springs, the moment arm $C\,B$ is decreased; thus the force exerted by the spring supporting the weight remains practically constant, and the weight remains wherever it is placed, or in other words is in indifferent equilibrium. One end of

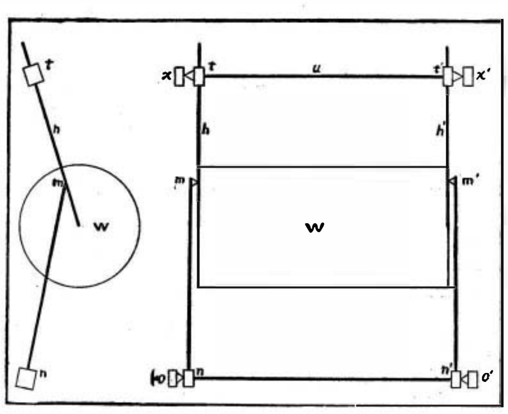


Fig. 4.

each of the two springs S and S is attached to the beam, having a knife edge bearing at its center, bearing in a block E, capable of movement along the link L, which can be rotated about its center by adjusting screws. The weight A and point of suspension C, can also be moved along the arm R; thus one is able to vary the time of vibration of the system at pleasure, it being very important that this should not coincide with the time of vibration of the ship.

The apparatus for recording horizontal vibrations consists of a weight W, Fig. 4, so suspended by linkwork that its motion shall be as nearly horizontal as possible; and for the limited travel of the weight, is for all practical purposes a truly straight line motion. The weight W has attached to it two rods h' free to slide through the sleeves t, which form part of the top rod u. This rod u is pivoted in the blocks $X\,X'$ sliding in the main frame.

The frame $m\,n\,n'\,m'$ is pivoted to $h\,h'$ at $m\,m'$, and is free to rotate about the fixed pivots $O\,O'$. Thus when the weight moves from its center position, the pivots $m\ m'$ move in the arc of a circle having its center at O. If $h\ h'$ were fixed at $t\ t'$ and not pivoted at $m\,m'$, W would also move in the arc of a circle having X as its center; however, as $h\,h'$ is pivoted and free to slide through $t\,t'$, they will slide enough so that the combination of $h\,h'$ sliding through $t\,t'$, and rotating about an axis through $X\,X'$, raises the center of the weight W an amount it tends to fall due to the rotation of $m\,m'$ about $O\,O'$. Thus the center of weight W moves in a horizontal line.

The blocks $X\ X'$ and the top rod u are capable of being raised or lowered by the miter gears on top. This vertical motion raises or lowers the upper point of suspension of the linkwork, hence the length and therefore the period of the equivalent simple pendulum can be varied at will.

The motion of the center of the weight W of the transverse system is transmitted directly to the recording penholder by means of a rod, provided at each end with universal joints to eliminate friction and side strains. The motion of the longitudinal system is transmitted by means of a bell crank and rods, also provided with universal joints. All transmission rods are provided with turnbuckles and locknuts, so that the pens can be adjusted to the zero position on the paper when the weights are in their mid-position.

The paper is fed in a continuous strip 9 inches wide at the rate of 30 inches per minute, from the supply roll N, Fig. 5, over the brass drum D, thence down around the roll f, thence up and between the rubber-covered feed rolls $f\,f'$, thence under the shear bar V and out. Power is supplied by a large spring motor.

The penholders are of sheet aluminium, having a long foot, provided with pivot bearings, Fig. 5, and an adjusting screw for varying the pressure of the pen upon the paper. Hunt's round-pointed "Drawing" pens No. 99 were used, carried in aluminium quills capable of adjustment in a vertical plane, in order that all pens and the spark points be brought into the same straight line at right angles to the direction of motion of the paper.

The machine is mounted upon four leveling screws, it being necessary that it stand perfectly level while recording. It has been found impossible to take records while the ship is in rough water; the horizontal systems are so sensitive that the turning of the ship's head even a small amount while under 8 or 10 knots brings the pens into collision and spoils the record. The machine weighs, complete with batteries, 167 pounds.

The question has often been asked, Of what use is such a machine? What if the ship does vibrate, what's the harm? How are you going to stop it? The harm is, that if the vibration is of sufficient magnitude it racks the ship, and even though comparatively slight it makes a ship very uncomfortable to live upon. For example, on the weather deck of the "Kershaw," directly over the propeller, a vertical vibration of 0.06 of an inch was recorded. This vibration occurred 432 times per minute. Now, a person weighing 160 pounds standing beside the machine would have experienced a variation of pressure upon the soles of his feet, above and below his weight, an amount equal to $F = 0.142m \times 10^{-5} \times n^2 S$ (George W. Melville in Marine Engineering, p. 63, vol. viii.) where m is the weight of the person in pounds, n the number of vibrations per minute, and S the amplitude, or 0.06 inch in this case. This gives F the value of 2.54 pounds. So that at one instant his apparent weight is $160 + 2.54$ or 162.54 pounds, at the next $160 - 2.54$ or 157.46 pounds, a total variation of a little over 5 pounds. At the same time he experiences a horizontal vibration having an amplitude of 0.12 of an inch occurring 300 times per minute, producing a horizontal pressure of 2.45 pounds. It will be readily seen that even this slight vibration tends to make a ship uncomfortable. The "Kershaw" is by no means a heavy offender in this respect.

A ship's hull like all bodies possesses elasticity. If an external force acts upon this at regular intervals, it will set up a series of vibrations. This action is best illustrated by taking a slender rod, $A\,C\,B$, Fig. 6, of uniform section and material. If a force be applied at A the rod will bend, assuming the position $A_2\,C_2\,B_2$. If this force be removed the rod will spring back, but will not stop at its original position, but will pass to some position $A_1\,C_1\,B_1$, finally coming to rest at its original position. If the force, instead of being removed, were periodically reversed in direction, the rod would vibrate between C_2 and C_1, and would come to rest only after the force had ceased acting.

We have a similar condition upon a steamship, our

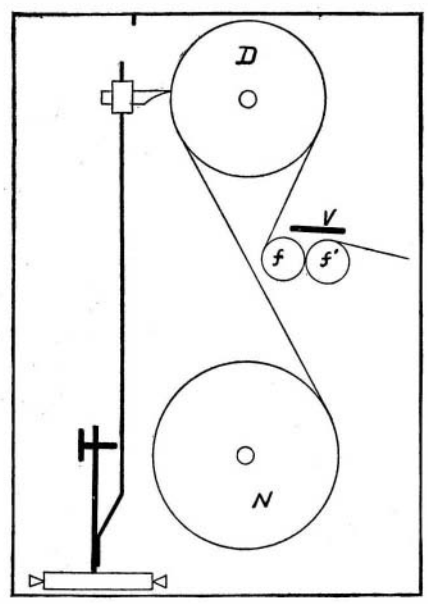


Fig. 5.

rod being the hull and our force representing the forces produced by the unbalanced forces of the engine and propeller. Like all elastic bodies, every ship has its natural period of vibration, different in every ship and dependent upon the structural arrangement, age, con-

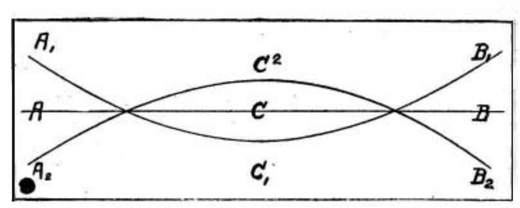


Fig. 6.

dition, draft of water, speed, depth of water under the ship, position of the fixed weights, boilers, engines, etc., and upon the amount and stowage of the cargo, coal ballast, etc. By taking careful records with the machine, at regular intervals along the deck, a curve can be readily constructed, by taking distances along the deck as abscissas and amplitude of vibration as ordinates. This gives what is known as the node curve, and shows the positions of maximum and minimum vibration throughout the length of the ship. By placing the machine over and as near the propeller as possible, one can determine which blade or blades of the propeller, if any, is producing more vibration than the others. As the velocity of the wake, and hence the slip of the wheel, is greatest near the surface, and as the thrust of the propeller increases with the slip, consequently each blade of the propeller experiences a greater resistance near the top, and a less resistance near the bottom of its revolution; hence, as each blade passes through the top position, it produces a vibration upon the ship which is recorded by the machine. Being mainly a transverse vibration, it is most noticeable on the transverse curve, which shows as many vibrations per revolution of the engine as the propeller has blades. If, now, one blade be a trifle larger or of slightly greater pitch than the others, it produces a greater vibration, and, knowing the position of the engine (as explained above) at the instant this blade passes through its position of maximum resistance, it is a simple matter to identify that blade.

The critical number of revolutions of the engine can also be determined with this machine. Vessels having quick-running engines, such as torpedo boats, experience an excessive vibration as the number of revolutions of the engine approaches a certain amount, decreasing as this point is passed but reappearing at each multiple of the original. This number of revolutions is known as the critical number, and is the point at which the number of revolutions of the engine coincides with the natural period of the ship's hull.

With this machine the forces of the engine producing vibration can be studied; and knowing the instantaneous position and direction of motion of each part of the engine, those parts producing vibration can be identified, and means adopted for their suppression. The effect of the various systems of balancing can also be studied and compared.

An ingenious beacon is located at Arnish Rock, Stornoway Bay, in the Hebrides, Scotland. It is a cone of cast-iron plates, surmounted by an arrangement of prisms and a mirror which reflect the light from the lighthouse on Lewis Island, 500 feet distant across the channel.

MORNING AND EVENING STARS FOR 1907.

BY FREDERIC R. HONEY, TRINITY COLLEGE.

The purpose of this article is the same as that of my contribution on this subject for 1906, viz., to assist the non-professional student in identifying the planets which rise before and which set after the sun, for any day of the year.

The orbits of Mercury, Venus, the earth, and Mars are plotted; those of Jupiter, Saturn, Uranus, and Neptune extending beyond the limits of the page.

Mercury's revolution round the sun is performed in very nearly 88 days; and since Venus revolves in her orbit in 224 days and a fraction, a common divisor of 88 and 224, i.e., 8 days, has been selected as a convenient interval of time.

Mercury is represented in eleven positions 8 days apart during each revolution, and Venus is shown in twenty-eight positions at the corresponding dates.

After an interval of exactly 88 days, Mercury gains on his first position only a very small fraction of a degree (= 5⅓ minutes) and in four times 88, or 352 days, during which Mercury makes four revolutions, he advances on his first position about 1-3 deg. (= 22 minutes). By assuming a mean position, this very small error is diminished and is not noticeable in a plot of these dimensions. The positions of the planet are therefore made identical, and four dates are attached to each. Intermediate positions at intervals of four days are also shown.

Mercury's position on January 6 is again reached on April 4, July 1, and September 27. Similarly, his position on January 14 corresponds with that of April 12, July 9, and October 5. By this arrangement the planet's positions are indicated for 44 different dates.

Since the period of Venus's revolution is 224.7 days, after the exact interval of 224 days she falls a little behind her first position of January 6, and during the remainder of the year is represented by an open circle with the new date attached. She reaches on August 18 very nearly the same position as that occupied on January 6; and the same statement applies to each of the subsequent dates.

The positions of the earth and Mars are shown at intervals of eight days from January 6 to December 24. Jupiter's distance from the sun is more than five times that of the earth; it is therefore impracticable to plot his orbit on the same scale, and since his period is less than twelve years, he revolves at an average of about 30 degrees a year. His positions in the heavens are indicated by the arrows for January 6, April 4, July 1, September 27, and December 24. His apparent motion is so slow that the reader will have little difficulty in approximately determining the intermediate position for any assigned date.

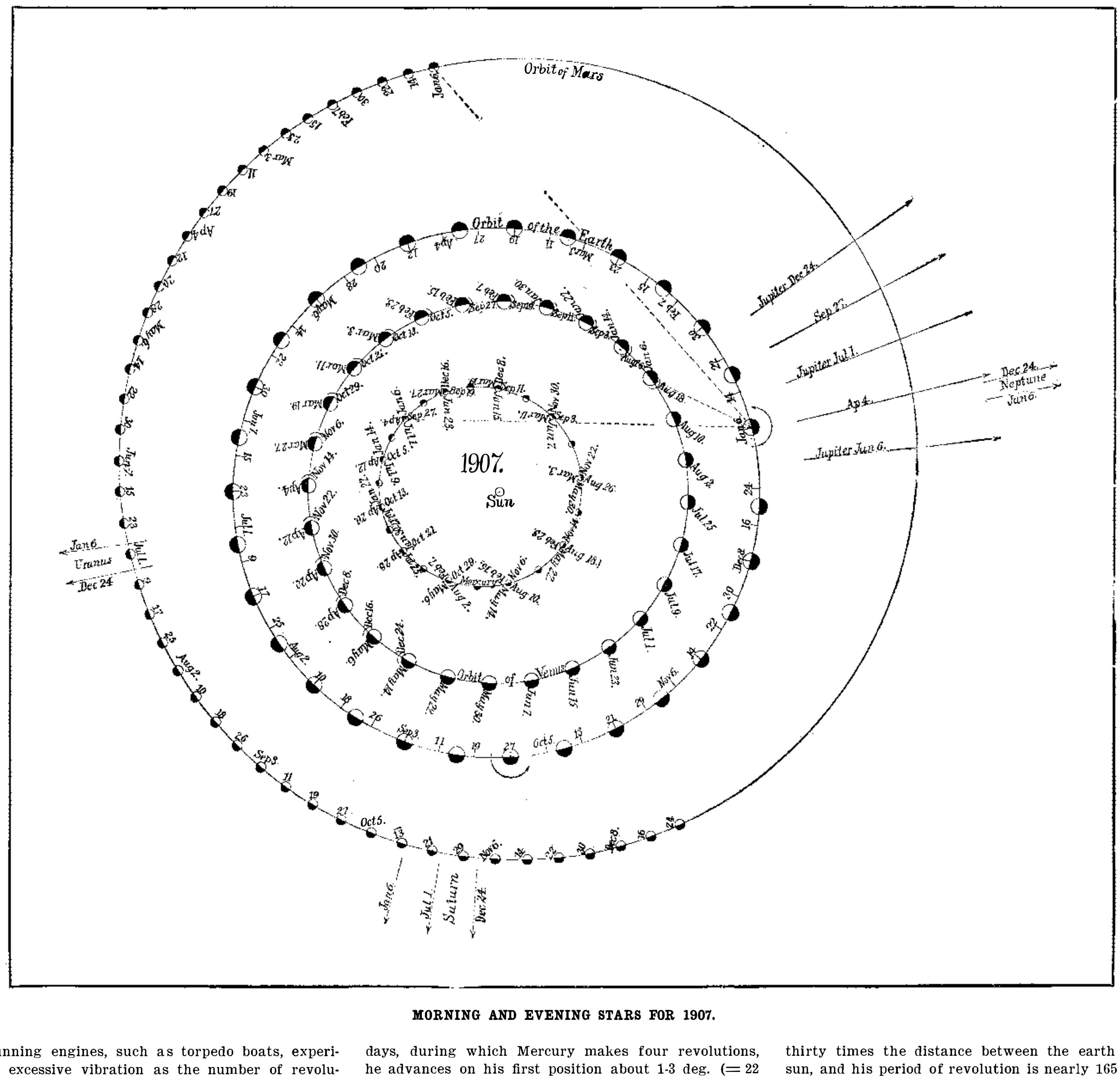
The statements also apply to Saturn, whose distance from the sun is about nine and a half times that of the earth. His positions are indicated by the arrows for January 6, July 1, and December 24. His period is nearly 29½ years.

The apparent motions of Uranus and Neptune are so slow that it is only necessary to indicate the dates at the beginning and at the end of the year. The former is over nineteen times the distance from the sun to the earth, and his period is 84 years; while Neptune is thirty times the distance between the earth and the sun, and his period of revolution is nearly 165 years.

If the reader will note that the earth rotates on its axis in the direction of the arrow (see September 27) he will see that at sunrise the observer is emerging from the shadow area, and that at sunset he is entering it. Before sunrise any planet which in the plot is on the right of the sun will evidently rise before him, and is morning star; and after sunset any planet which is on the left of the sun will set after him, and is therefore an evening star.

In order to ascertain which planets are morning and evening stars, this page should be turned until the earth at the assigned date is between the reader and the sun, so that the date attached to the earth may be read without turning the head. For example, if this page is turned about one-quarter of the way around, until the earth in the plot on January 6 is between the observer and the sun, it will be seen that Mercury, Venus, and Mars are on the right hand of the sun, i.e., they are morning stars at this date.

While it is true that Mercury is approaching aphelion



MORNING AND EVENING STARS FOR 1907.

his apparent distance from the sun is very much diminished, on account of the relative positions of the planet and the earth, and he is also in the neighborhood of his maximum distance from the earth. He reaches superior conjunction on February 2; his apparent diameter is therefore approaching its minimum.

On January 6 Venus is very near the earth. Her apparent diameter is about five-eighths of her maximum size, which is more than six times larger in diameter than she appears at superior conjunction, when she is separated from the earth by a distance equal to the sum of the orbit radii of the planets. A large part of her surface is in shadow, but her visible illuminated surface reflects a great deal of light.

At this date a large part of Mars's illuminated surface is visible, but on account of his great distance from the earth, his apparent diameter is not more than about one-half as large again as the minimum.

As between sunset and sunrise the observer is somewhere within the shadow area, the reader will easily conclude from an inspection of the plot that on January 6 Jupiter and Neptune will be visible during the hours of darkness.

Saturn being on the left of the sun will set after him, and is therefore evening star. The apparent distance from the sun will diminish as the earth revolves in its orbit.

If the reader will place a straightedge through the centers of the earth and sun, Uranus will appear a short distance on the right, and is therefore morning star. As the earth revolves in its orbit the apparent distance between the sun and Uranus will evidently increase.

In order to become familiar with the method of using the plot, the reader is recommended to give his attention to one planet, and note the change of its position relative to the sun and earth. Following the rule here given, he can easily determine whether it is morning or evening star, and also when conjunctions occur.

At superior conjunction, Mercury and Venus change from morning to evening star; while at inferior conjunction, the change is made from evening to morning star. After five conjunctions, alternately superior and inferior, of which three will be superior and two inferior, Mercury will reach the last conjunction this year on November 14, when a transit across the sun's disk will occur. After this date Mercury will be morning star for the rest of the year.

Mercury passes aphelion on January 14, April 12, July 9, and October 5. For several days before and after April 12 he will be seen very advantageously as morning star. Also before and after June 23 and October 21 he will be distinctly visible as evening star, when he is approaching and receding from aphelion. These positions are selected as illustrations, because at these dates he is not far from his maximum distance from the sun. The perihelion passages are on February 27, May 26, August 22, and November 18. The transit will occur four days before the planet reaches perihelion.

Venus will be morning star until September 14, when she will reach superior conjunction. She will then be evening star for the rest of the year.

The positions of Mars relative to the sun and earth before and after opposition, which occurs on July 6, have been explained in the SCIENTIFIC AMERICAN in a previous article (November 24, 1906), and with the aid of the plot the reader will have little difficulty in realizing the situation in the heavens of Jupiter, Saturn, Uranus, and Neptune at any assigned date.

Lead in Ice Cream.

Baldoni (Riforma Med.) finds considerable amounts of lead in ice cream, fruit ices, etc., as sold in Rome. He attributes many of the disturbances of digestion occurring during the summer when ice cream, fruit ices, sorbets, etc., are consumed in larger quantities to the lead contained in these articles. The linings of the receptacles in which ice cream is made often consist of an alloy of tin and lead. The ingredients of ice cream dissolve this, but in addition to this, in turning the mass in the freezer a certain amount of the lining of the vessel is rubbed into the cream. This was proved conclusively by the writer, who found that particles of tin and copper were precipitated at the bottom of glass vessels in which he melted ice cream. On filtering the liquid these articles also were found on the filter. He destroyed the organic portions of the cream by means of fuming nitric acid and by electrolysis, and recovered the lead.

Price of Illuminating Gas in England.

Consul F. W. Mahin reports that the price of illuminating gas in Widnes, Lancashire, England, is now 32 cents to small consumers, but will be reduced to 30 cents on July 1. Large consumers will pay from 22 to 26 cents. This is claimed to be the cheapest gas in the world. The town has about 30,000 population. The price of gas is remarkably low everywhere in Great Britain, whether under public or private control, the general range of price being 40 and 70 cents.

Correspondence.

Large Powder Chambers a Cure for Erosion.

To the Editor of the SCIENTIFIC AMERICAN:

Supplementing my former letter and your editorial comments thereon, appearing in your issue of the 19th instant, I desire to direct attention to further and most important lessons taught by the firing records made by both the Gen. Crozier wire wound, and the Brown wire 6-inch guns, recently tested by the United States government at Sandy Hook.

Most surprising results were revealed in regard to high velocities with low maximum pressure.

The first round from the Gen. Crozier gun, with 33 pounds of powder (100-pound shot) gave a muzzle velocity of 1,604 feet per second, with a pressure of 8,600 pounds per square inch.

The second round (100-pound shot) with 49 pounds of smokeless powder, gave a muzzle velocity of 2,161 feet per second, with a pressure of only 15,470 pounds, which was most astonishing in comparison with the results obtained with the old brown prismatic powder, when a pressure of about 37,000 pounds per square inch was required to secure about 2,000 feet per second velocity.

To establish more fully the fact that these remarkable results were due to the large powder chamber, we quote the government record of the first two shots fired from the Brown wire 6-inch gun, which also had a powder chamber of about the same size as that of the Crozier gun: The first round with 33 pounds of powder (100-pound shot) gave a muzzle velocity of 1,913 feet per second, with a pressure of 12,275 pounds per square inch. The second round from the Brown gun, with 49 pounds of powder (100-pound shot) gave a muzzle velocity of 2,484 feet per second, with a pressure of only 20,866 pounds per square inch.

Thus we have the records of both the Crozier and the Brown guns, both having large powder chambers, to establish conclusively the fact that such guns are capable of giving comparatively high muzzle velocities with low maximum pressures.

Indeed, the official records show that these guns did give muzzle velocities as great as can be obtained from the best service guns of the same caliber now in use, with very much lower maximum pressures.

The importance of these facts is, that when fired with service velocities of 2,600 or 2,700 feet per second the pressures would be so extremely low—at least 10,000 pounds less than the service gun—that the life of these guns will be many times longer than that of any guns of the same caliber having the present service powder chamber.

A 40-caliber 12-inch gun with a powder chamber of 25,000 cubic inches, which would be about the same proportion as the chambers in the Crozier and Brown guns, and with 480 pounds nitrocellulose powder, properly granulated, would easily give an 800-pound shot a muzzle velocity of 2,600 feet per second, and with a pressure of not more than 26,000 pounds per square inch. With that low pressure, a 12-inch gun could fire three or four times as many shots, without being very much eroded, as the 12-inch guns now in use can stand without serious erosion. These require a pressure of about 37,000 pounds per square inch to give the same velocity that 26,000 pounds pressure would give in a 12-inch gun with the larger chamber.

It is stated in the last annual report of the chief of ordnance of the United States army, that the life of their 12-inch guns was limited to 60 shots.

In event of great emergency a large-chambered 12-inch gun could be fired with 600 pounds of powder, which would give an 800-pound shot a velocity of 3,200 feet per second and a pressure not exceeding 45,000 pounds per square inch, being the service pressure of the above-mentioned 6-inch wire guns.

The adoption of the large-chambered 12-inch gun is feasible, and the weight of the gun need not be increased, nor its cost, if it were wire wound, and wound its entire length, on the plans of the Crozier 10-inch wire-wound gun, or the 6-inch Brown wire gun.

This large-chambered 12-inch gun would have many advantages over the proposed 14-inch guns which were recently recommended by the Ordnance Department to replace the 12-inch guns now in service.

1. In the first place, its cost, including carriage (the present disappearing carriage for 12-inch guns could be used), would be very much less than the 14-inch gun with correspondingly larger carriage.

2. The life of this 12-inch gun with the large chamber would be as long as the more expensive 14-inch gun, when fired, to obtain the same energy.

3. Such a 12-inch gun could be fired more rapidly, the ammunition being so much lighter, and when emergency charges were necessary, it would have fully 50 per cent greater striking energy.

Pressures increase rapidly with the increased density of loading without a corresponding increase of velocity, as illustrated by the following figures, quoted from the official government firing sheet of the 6-inch Brown wire gun, viz.:

33 pounds of powder gave 1,913 feet velocity with 12,274 pounds pressure.

49 pounds of powder gave 2,484 feet velocity with 20,866 pounds pressure.

61 pounds of powder gave 3,000 feet velocity with 30,000 pounds pressure.

75 pounds of powder gave 3,514 feet velocity with 50,000 pounds pressure.

84 pounds of powder gave 3,723 feet velocity with 66,000 pounds pressure.

If the powder chamber in this 6-inch Brown gun had been even still larger, so that the density of loading had not exceeded 0.6 of its capacity, the maximum pressures would have been much lower than they were, and the muzzle velocities would still have remained about the same, and naturally the life of the gun would have been prolonged.

In order to get high velocities from small or ordinary chambered guns, the density of loading is necessarily very high, thus resulting in high pressures and short life to the gun. JOHN H. BROWN.

New York, January 30, 1907.

Aeronautical Notes.

Members of the Aero Club of America will go to Washington, D. C., and make a balloon ascension at that city on Washington's Birthday. They expect to interest a sufficient number of people to form an affiliated club in the capital city.

The announcement has just been made that a wealthy American gentleman has given the Aero Club a prize running up into the thousands for the first flight in this country of a motor-driven aeroplane. The amount of the prize and the conditions under which it will be contested for have not as yet been announced. Altogether, the prizes offered in Europe and America now aggregate over $200,000, which should be sufficient inducement for inventors having a perfected machine to make some public demonstrations. The Wright brothers, of Dayton, Ohio, were in New York recently, and they stated that they were building two new machines, one of which would be capable of carrying two people, while the other is intended for long distance flights. No doubt these gentlemen intend to compete for the prizes that have been offered.

The Aero Club of America announces that, owing to the generosity of certain citizens of St. Louis, it will be enabled to offer a number of supplementary prizes to the contestants in the Bennett International Aeronautic Cup Race, to be held in that city on October 19. These prizes are in addition to the International Aeronautic Cup and the $2,500 offered to the winner. They include $1,000 for the contestant making the second greatest distance; $750 to the third; $500 to the fourth, and $250 to the fifth. These prizes will be given in cash or plate, at the option of the winner. It is probable that the Aero Club will offer a separate cup to the aeronaut who remains in the air the greatest length of time, while the German-born citizens of St. Louis have promised a special cup to the representative of Germany who makes the best record in the race. Foreign entries closed Feb. 1. American competitors must make their entries 60 days before the race. The American team will be chosen by a committee from among about a half dozen entries. Three balloons, or other type of flying machine will represent each country, and it is expected that representatives of England, France, Germany, Italy, and Spain will take part in the second contest.

By a decision of the Secretary of the Treasury under date of January 16, 1907, it has been decided that airships and balloons may be imported into this country under bond for the purpose of competing in the race. Free entry under bond by non-residents of the United States will be limited to balloons for the purpose of racing or taking part in specific contests, but not for display at shows of any kind. A consular invoice to cover such balloons must be obtained before departure from the United States consul at the city where the goods are shipped. On this consular invoice there must be affixed a declaration of intention by the oath of the owner, or his agent, to the effect that these balloons are shipped into the United States for the purpose of taking part in the Gordon-Bennett International Aeronautic Cup Race. This consular invoice and certificate must be presented at the time of entry into the United States. The Aero Club of America has appointed Messrs. Niebrugge & Day, 121 Pearl Street, New York, to act for the contestants in this contest. It is suggested that balloons should arrive at the port of New York at least two weeks before the date of contest in order that they may reach St. Louis in ample time. It is also suggested that Messrs. Niebrugge & Day be given notice at least a week in advance of the shipment, with name of steamship. These gentlemen will make arrangements with some surety company to issue bonds to cover the customs dues. The balloons must be exported from the United States within six months from the date of entry.

THE SOMERSAULTING AUTOMOBILE.

A leading attraction at many of the county and State fairs last summer was the thrilling exhibition of the somersaulting automobile. The automobile travels down a steep incline, at the bottom of which is a sharp upward turn, which shoots the machine into space, where it turns a complete somersault in the air and then drops onto a spring platform.

The somersaulting idea is not entirely new, for over a year ago we illustrated a French apparatus of this character which was on exhibition for a short while in this country. However, the methods of somersaulting the machine are very different in the two cases. In the French apparatus a system of springs and levers gives the rear of the car a throw just as it is leaving the track; while in the present apparatus, which was invented by Mr. Maurice Garanger, of this city, entire dependence is placed on the form of the track to properly somersault the machine, thus obviating all danger of breakage, and preventing that sudden jerk which was found to be so injurious to the performer in the French apparatus. The inclined chute consists of a pair of broad tracks for the wheels of the vehicle, and between these tracks are a pair of guide rails. The vehicle is provided with two ball-bearing rollers in front, which bear against the sides of the rails. The rollers are mounted on vertical axes, and serve merely to guide the machine laterally without interfering with its vertical movement. At the rear there are also two rollers, but these are mounted directly on the rear axle, and they ride on the top of the rails. The rails have a V-shaped upper tread, and as the rear rollers are cut to fit this tread, they help to hold the machine in proper alignment with the track. As may be seen in the engraving, the guide rails terminate in a sharper upward bend than do the main tracks. The forward end of the vehicle follows the main track, while the rear is pitched upward by the guide rails. The vehicle is thus caused to turn a somersault forward.

Odd as it may seem, the car does not describe a loop anywhere in its course; for, to be sure, it must turn on its center of gravity, which is obliged to traverse a parabolic curve, just like a stone or any other body that is thrown through the air. So slow is the turning movement in comparison with the forward motion of the center of gravity, that no loops are described even by the wheels, though investigation shows that just after the car is launched, its extreme forward end momentarily moves backward and doubles on its course, while just before the landing is made, a similar loop is described by the extreme rear end of the automobile. To illustrate the peculiar curves described by the car, we have plotted its course across the gap, showing its position at intervals of two feet, as measured along the horizontal. In order to avoid confusion, the car at the successive positions is shown alternately solid and in outline. The center of gravity at each stage is indicated by a dot, and these dots are connected by a broken line which, as will be observed, is a parabola. Two of the broken lines show the paths followed respectively by the forward and rear wheels. The front wheels leave the track with the car inclined at an angle of 45 degrees; but the rails which guide the rear rollers pitch the rear of the car upward through an angle of 40 degrees, during which time the center of gravity moves two feet forward, as measured in a horizontal direction. The car, now clear of the track, continues the turning movement at the rate of 40 degrees for every two feet of horizontal advance until it eventually lands upon the spring platform at the end of the gap.

In the construction of the incline, the greatest care is necessary to obtain a proper relation between the pitch of the guide rails and that of the track. A variation of a fraction of an inch is sufficient to cause a bad landing of the car. If the guide rails were not used, and the rear of the machine were guided by the tracks on which the forward wheels travel, there would be a turning movement of only 1 or 2 degrees per horizontal foot. By shortening the wheel base, the angle of rotation per foot may be increased, and conversely, by lengthening the wheel base the angle may be decreased until there is no rotary movement. Thereafter, further lengthening of the wheel base will cause the car to turn a somersault in the opposite direction.

The machine is, of course, merely a dummy automobile, for it carries no motor, brake, or steering gear. The performer is strapped to the seat, and has absolutely no control of the car. The car is well cushioned, and, as may be clearly seen in one of the engravings, a pillow is placed under the strap to prevent injury to the occupant.

The total weight of the car loaded is about 800 pounds. It is drawn up, with an attendant, to the top of the incline, which is 50 feet above the ground. When all is ready the attendant releases the clutch, and the car shoots down with rapidly-increasing velocity. Just as it is about to take the leap it has a speed of 28 miles an hour. To the spectators the most thrilling moment occurs just after the car has passed the apex of its course, for here the performer, head downward, appears to be for the moment stationary, while the car swings rapidly over her. But it is all over in an instant; for in less than a second the gap is traversed.

As may well be imagined, the greatest care must be exercised in arresting this tremendous projectile, and bringing it safely to a stop. For this purpose a landing platform of collapsible type has been invented. The platform is normally held in an inclined position by a series of heavy springs acting through the medium of four levers.

When the vehicle lands on the platform the latter collapses, and the shock is taken up by the springs. Then the machine rolls off and along the ground for a distance of 30 or 40 feet, until its energy is spent.

No mishaps have as yet occurred, though occasionally when all four wheels have not struck the platform at exactly the same instant, a wheel has been crushed by the terrific impact; for it should be borne in mind that an 800-pound car is no light object to be hurled across a gap of 20 feet.

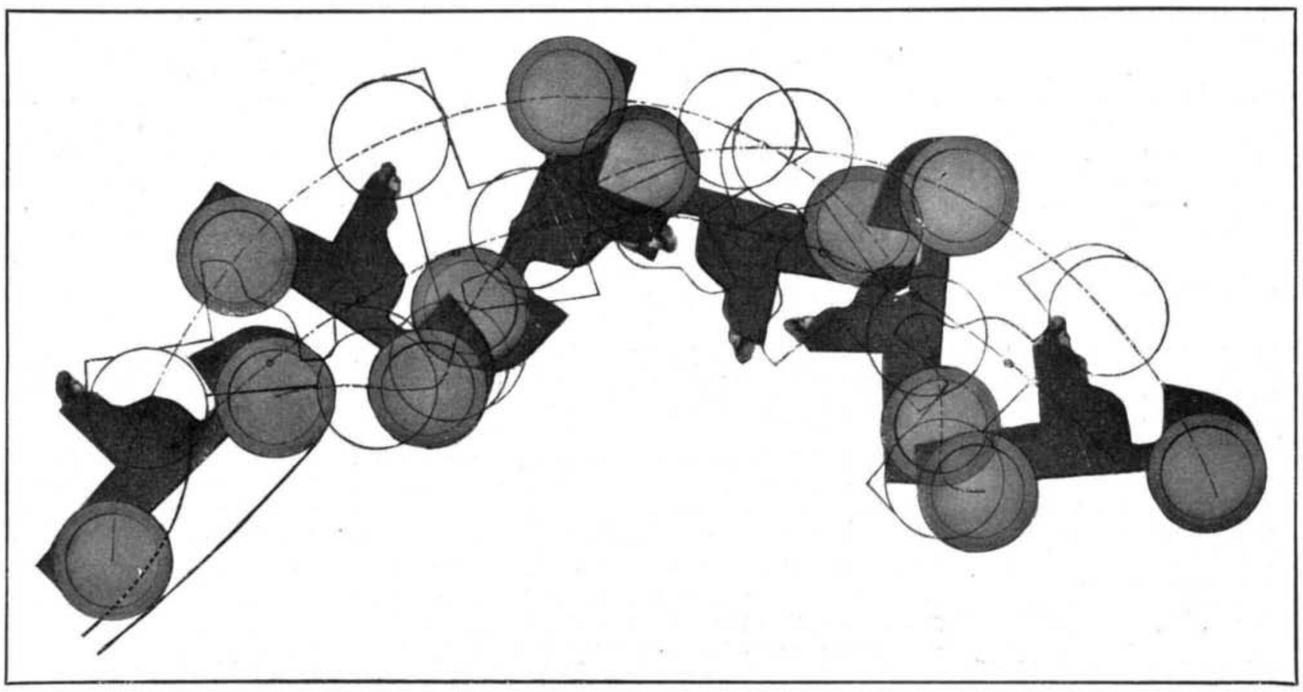


Diagram Showing Successive Positions of the Automobile in Its Leap Across the Gap.

The Forward End of the Car Momentarily Stands Still While the Rear Swings Over.

THE SOMERSAULTING AUTOMOBILE.

THE BATTLESHIP OF THE FUTURE.—I.

BY FORREST E. CARDULLO.

An unusual interest has been taken in the new British ship "Dreadnought," not only by those whom we might expect to find professionally interested in all naval affairs, but also by the average layman, who reads nothing more technical than the columns of the Sunday paper. To the latter she is interesting simply as the biggest and most powerful warship afloat, but to the man who concerns himself with naval affairs, she is even more interesting as the forerunner of the new type of battleship.

In most respects, the "Dreadnought" is simply a further advance along those same lines in which battleship design has been progressing for the past fifteen years. Her armor is of Krupp steel, similar to that carried by the present-day type of ship, being, however, a trifle thicker than is usual in British ships. Her speed is high for a battleship, being 21½ knots. She is driven by steam turbines, instead of reciprocating engines. The hull is subdivided into separate watertight compartments to an unusual extent, as a protection against torpedoes. To make all these improvements possible, the ship is of great size, being of about 18,000 tons nominal displacement. There are many other unusual features in her construction, adopted with the idea of making her more seaworthy, more comfortable for her crew, or more convenient to operate, but none of them materially affect her fighting efficiency.

In one respect, however, the "Dreadnought" is a radical departure from the type of battleship that has been the accepted standard for the past fifteen years. Her main battery consists of ten 12-inch guns, in place of the four 12-inch guns usually carried. She is without any intermediate battery whatever, while the present type of ship carries an intermediate battery of from twelve to twenty guns, varying in caliber from 6 to 8 inches. All the weight generally devoted to this battery, its ammunition, mountings, armor, etc., in the case of the "Dreadnought" is devoted to the primary battery. The reason for this change is as follows:

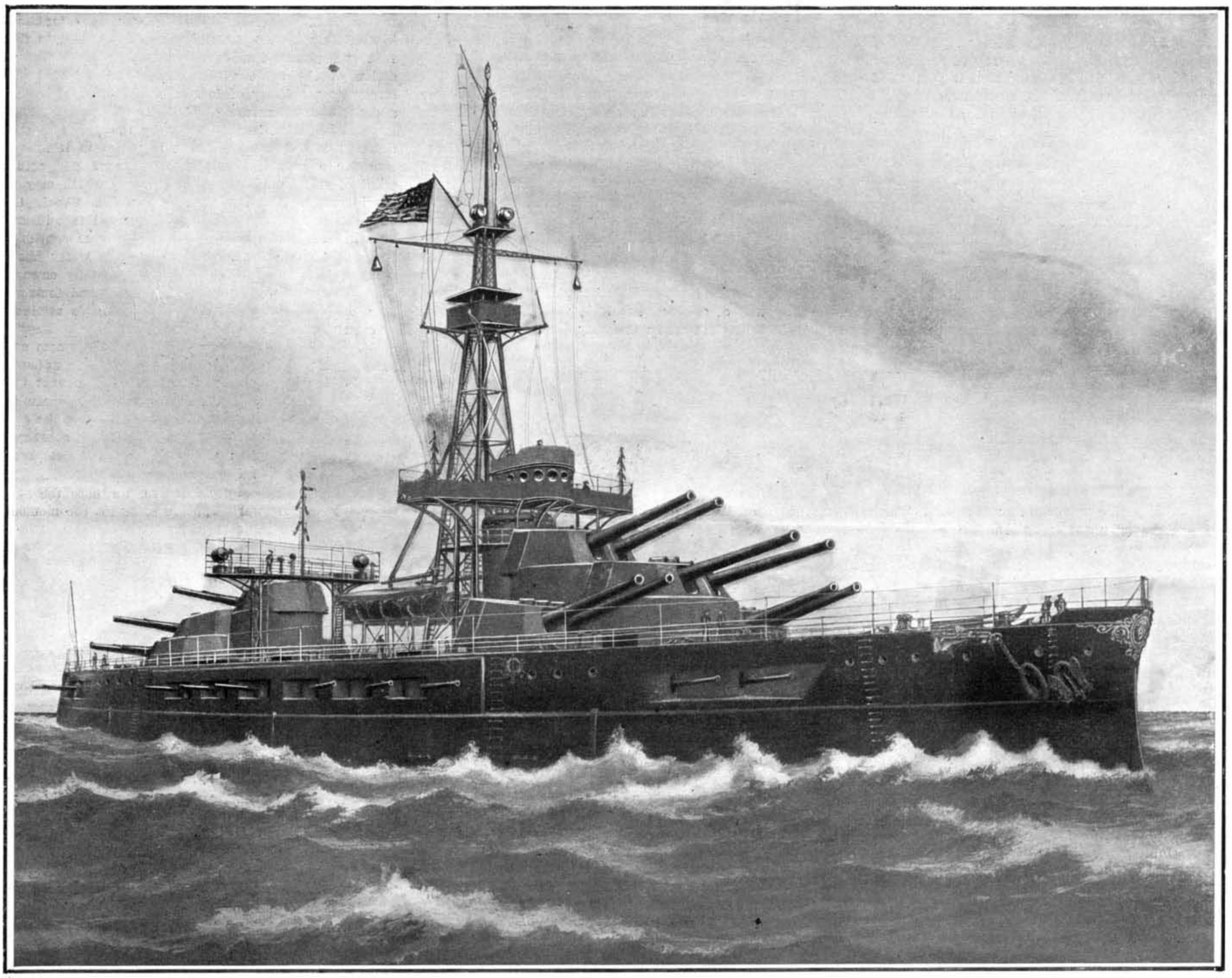
Let us suppose that the "Dreadnought" engages our own "Connecticut." The "Connecticut" carries an intermediate battery of unusual power, and is therefore an especially good representative of the present type of ship. If the vessels fight at long range, the 12-inch guns of the "Dreadnought" will soon destroy the "Connecticut's" intermediate battery, since they can easily penetrate the 7 inches of armor defending it, even at 10,000 yards range. While at this range the "Connecticut's" guns can inflict a tremendous amount of damage on the "Dreadnought's" upper works, they can do nothing which will impair her fighting ability in the least, since all of the heavy guns, machinery, magazines, and other vitals of the British ship are protected by armor 12 inches thick.

If, on the other hand, the vessels close in till the heavy guns of each can inflict serious damage on the other, the four guns in the "Connecticut's" primary battery would be overwhelmed by the ten guns of the "Dreadnought," while the American's intermediate battery would be powerless to affect the result. Twenty of her guns would be ruled out of the battle through lack of penetrating power. Although they might be trained against the upper works of the British ship, where they could destroy perhaps a million dollars' worth of property, the effort would not have the slightest effect on the result of the battle. Neither would the intermediate battery effect any injuries of this character which the main battery of another "Dreadnought" could not inflict. At all ranges, and for any service, the plan of having two calibers of heavy guns aboard ship is inferior to the new plan of making all these guns of the same caliber.

In the course of this paper the writer purposes to develop in a general way the lines along which battleship design may be expected to progress in the future. Our deductions will be based on several fundamental propositions, the first of which is that all her heavy guns will be of the same caliber. The second is that invention and discovery will in the future, as in the past, permit of continual improvements in the material and mechanism of warships. The third is that individual ships will continue to increase in size and power, provided that there is a corresponding gain in efficiency. The fourth is that the designer must seek to obtain the most powerful fleet possible with a given annual money cost. It costs money to build warships, and it costs even more money to maintain them ready to perform effective service. The first cost of a ship of a given type is very nearly proportional to her displacement. The cost of maintenance of a ship is nearly proportional to her displacement, being, however, less per ton in the case of the larger ships. A large ship is more powerful in proportion to its size than is a small ship, and therefore more powerful in proportion to its cost. The limit to the size of a ship is reached at that point where an increase in the number of guns carried does not produce a proportionate increase in the power of the ship, on account of interference between them. It is not possible to arrange a very large number of heavy guns on a ship in a satisfactory manner, since either each gun will have only a small arc of fire, or else the blast from one gun will prevent another from being properly served and aimed. It is next in order, therefore, that we investigate the probable distribution of guns on our battleship of the future.

Of the possible arrangements of heavy guns, the most usual is to mount them in pairs in turrets. This arrangement combines a maximum arc of fire and a very thorough protection with a minimum weight of armor and mountings. A number of arrangements of guns so mounted are shown in Figs. 1 to 4. Fig. 1 is the arrangement to be used on the United States battleship "Michigan." It will be noted that there are eight guns, so mounted that all of them may be fired on either broadside, four of them may be fired ahead, and four of them may be fired astern. Assuming that broadside fire is twice as valuable as bow or stern

(*Continued on page 136.*)



Displacement, 26,000 tons. **Speed with producer-gas engines,** 22.5 knots. **Cruising radius,** 13.000 miles. **Armor:** Belt, 12 inches; barbettes, 16.4 inches; turrets (face), 16.4 inches. **Armament:** Sixteen 12-inch, 50-caliber, 75-ton guns, firing 1,200-pound shell with 3,300 foot-seconds velocity. Torpedo boat defense, twenty 4.7-inch, 60-caliber guns, firing 50-pound shell with 4,000 foot-seconds velocity. **Note the absence of smokestacks. The main battery emplaced in two diamond-shaped barbettes at each end of central armored redoubt, as in diagram Fig. 5.**

THE BATTLESHIP OF THE FUTURE.

THE OPTICAL INTENSIFICATION OF PAINTINGS.

BY R. W. WOOD, PROFESSOR OF EXPERIMENTAL PHYSICS IN THE JOHNS HOPKINS UNIVERSITY, BALTIMORE.

One of the great difficulties which, the artist has to contend with in representing scenes in which great contrasts of luminosity occur, is the comparatively narrow range of luminosity obtainable on canvas with pigments. According to Aubert, the whitest paper is only fifty-seven times as luminous as the darkest black paper, and this probably represents about the range obtainable in paintings. Contrast with this the enormous range of luminosity in a sunlit landscape, where the high lights are many hundred times brighter than the deep shadows, to say nothing of sunset views, where the disk of the sun itself is to appear in the picture. As is well known, the colors of natural objects change in tint as the illumination is increased, green becoming yellowish for example; and artists, by taking advantage of this circumstance, consciously or unconsciously, are able to suggest a high degree of illumination without actually reproducing it. Pictures are sometimes improved by strong local illumination; anyone who has spent much time in sketching must have frequently noticed what pleasing effects are sometimes produced when a ray of sunlight, filtering through the trees, falls upon that portion of the canvas which represents, say, a sunlit meadow. Noticing effects of this kind so frequently, I have been led to experiment with carefully-graded illumination, and have obtained results of remarkable beauty. If we can produce a strong illumination on all of the high lights of the picture, and a feeble illumination on all of the shadows, we shall obviously greatly increase the range of luminosity. This may be done by a very simple means. We have only to take a photograph of the painting on an orthochromatic plate, preferably on a red sensitive plate with a suitable ray filter, make a lantern slide from the negative, and project this picture, not on a white screen, as is usually the case, but upon the original painting. The experiment is to be made in a darkened room, of course.

Effects of a very startling nature are produced in this way, especially in the case of moonlight and sunset pictures with fine cloud effects. The most striking, and artistically the most pleasing subject which I have yet tried is a little pastel of the market place in Concarneau (Brittany) by Bullfield, which is a wonderfully sunny picture. Under the graded illumination of the lantern the picture becomes filled with a perfect flood of sunlight, and we feel at once that here for the first time we are looking at a picture in which the enormous luminosity contrasts of nature are really approached. If after looking at the picture illuminated in this way for a few minutes, we remove the slide from the lantern, allowing a uniform illumination to fall upon it, we feel a decided shock. The picture looks as if it had not been dusted for ten years, the sunlight leaves it, and everything looks flat. As we become accustomed once more to the usual illumination, the appearance of the picture gradually improves. It is most curious, however, to note how a short view of the painting under the light of the lantern educates us at once to a higher standard of luminosity contrast, so much so in fact that when we change suddenly to ordinary illumination the picture at once strikes us as a very feeble attempt at anything like correct values. The effects are very different, according to whether we take our negative on an ordinary or on an orthochromatic plate, especially if there is much blue in the picture. We can in this way alter the relation of the values in the picture, and study the effect.

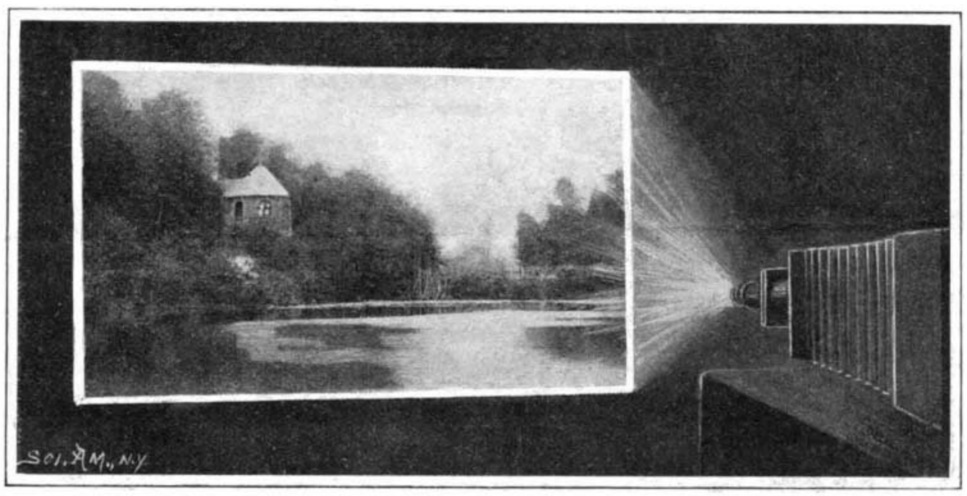
It is my opinion that if the values are correct in the original painting, they will hold under the graded illumination produced by the lantern. If they are not right, the errors will be glaringly magnified. As yet I have not had an opportunity to experiment with many pictures, but the method is so easily carried out that anyone having a good lantern can repeat the experiment.

If the picture contains patches of bright, pure red, and a red sensitive plate is not available, it is a good plan to touch up the negative, as otherwise the illumination of these patches will be too feeble. Any desired effect can be secured by local reduction or intensification of the negative or lantern slide. We can in this way experiment to our heart's content with a painting, altering the values at will without injuring it in the slightest. A most curious effect is obtained if the negative itself is projected upon the painting. This of course lessens the contrast, and if the negative is a fairly dense one, it may destroy the contrast almost entirely, making the picture look like an almost flat wash of chocolate. This experiment is instructive only as showing how completely the values in a picture can be controlled by local illumination.

The method is of course of very little practical importance, though a small exhibition of suitable pictures illuminated in this way would be well worth attending. Each picture would have to be illuminated by a separate lantern, of course.

In repeating these experiments, the only difficulty which will be found is getting the lantern picture "into register" with the painting. In taking the negative care should be taken to have the painting exactly vertical, and the lens of the camera directly in front of its center. The same conditions should obtain during the illumination of the painting. It takes some little practice to get the projected picture exactly the right size. The best plan is to select two conspicuous objects, and note whether their distance apart is greater or less in the projection than in the painting. If the former is found to be true, the painting should be brought nearer to the lantern, the focus being changed, of course.

Very likely scenic effects on the stage could be heightened by employing this method of illumination, or some modification of it.



THE OPTICAL INTENSIFICATION OF PAINTINGS.

The Cause of Soft-Shelled Eggs.

Poultry writers, since the time the Shanghai rooster first invaded Boston, have been repeatedly telling us that soft-shelled eggs were caused by an insufficiency of lime in the food consumed by the hens. Such, however, is not the case. The soft-shelled egg is a case of arrested development, due to nervous interference with the functions of the oviduct. The laying of incompletely developed eggs corresponds to abortion in mammals, and can likewise be brought about by extreme mental disturbance. In experiments conducted at the Kansas Experiment Station the writer was able to cause the production of soft-shelled eggs by continued excitement of confined hens. It was also shown that the hen's system on an ordinary diet contains enough calcium carbonate for the formation of about five or six eggs. If lime was withheld from the food, the hen after having laid this number of eggs, will stop laying. When lime was given in limited quantities the hens laid apparently normal eggs, but only as frequently as the lime furnished would supply shell material. Careful weighings proved that eggs thus produced, though apparently normal, were actually thinner-shelled than normal eggs from the same hen. But little is known about the process and control of egg formation, and further study should yield facts of both scientific interest and practical bearing.

Official Meteorological Summary, New York, N. Y., January, 1907.

Atmospheric pressure: Highest, 30.69; lowest, 29.57; mean, 30.23. Temperature: Highest, 62; date, 7th; lowest, zero; date, 24th; mean of warmest day, 54; date, 7th; coolest day, 7; date, 24th; mean of maximum for the month, 38.9; mean of minimum, 25.6; absolute mean, 32.2; normal, 30.5; excess compared with mean of 37 years, +1.7. Warmest mean temperature for January, 40; in 1880 and 1890. Coldest mean, 23; in 1893. Absolute maximum and minimum for this month for 37 years, 67 and —6. Precipitation: 3.26; greatest in 24 hours, 0.98; date, 12th; average of this month for 37 years, 3.76. Deficiency since January 1, —0.50. Greatest precipitation, 6.15, in 1882; least, 1.15, in 1871. Snowfall, 11.7. Wind: Prevailing direction, N.W.; total movement, 9,060 miles; average hourly velocity, 12.2; maximum velocity, 59 miles per hour. Weather: Clear days, 7; partly cloudy, 9; cloudy, 15. Fog: 8th, 18th, 19th, 20th.

In the year just closed 11,753 automobile owners registered with the Secretary of State of the State of New York. This is an increase of 3,128 over the preceding year. During 1906 certificates were issued to 7,067 chauffeurs, as against 4,387 in 1905.

Has the Gulf Stream Any Influence on the Weather of New York City?

The following letter, by Mr. James Page, was sent in reply to a gentleman who had been told that a mild winter in New York city was due to the fact that the Gulf Stream is running sixty miles nearer shore than previously. We hope that its publication may contribute to correct the numerous popular misapprehensions relative to the important part played by the Gulf Stream in the economy of nature.

The Weather Bureau is in almost daily receipt of inquiries of this and a similar nature, all having their origin in a misconception of the character and extent of that motion of the ocean waters to which the name Gulf Stream may properly be applied. Speaking with precision, the term should be limited to that continuous discharge of the water of the Caribbean Sea and the Gulf of Mexico which takes place through the Straits of Florida, a narrow outlet bounded on its western side by the State of the same name, and on its eastern by Cuba and the Bahama Islands and Bank. Through this channel, constricted in its narrowest portion to a width of 32 miles, there is a constant outflow of the warm, equatorial waters heaped up in this vast and almost landlocked basin by the persistent action of the trade winds, rising at times in midstream to a velocity of four or five knots, and having a constant temperature of 81 deg. or 82 deg. F. The impetus imparted to this water by the pressure from the rear is moreover sufficient to maintain it in motion for a considerable distance beyond the actual point of exit from the channel proper, which may be considered as terminating at Matanilla Shoal, the northern extremity of the Great Bahama Bank, in latitude 27 deg. north. As a result the stream continues to be felt as a distinct body of warm water about forty or fifty miles in width, moving steadily onward, but with uniformly diminishing velocity and temperature, until a point opposite Cape Hatteras is attained, or even opposite the Capes of the Chesapeake. Beyond this point, however, the warm current spreads out over the adjacent area of the ocean like a vast fan, and the identity of the stream is consequently obliterated in the general eastward drift which characterizes the waters of the temperate latitudes.

Speaking then with precision, the Gulf Stream is a current of warm water, forty or fifty miles in width, which emerges from the Straits of Florida, follows the coast of the United States northward as far as the Capes of the Chesapeake, and is there merged in the generally eastward drift underlying the prevailing westerly winds of the temperate latitudes. To describe it in the language of Maury as "a river in the ocean, having its fountain in the Gulf of Mexico and its mouth in the Arctic Seas" is picturesque, but highly exaggerated and erroneous.

With reference to movements of the stream (viz., changes in its location as a whole), reports of which, furnished by navigators, appear from time to time in the daily newspapers, it may be said that these probably do exist, although within narrow limits. Observations of the "set" experienced by vessels crossing the stream, as also of the warmth of the surface waters, show that the position of the axis, or line of greatest velocity, as also that of the line of maximum temperature, may vary from day to day over a range of fifty miles. The methods of observations employed are, however, so replete with sources of error that little confidence can be placed in any single result. That such movements can have any effect upon the climate in the vicinity of New York is highly improbable, the stream itself in these latitudes being so dispersed as to be almost indefinable, and the modifications of the surface temperatures of the adjacent waters wrought by a temporary change in its position being certainly negligible.—Monthly Weather Review.

The three turbines of the "Carmania" contain in the aggregate a million and a quarter of blades, and those of the "Lusitania" will have approximately three millions of blades together. This means probably over one million of blades for each of the low-pressure turbines. The number of blades in the largest turbine which the Westinghouse Company has yet built is something over 85,000, but these turbines being built for electrical station purposes run much faster than the marine turbines, which latter have therefore a much larger number of blades. While the insertion and fastening of all these blades may present a problem to the manufacturer, the entire rotor shaft and attached blades are, so far as the operating engineer is concerned, a single piece. The blades when they leave the builders' hands are really integral with the spindle and case.—Power.

THE NEW LOCK AND KEY BOTTLE FOR HOLDING POISON.

The question of regulating the sale of poisons has become a very serious one in the great cities of the world, where the rush and roar of modern life make the druggist busy and the consumer careless. Thousands of inventive minds have been busy trying to devise some means of averting the many fatalities which we read about in the newspapers; and bottles have been produced with rough corrugations, fantastic death's head labels, and the like, but to little purpose.

Nurses and relatives of the invalid, or in many cases the sick man himself, have reached hastily for supposed medicine, and poured out and administered instead a deadly dose before the dreadful error was detected. Now, however, in London, Paris, Berlin, and other great centers an entirely new bottle for poisons has been devised, with the simplest lock and key arrangement, which will render it absolutely impossible that any tragedy shall ensue if it be used in the sickroom.

This new bottle, which has the approval of the most eminent physicians and toxicologists, costs but a few cents more than an ordinary medicine bottle, and it has a way of locking itself automatically, although the key is always attached to it, so that it may be readily opened when necessary. Thus it is absolutely impossible for anyone to mistake this poison bottle for one containing innocuous fluid. It clearly conveys its message of warning even when handled in the dark—a circumstance of the sick-room which has led to so many tragedies.

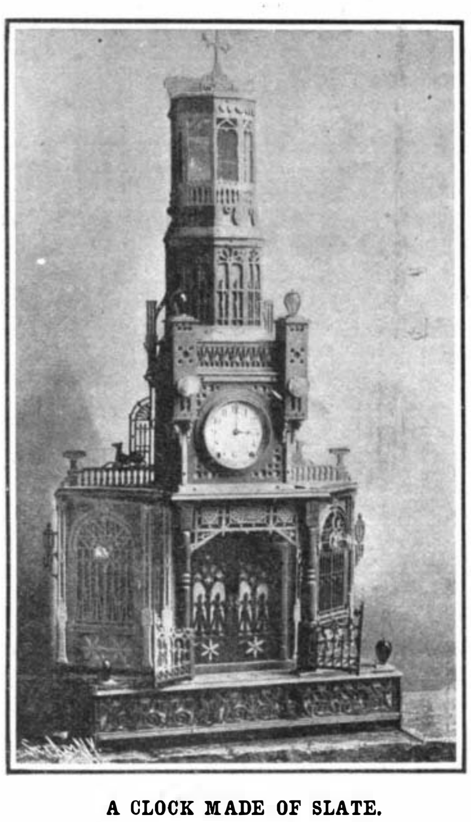
THE SPIDER'S WEB AS A NEGATIVE.

To one on a vacation and interested in photography, the good part of a day may be spent in collecting and printing cobwebs. The process is easy. Let him get the farmer's potato sprayer, put in it some "sizing japan," thinned with turpentine and colored from a terra-cotta tube. Then let him take some old window glass, or a few cleaned photo plates, and go in quest of a clear web with a good center. He will find it on an outbuilding or fence in the open. When found, let him spray it, then bring up a dry plate of glass behind it and lift it from its moorings. In a couple of hours the web will be dry, and so hard that the plate can be washed without any injury to the web. From plates thus secured he may make prints to his heart's content. To make combination pictures, put the plate over any clear negative and print through both of them. For printing the webs themselves, blue-print paper may be used to advantage, inasmuch as it simplifies the work.

In finer experiments I have tried dyeing the web, spraying it with a tincture to make it opaque, then taking a fresh damp photo plate which had previously been exposed to the light and washed in a hypo bath, to lift it. The filaments of the web were so fine, however, that though perfectly preserved it was impossible to make a print from it. So that for photos I still stick to the enameling process; that is, to spraying with "sizing japan." The japan is the same as used for gold lettering.

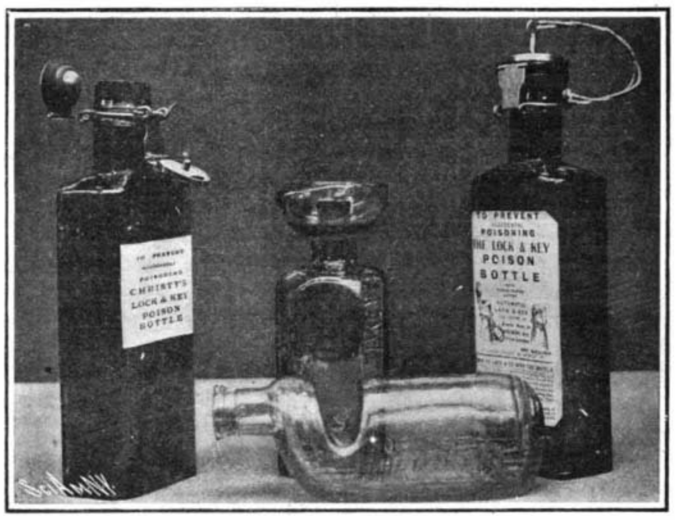
A CLOCK MADE OF SLATE.

Among the many queer materials from which clocks have been constructed heretofore, slate is probably one of the rarest; in fact, it may be taken for granted that the clock shown in our illustration is the only one of its kind in existence, being constructed entirely of roofing slate.



A CLOCK MADE OF SLATE.

Mr. O. Pritchard, a slate quarryman of Cardiff, Md., the builder of this unique timepiece, has made use of five differently-colored slates, including the peach-bottom blue slate and the red, green, and purple slate of Vermont. These colors are blended very artistically together, and the 164 pieces, mostly in open-work design, composing the clock are united by 300 screws of different sizes. The pieces of slate vary in thickness from 1/16 to 1/4 inch. The design of the clock, which has a cathedral gong, represents a church front, lighted with nine three-candle-power colored incandescent bulbs, adding much to the beauty of this unique construction. The clock, which required eight months to complete, is four feet high, two feet wide, and one foot deep. Owing to the extreme thinness of the slate sheets, many were broken before the clock was finished.



A POISON BOTTLE WHICH CANNOT BE ACCIDENTALLY MISTAKEN FOR AN ORDINARY PHIAL.

A SPIDER'S WEB PRINTED ON A PHOTOGRAPH.

The maker of the above clock is working on another larger clock of slate in the style of a grand Gothic altar, which will require two years to finish.

Little is known about how long the seeds of the various vegetables preserve their germinative power. De Candolle alone, hitherto, had studied the question. In 1846, he sowed the seeds of 368 different species gathered by himself and preserved for 14 years. He saw 17 species germinate; 5 malvaceous (out of 10 sown); 9 leguminous (out of 45); 1 labiaceous (out of 30). Mons. Paul Becquerel has recently taken up this investigation upon a larger scale, and he has just communicated his results to the Académie des Sciences. He sowed 550 species belonging to 30 families of monocotyledons and dicotyledons. These seeds had been preserved at the museum for a time varying from 25 to 135 years. They were washed in sterilized water; husked when the integument appeared too impermeable; then placed upon moist aseptic *coton hydrophile* in a glass tank covered with a glass plate, which was maintained at a constant temperature of 28 deg. C. Out of these 550 species, each represented by a dozen seeds, 23 only germinated: 18 leguminous (2 laburnum, 1 mimosa, 2 acacias); 3 lotus; 1 malvaceous (lavatera), and 1 labiate (stachys). Seeds from 30 to 60 years old, several of which had the reputation of being good for several centuries, did not germinate. Of this number were: poppy, tobacco, euphorbia, foxglove, etc. The seeds more than 45 years old that germinated belong to the following species: *Acacia bicapsularis, Cytisus biflorus, Leucæna leucocephala.* These seeds have a thick integument assuring impermeability to the gas of the atmosphere almost as perfect as if that impermeability had been produced artificially. This peculiarity agrees with the fact universally known to-day, that desiccation is an indispensable condition in the good preservation of seeds.

A New Denatured Alcohol Bill.

The compromise denatured alcohol bill agreed on by the House Committee on Ways and Means carries a provision that the measure shall not become effective until after September 1, 1908. This date was fixed at the request of Mr. Yerkes, Commissioner of Internal Revenue, for the purpose of granting him adequate time to prepare regulations for the manufacture of alcohol by small manufacturers not connected with distilleries.

The present law removing all internal revenue tax from denatured alcohol permits only distilleries and factories having large denaturing warehouses to engage in the manufacture of the alcohol designed for fuel, light, and manufacturing purposes, and the bill just reported by the House Committee is to permit farmers to convert their products into alcohol.

PUBLIC WEATHER TOWERS IN VIENNA.

In several of the beautiful parks of the city of Vienna very interesting weather towers or booths (Wetterhäuschen) in the shape of a pagoda can be seen. In the Maria Josefa Park, just opened, is one shown in our engraving, which is distinguished from most others by the number of its meteorological instruments, and by very full data and indications of general interest. It was made by Heinrich Kappeller, from a design by Ignaz Fuchs. On the front is an ingeniously constructed universal clock, designed and patented by Prof. Lauda, of Leitmeritz, and made in Vienna. This clock shows the time in all the large cities of the world. On the northeast side is an immense atmospherical thermometer, showing the temperature of the moment, while another beside it gives the extremes of the twenty-four hours past. On the northwest side is a new instrument, namely, an electrical barometer, which gives warning of impending electrical storms. Beneath it is a meteorological telegraph instrument, and from these two weather prophets reliable conclusions can be reached. On the southeastern side is a self-registering barometer, by which the variations in atmospheric pressure for an entire week are recorded on a strip of paper. On the southwestern side are two self-registering thermometers, protected from the sun. One shows the variations in the temperature of the atmosphere, the other the changes in a stratum of earth beneath the booth some eight feet deep. The remaining space is filled with interesting meteorological data. The booth receives much attention from visitors. The idea of combining the useful with the ornamental is a good one, and might be followed to advantage in our public parks.

PUBLIC WEATHER TOWER IN VIENNA.

THE BATTLESHIP OF THE FUTURE.—I.

(*Continued from page* 133.)

fire, we may estimate roughly the power of this arrangement as $2 \times 8 + 4$, or 20 gun units. In like manner we may say that its comparative efficiency is $20 \div 8$, or 2.5.

Fig. 2 represents the arrangement of the guns of the "Dreadnought." In this case, although there are ten guns, only eight of them can fire on either broadside, and six of them can fire ahead. While theoretically six guns may be fired astern, also, as a matter of fact there is a large space to the rear of the ship on each side of the center line, on which only four guns can be brought to bear. In this design, none of the guns fire over the turrets of other guns, it being different in this respect from all the others shown. The power of the "Dreadnought" is $2 \times 8 + \frac{6 + 4}{2}$, or 21 gun units, and the efficiency of the arrangement is $21 \div 10$, or 2.1.

Fig. 3 is a distribution of twelve guns after the arrangement in use on our own "Connecticut." Eight guns can be fired on either broadside, and six guns ahead or astern. The power of the arrangement is 22 gun units and the efficiency is 1.83. Fig. 4 is another arrangement of twelve guns. No similar arrangement is in use on any ship at the present time. Ten guns may be fired on either broadside, and eight ahead or astern. The power is 28 gun units, and the efficiency is 2.33.

In each of the arrangements so far discussed, each turret is presumed to be mounted on a barbette, or circular armored tower, rising from the armored deck at the water line to the base of the revolving turret. The armor of this barbette comprises more than half the weight of the whole structure. If we arrange the turrets in groups, each group mounted as close together as possible, and all mounted on an armored citadel, instead of several separate barbettes, there is a possibility of a considerable saving in weight. In Fig. 5 is shown such an arrangement, where the armament is gathered into two groups of four two-gun turrets each, each group of turrets being mounted on an armored citadel, diamond-shaped in plan. For the same thickness of armor, the weight of the citadel is but two-thirds of the weight of four barbettes. The power of this arrangement is 32 gun units, since twelve guns can be fired on either broadside, and eight guns ahead or astern. Since the efficiency, on the plan we have been considering, depends on the number of guns carried in two-gun turrets, each mounted on a separate barbette, we may estimate the comparative efficiency of the proposed arrangement in the following manner: Assuming that the weight of the barbette is 50 per cent of the weight of the whole structure, we have reduced the total weight by 1-3 × 50 per cent, or 16 2-3 per cent. For the same number of guns, the total weight of the structures is but 83 1-3 per cent of that of eight separate turrets, each with its own barbette. The efficiency of the arrangement is accordingly 32 ÷ (16 × 83 1-3 per cent), or 2.40.

It is possible to mount guns in threes as well as in pairs, provided that the turrets be suitably enlarged. The turret would become circular instead of elliptical, a slightly greater distance between the guns would be desirable, and the three guns would be trained and elevated as a unit in the same manner as the two guns of a turret now are. The disadvantages of such a scheme are that it makes the turret more complicated and crowded, that the larger turret is a better target, and that an accident to a turret will put three guns out of action instead of two. The advantages are that a ship of a given size may in this way carry more guns, since the weight of the entire structure is not increased in the same proportion as the number of guns, that the guns may be so arranged as to interfere less with each other's fire, and that given the same number of guns and the same displacement, the ship having three-gun turrets will be more speedy, more heavily armored, and more powerful in point of gun fire than her opponent with two-gun turrets. In the writer's opinion, the advantages of the system very much outweigh its disadvantages. Accordingly, we will consider the following possible arrangements of guns.

Fig. 6 is an arrangement of twelve guns in four three-gun turrets. The entire twelve may be fired on either broadside, and six may be fired ahead or astern. The power of the arrangement is therefore 30 gun units. The efficiency may be estimated as follows: In the case of the two-gun turret, the weight of the turret and barbette together is very nearly 75 per cent of that of the whole structure, while the weight of the guns comprises the remaining 25 per cent. To allow of three guns in a turret, the area of its ground plan must be increased 50 per cent. This will necessitate an increase of 23 per cent in the circumference of its walls, or an increase of 75 per cent × 23 per cent, or 17 per cent, in the total weight of the structure. The extra gun will increase the total weight by ½ × 25 per cent, or 12½ per cent. The whole increase in weight will be 17½ per cent plus 12½ per cent, or 30 per cent. It therefore follows that the weight per gun is 2-3 × 130 per cent, or 87 per cent of its former value. The efficiency of this grouping is therefore 30 ÷ (12 × 0.87), or 2.88.

The three-gun turrets may be arranged in any of the groupings that have already been found possible with two-gun turrets. Combinations may also be arranged of two-gun and three-gun turrets on the same ship. What seems to be the most powerful practicable arrangement of guns is shown in Fig. 7. Twenty guns are here gathered in two groups, one at each end of the ship. Each group consists of four turrets mounted upon a diamond-shaped citadel. Of these turrets, the two on the center line of the ship are three-gun turrets, while the other two are two-gun turrets. Sixteen guns can be fired on either broadside, while ten can be fired ahead or astern. The power of the arrangement is 42 gun units, and since the weight of all the gun structures may be shown to be but 75 per cent of that required to mount twenty guns in ten separate turrets, the efficiency of the arrangement is 2.8.

Fig. 1.—Eight 12-Inch (Michigan).

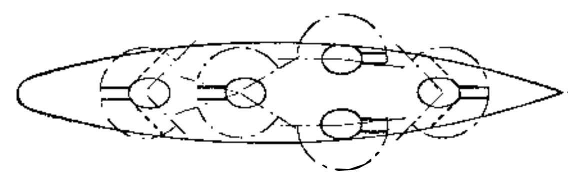


Fig. 2.—Ten 12-Inch (Dreadnought).

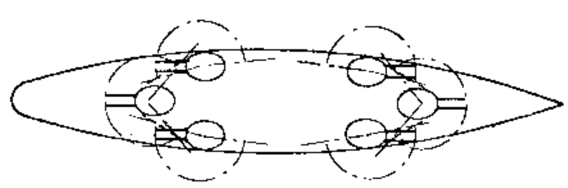


Fig. 3.—Twelve 12-Inch.

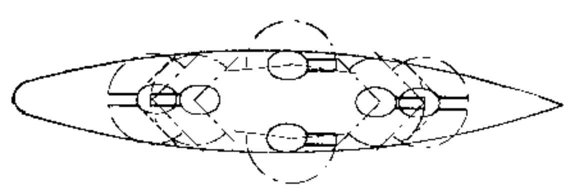


Fig. 4.—Twelve 12-Inch.

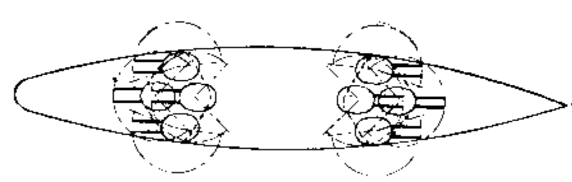


Fig. 5.—Sixteen 12-Inch in Two Groups of Four 2-Gun Turrets.

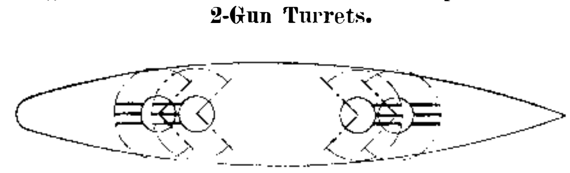


Fig. 6.—Twelve 12-Inch in Four 3-Gun Turrets.

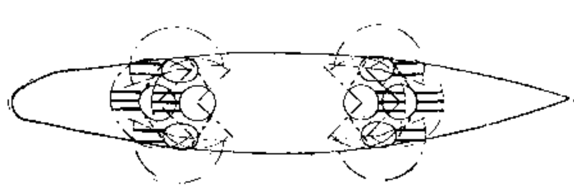


Fig. 7.—Twenty 12-Inch in Four 3-Gun and Four 2-Gun Turrets.

The few arrangements which have been here presented do not by any means exhaust the list of desirable combinations. They are to be taken simply as representative of what may be done, and the comparison of them is interesting because it affords us an idea of the principles by means of which their relative value may be estimated. What will be a very serious objection in the minds of many naval authorities to some of the plans proposed is the fact that they involve an extraordinary concentration of guns in a small space. It will be argued that in the case of the arrangement shown in Fig. 7, for instance, a single shot could put out of action ten guns, or half the power of the ship. On the other hand, it is to be noted that the great size of ship required to carry so heavy an armament, together with the saving in weight effected by the arrangement, permits of the application of armor so thick as to make its penetration impossible except at very short range. The argument that it is poor policy to put all your eggs in one basket is met by the answer that one basket in this case may be more carefully guarded and thoroughly protected.

The type and caliber of gun carried is second only to the number and arrangement, in determining the size and general construction of the ship. The type of gun will affect the thickness and distribution of armor, and indirectly, the size and speed of the vessel. It is of paramount importance that a battleship shall be armed with guns of such caliber and power as will enable her to fight on equal terms with any ship of approximately equal tonnage, and all other considerations are of secondary importance. That the guns of the future will be more powerful and effective than those of the present day goes without saying, but it is not so easy to see in what way this increased power will be gained.

The power of a gun of a given caliber may be increased in one of two ways. Either the length of the gun may be increased, or the pressure of the explosion may be raised by increasing the powder charge. The limit to the length of the gun is about sixty calibers, since when this length is reached, it is found to be better to enlarge the caliber of the weapon and diminish the ratio of length to bore. The limit to the explosion pressure is about 17 tons per square inch, and this limit is set, not by lack of strength on the part of the walls of the gun to resist a greater pressure, but by the fact that greater gas pressures produce too great erosion in the bore of the gun. Guns have been built and tested which successfully endured a pressure of 32 tons per square inch, and if sufficient improvement can be made in powders, and in the material of inner tubes, so that heavier pressures may be sustained without too serious erosion, we may expect great advances in the power of guns.

The value of a gun as a naval weapon depends on two things, first on its ability to penetrate armor, and second on the weight of shot thrown in a given time. Given two guns of equal penetration at battle ranges, their relative values are as the weight of metal thrown per minute by each. When, however, we are called upon to compare two guns of different penetration, it is more difficult to get an idea of their relative value. The writer is inclined to estimate their relative value by comparing the range at which they will penetrate the armor to which they will probably be opposed. If this principle be correct, it will appear from the tables of gun penetrations and probable thickness of armor that the power of a gun varies as the cube of its caliber, for a given muzzle velocity and form of projectile; but when the caliber has become so great that the gun is able to penetrate any armor to which it will be opposed, at battle ranges, a further increase is useless, and the law given above no longer holds. If we consider that the weight of metal thrown per minute by a gun is independent of its caliber (since the smaller it is the faster it can be fired), which is nearly true for guns of 6-inch caliber and over, we have 1 twelve-inch gun equal to 1.7 ten-inch guns, or 3.4 eight-inch guns, or 8 six-inch guns, or 0.63 of a fourteen-inch gun.

Facilities for rapidly loading, sighting, and firing naval guns are of very great importance when applied to guns of sufficient penetration. A more rapid rate or fire demands a larger supply of ammunition, better and more powerful ammunition hoists, and greater space and weight for magazines and loading machinery. Were it not for this fact, we might expect to see the displacement per gun continually decreasing, as improvements are introduced which tend to cut down weights, but the probabilities are that the extra weight demanded by the improved rate of fire will just about balance any saving that may be had from other sources.

(*To be continued.*)

Death of Sir Michael Foster.

One of England's most noted surgeons, Sir Michael Foster, K.C.B., died January 30, 1907. He held at various times the posts of professor of practical physiology at University College, London; prælector of physiology, Trinity College, Cambridge; president of the British Association; professor of physiology, Cambridge; and secretary of the Royal Society. He represented London University in the House of Commons, 1900-06. He was joint editor of "Scientific Memoirs of Thomas Henry Huxley."

A landslide occurred in October on the Thompson ranch at Scott's Valley at Santa Cruz, Cal., which uncovered a bed of whalebone which apparently has been there since the antediluvian period. The place where the prehistoric bones were uncovered is fully 600 feet above the sea level and six miles from the shores of Monterey Bay. Other discoveries of the kind have been made in various sections of the county, and scientists who have made a study of the geological formation of the soil at different times claim that the present site of Santa Cruz, extending as far back as the Santa Cruz Mountains, was once covered by an immense body of water.

RECENTLY PATENTED INVENTIONS.

Of Interest to Farmers.

SEED-SOWING MACHINE.—M. H. BROWNING, Perry, Ill. In this patent the invention is an improvement on that class of broadcast seed-sowing machines which are particularly adapted for sowing clover and other seeds among standing corn or on ground in which corn or other crop has been planted in rows.

BEET-HARVESTER. — J. F. SANDBERG, Smithfield, Utah. The beets are planted in rows. A rotary cutter at the front end cuts off the very rank tops and a topper by its blades co-operating with the roller operates to cut the top portions sufficiently below the ground surface, the scraper following and discharging tops to one side, the plow following in line with the rows and digging out the beets, disintegrating the soil and separating it from the beets by aid of pins. A rake in the plow's rear gathers and discharges the beets by aid of the toothed roller to a trough at the rear where they are discharged aside by the conveyer.

Of General Interest.

LOGGING DEVICE.—G. MOORE, Granite Falls, Wash. The invention relates to logging devices such as shown and described in the Letters Patent of the United States formerly granted to Mr. Moore. The object of the present improvement is to provide a device arranged to permit convenient running of the logs down steep grades under perfect control of the operator and without danger of injuring the logs or wasting time.

LOCKING DEVICE FOR UMBRELLAS.—B. MOSES, Jennings, La. One purpose of this inventor is to provide a lock or catch forming a portion of an umbrella or parasol which cannot be unlocked to open the umbrella except by one familiar with the combination, or by violent means, or by taking the lock apart, the object being to prevent the indiscriminate appropriation of umbrellas by persons not entitled to their use.

PROCESS OF MAKING FERTILIZER FROM LEATHER SCRAP.—E. J. FUCHS, Scranton, Pa. The invention refers to the material known as "ammoniate fertilizer," which is made from the scraps and refuse portions of vegetable-tanned leather. This ammoniate is employed mainly in the manufacture of fertilizers. By preparing the ammoniate so that it contains no tannin and little or no unavailable ammonia its quality is greatly improved, and by eliminating the soluble tannin it is possible to practically make all of the ammonia available.

CONTRACTIBLE MOLD.—G. GEORGENSON and J. E. HENNEN, Fond Du Lac, Wis. This flexible mold is for use in the construction of arches, culverts, sewers, or the like, in which a temporary support is required for the cement, brick, or stone used in construction. A "cylinder" is employed, being formed of sheet metal and provided interiorly with means for expanding and contracting it.

WHIP-SOCKET.—T. ARMSTRONG, Saranac, N. Y. In this case the invention has reference to improvements in whip-sockets, the object being to provide a novel and simple means for locking the whip-stock in the socket, thus preventing the removal excepting upon its release by unlocking the retaining mechanism.

SAFETY-RAZOR.—J. R. CURLEY, New York, N. Y. Mr. Curley has for an object the provision of a razor arranged to permit of using the implement to produce either a right or left hand shearing cut or a straight scraping cut and to allow convenient opening for cleaning purposes and insertion and removal of the blade and a very fine adjustment of the blade relative to the guard.

PROCESS OF MAKING VANILLIN.—E. L. FROGER-DELAPIERRE, 25 Rue de Belfort, Courbevoie, Seine, France. The present invention has for its object a process for the production of vanillin or other aromatic aldehydes containing free phenol groups. This process is based upon the oxidizing action exerted by oxygen in presence of terpins, sesquiterpins, etc., upon phenols containing allyl groups or propenyl groups, or upon certain derivatives of such phenols with free phenol groups, such as clove-oil, eugenol, isoeugenol, and their analogues.

MARINE VESSEL.—J. F. GRAY, Portsmouth, N. H. By means of this invention, Mr. Gray provides a life-boat completely inclosed, and which may be operated as a submarine and to allow persons to enter the life-boat even after the wreckage of the larger vessel without in any way opening the life-boat to the surrounding air or water, as the case may be, after which the life-boat may be sealed, and disconnected from the larger vessel, the life-boat being fitted with propelling means, and such equipment as will render it self-sustaining.

CARD-CASE.—M. NIELL, New York, N. Y. In this patent the invention refers to card-cases to hold business or personal cards, and has for its object the provision of a case adapted to hold such cards, to keep them in a serviceable condition, and to enable one card to be withdrawn from the case without handling the remaining cards therein.

SOAP.—L. H. REUTER, New York, N. Y. Average soap of the market contains too much free alkali—so much, indeed, that it cannot be used without injury for toilet, medicinal, or technical purposes. On a large scale a neutral soap is not obtainable in one operation, and therefore practically all soap manufactured necessarily contains an excess of free alkali, which can only be removed in a second operation — for instance, by neutralization with an acid.

BRICK-KILN.—C. K. WELLER, Atlanta, Ga. The object of this improvement is to provide a structure wherein it is not necessary to cover the entire length of the kiln-floor, as in other structures heretofore used, before turning the drying-air into the duct; but as fast as a bench or section of the brick is set the air may be turned into it and the drying commenced, thus facilitating the working of the kiln.

DRAFTING APPARATUS.—T. F. WILLIAMS, New Bethlehem, Pa. This apparatus is especially useful in connection with devices embodying the use of scales for the purpose of measurement. The object of the inventor is to provide an apparatus which permits the drafting of designs and other drawings with exactness and rapidity and which facilitates the laying off of measured distances in horizontal or vertical directions.

COMPOSITION FOR SOUND-RECORDS.—E. J. B. BROCHERIOUX, P. J. TOCHON, A. FORTIER, and L. V. MAROTTE, 23 Quai Voltaire, Paris, France. The object of this invention is the production of a special composition designed to be applied to the surface of paper, cardboard, pasteboard, and other substances to form a film or coating on which sounds may be recorded and subsequently reproduced by means of a phonograph. It is especially suitable for the production of cards which bearing the record may be forwarded by post and read by the recipient by means of a phonograph.

HYPODERMIC SYRINGE.—J. DE LISLE, New York, N. Y. The object of the present invention is to provide a syringe arranged to contain antitoxin serum in an absolutely aseptic condition during the time the syringe is stored or in transit and to enable the user to readily rearrange the parts to allow a free unobstructed flow of the serum through the needle when the syringe is used. It relates to hypodermic syringes, such as shown and described in Letters Patent of the United States formerly granted to Mr. De Lisle.

TOBACCO-BOX. — M. B. BEHRMAN, Baltimore, Md. The inventor produces an improved tobacco-box which is simply and durably constructed and adapted to be carried in the pocket to contain and protect a tobacco plug, and having an attachment which may be quickly and easily operated to sever a portion of a size suitable for chewing. The inconvenience of using a pocket-knife is thus avoided. Mr. Behrman has invented another tobacco-box and it is an improvement in that class of pocket tobacco-boxes which are provided with a cutting attachment for severing from a plug portions or sections of a size adapted for chewing.

PAPER-ROLL HOLDER AND CUTTER.—J. F. FINAN, Cumberland, Md. The invention consists in an improvement upon the general construction of a roll-holder and cutter, seen in previous patents granted to Mr. Finan. In the present improvement the cutter-bar gravitates to its outward position by reason of downwardly-inclined guides, and is one in which a simple and better construction is obtained. The cutter devices may be applied to any form of roll holder already in use as a wall-bracket.

UMBRELLA. — P. GREEN, Wytheville, Va. The invention pertains particularly to the means whereby an umbrella is held open and closed by the operation of a runner in connection with a stick. In operation a spring-latch will be disengaged by small pressure upon the thimble in the direction of length of the stick when it is desired to adjust the umbrella from open to closed position, or vice versa.

NUT-LOCK.—E. L. PITTS, Phœnix, Ariz. In this case the invention is an improved nut-fastening adapted for application in various ways, but particularly for the pivots of barbers' shears, scissors, and other cutting implements. It is applicable as a nut-lock and screw attachment for connecting any two or more parts, whether movable on each other or not.

DISPLAY-HANGER. — R. O. DOUGHTY, Mount Pleasant, Mich. The object in this instance is to provide a hanger or merchandise-support, more especially designed for use in stores and arranged to compactly support and display for scarfs, collars, muffs and other articles to the greatest advantage, and at the same time preventing petty theft or removal of the articles by unauthorized persons.

TELEGRAPHIC CODE.—A. M. FISHER, Box 1375, New York, N. Y. The object of the invention is to provide a code, more especially designed for the use of large business concerns and arranged to permit convenient and accurate codifying of correspondence, specifications, orders, and the like, each code-word being readily pronounceable and of not more than ten letters.

Hardware.

PIPE-CLAMP.—R. PARKER, Lakewood, N. J. This invention is an improved clamp embodying in its construction a plurality of jaws which are universally adjustable, adapting them to support pipes of irregular forms, branch joints, and any kind of pipe-fitting. The nature of the construction is such that it may be folded to occupy a small compass, enabling the clamp to be conveniently carried from place to place, and manufactured at a small cost.

TOOL.—J. B. KRAUS, Puyallup, Wash. This invention relates to watchmakers' tools; and its object is to provide a tool for accurately and quickly placing the roller-table in position on the balance-staff in a very convenient manner and without danger of injuring the roller-jewel, pivots, or balance-wheel.

Household Utilities.

SHOVEL.—C. F. SMITH, New York, N. Y. This shovel is for use in sifting ashes, especially before the same are removed from the stove. The invention is particularly directed to a form of detachable bottom for the shovel and a novel device for securing the same in place, the device being of such construction and placed in such position as not to interfere with the use of the shovel in the ordinary manner.

LIQUID-SEPARATOR.—G. W. DIXON, Chicago, Ill. This invention relates to improvements in devices for the separation of light matter from heavy liquids—such as cream, oils, fats, grease, and the like—the object being to produce a simple device particularly adapted for household use in separating cream from milk in bottles or other receptacles.

Machines and Mechanical Devices.

ASH-HANDLING CRANE.—C. R. ORD, McAdam, New Brunswick, Canada. The object of the invention is to produce an apparatus especially adapted for handling ashes or cinders, facilitating the unloading and dumping operation. More specifically, the invention relates to means for dumping the bucket in which the ashes or cinders are carried, and, further, in providing an arrangement which tends to decrease the amount of leakage at the operating-cylinder.

MACHINE FOR SHAPING PRUNES.—A. C. BURDICK, Portland, Ore. This invention relates to a machine for shaping prunes, it being especially designed to roll dry or evaporated prunes into a novel shape, as best adapted for the top layer when packing them in boxes and commonly known as "facing" prunes. The machine is capable of acting on a large number of prunes simultaneously, thereby shaping them with facility and at a nominal cost.

COTTON-GIN ATTACHMENT.—G. W. LONG, Lindsay, Indian Ter. In this patent the invention relates to means for conveying or removing the cotton-seed from the gin-box, and has for its object peculiar, novel, and improved means for the purpose stated, the same being designed for use in place of the screw conveyer commonly employed in the bottom of the seedbox.

WRAPPING-MACHINE. —A. H. POTBURY, Portland, Ore. Caramels are supplied to links of a chain, which stops when a caramel is in position for removal. During movement of chain a strip of paper is fed into a paper-slot and then an arm swings to sweep the caramel into place for engagement by a plunger. In the meantime, severed from the strip, the caramel and paper move into a folding-box and then follows a process of folding the caramel. A new one is now placed on a new strip fed forward above the folded caramel, the plunger forcing the wrapped caramel into a chute. This movement makes the final folding, turning the folded ends up against the ends of the caramel, and completing the wrapping.

Prime Movers and Their Accessories.

INTERNAL-COMBUSTION ENGINE. — F. WACKENHUTH, Newark, N. J. The engine is particularly useful in burning liquid fuels, but operative in connection with gaseous or solid fuels, if desired. The object of the invention primarily is to secure complete combustion of fuel, at the same time avoiding loss of heat and radiation through the cylinder-walls and contamination of the fresh charge by the products of previous combustion within the cylinder.

RELIEF-VALVE FOR LOCOMOTIVES.—T. E. BEAGHAN, H. B. REID, and J. H. BEST, Shenandoah, Va. The object of the invention is to provide an arrangement which will operate to prevent compression in the ends of the cylinder or steam-chest when the pistons are moving freely therein and without steam and under such conditions as arise when the locomotive is driven or running freely without steam, as in stopping or in going down a grade.

HORIZONTAL BOILER.—J. C. PARKER, Red Bank, N. J. The brick arch commonly used in boilers for closing off the draft between the fire-box and the front end of the boiler is done away with in this case and is replaced by a coil of pipe having both ends connected to the boiler and covered with asbestos. By reason of deterioration this arch was rebuilt several times during the life of the boiler. This inventor effects just as perfect a seal between the fire-box and the front of the boiler and at the same time the water circulating in the coil forming this seal aids in generation of steam by the absorption of heat which would otherwise be lost.

Railways and Their Accessories.

MAIL-BAG-DELIVERY DEVICE.—P. J. A. SCHNOOR, Holstein, Iowa. The mail-bag is suspended from one of two supports on the derrick at the station or railway side, and a bag is also suspended from the head at the free or outer extremity of crane, the latter obviously being adjusted outwardly from the side of the car. As the car moves along the mail-bag on the derrick will be taken up by the crane, and the mail-bag on the crane will be taken up by the derrick.

Pertaining to Recreation.

AMUSEMENT DEVICE. — H. S. BASSETT, Edwall, Wash. This invention relates to that class of amusement devices designed for the production of peculiar sounds, and more particularly to devices in which the sound is produced by the vibration of a thin strip of material when exposed to the influence of a blast of air. The device may be carried in the pocket. Sounds may be produced by inserting the device between the lips and blowing through the same.

FISH-HOOK. — W. J. EVANS, Minneapolis, Minn. On this hook the bait is fully exposed at all times, but cannot escape from the hook or be detached by the fish. At the same time no part of the hook is passed through the body of the bait and the frog, the bait preferably used, may swim about, and even rise to the surface and breathe with nearly as great freedom as though the hook were not attached. The swimming bait attracts the fish and cruelty to live bait is obviated.

Pertaining to Vehicles.

STEERING DEVICE FOR WHEELED VEHICLES.—J. W. LOVE, Truby, Texas. The invention has reference more especially to steering devices for wheeled vehicles, such as cultivators, planters, sulky-plows, grain-drills, and the like; and one of the principal objects thereof is to overcome numerous disadvantages and objections frequently encountered in the use of other contrivances or structures hitherto devised for similar purposes.

VEHICLE-TIRE.—F. HITCHCOCK, Freeport, New York. One purpose of the invention is to provide an armor for use in connection with the shoe of an automobile or other vehicle tire and a protection for the inner tube, rendering the tire punctureless, and to so construct and apply the armor that it will not detract from the usual elasticity of such tires.

Designs.

DESIGN FOR A WALL-COVERING. — L. PRONBERGER, Berlin, Germany. This design for a wall-covering comprises alternate vertical bands, the broadest of which have a moire effect and at regular intervals ornamented with comparatively large fleur de lis.

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

Notes and Queries.

HINTS TO CORRESPONDENTS.

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

(10374) J. D. W. C. asks: Inasmuch as it is frequently stated to be a fairly well-established fact that our sun, with his attendant and dependent flock of planets, are in flight as one body, with some distant star as a center of the solar system combined orbit, it would be interesting to know the probable time, in earth-years, to complete the circuit. I am unable to find information on this point. If not too much trouble, please reply through inquiry column. A. There is no knowledge whatever upon the length of time required for our sun to make one circuit of its mighty orbit. It is quite a well-established fact that the sun and, of course, his family of planets with him, are moving in a certain direction in space. The stars in the quarter of the sky from which the sun is going are slowly moving apparently toward each other, and at the opposite point of the sky the stars are apparently moving farther from each other. Sufficient time has not elapsed since these observations began to enable one to determine the rate of the motion of the sun.

(10375) J. T. H. asks: Will you explain what makes the two images in a pair of glasses? I often see objects in my glasses reflected from behind me, one very clear reflection and the other dim to the right of the right eye and to the left of the left eye. I have also noticed my own reflection in the same way in a looking glass when held close to the face, but not when held at a distance of a foot away. A. There are two surfaces of every lens or mirror of glass coated on its back. Both of these surfaces reflect light from behind and to the side of the one wearing the glasses. If it is lighter in front than at the back, one does not notice these reflections and the images they form; but if it is dark in front and light behind the person, one can see the objects behind him. He may even see a double reflection of the same object, one from the front surface and the other from the back surface of the glass. One may easily amuse himself by experimenting in order to learn how much he may see in his glasses in this way.

(10376) S. A. H. asks: A friend makes the statement that a wagon wheel in motion moves faster at the top than at the bottom or portion on the ground. Is this the case? A. To answer the question, "Does the top of a wagon wheel move faster than the bottom?" it is necessary to define the word "move." When that is done it becomes evident that the question is very indefinite. A rotating wheel moves with the same velocity in every part, as measured in degrees of the circumference. If it did not it would break in pieces. The wheel has another motion as a whole along the road. In this respect the wheel moves all together and therefore with the same velocity. Still another motion is that of any point of the wheel with reference to a line on the ground. At one moment a point on the rim of the wheel is in contact with this line; it then rises till it is the entire diameter of the wheel above the line, and then descends till the point is again in contact with the ground. The wheel has meanwhile gone a distance equal to its circumference. The point has risen in a cycloid and moved down again in the same kind of curve. At any moment the point of the rim which is coming down to the ground is also coming to rest as viewed from that point of the ground. It touches the ground for an instant and moves up again. Since it was descending and now is ascending it is evident that between the two it must have come to rest. Since it is at rest for the instant it is in contact with the earth, that point is a center of motion, the hub is moving with a certain rate and the rim at the top is moving twice as fast as the hub in a forward direction. Now the front point of the rim is moving vertically down and the rear point is moving vertically upward at the same moment. This is one of the perpetually recurring questions. We have answered it hundreds of times. We have published notes upon it many times. Among recent notes, see Notes and Queries in Vol. 92, Nos. 16, 20, 25; Vol. 93, No. 2, price 10 cents each.

(10377) W. L. S. writes: I notice your answer to queries, No. 10297, in issue of January 19, 1907, and also remember substantially the same answer to a question about a year ago—that water would not burst barrels in freezing if the barrels were open at one end. On the contrary, they will burst in very cold weather, as I know from experience. For twenty-five years I was engaged in milling in southeast Missouri and for ten years had to get new barrels or repair the old ones every spring. At last I put in each barrel a piece of straight-grained wood about 2 x 2, with a hole ¾ inch bored through it about half the distance from the bottom to top of barrel. This piece of wood was allowed to extend 3 or 4 inches above the barrel. After putting in these pieces of wood our barrels would last, and hold water, for five or six years, and would freeze solid during the winter without injuring the barrels.

(10378) F. B. asks: How many pounds pressure would I get on a 12-inch pipe, running to a turbine, with a tank of water holding one and one-half million gallons of water, with a ten-foot fall? How many horse-power would it give me? How many horse-power would I gain with every ten-foot fall through the same pipe? How many horse-power will it require to lift a six-inch stream of water 100 feet with the best pump, and will it take twice as much power to lift a 12-inch stream the same height? A. You would have 4.3 pounds per square inch pressure at the turbine. It is possible to obtain 5 horse-power from the 12-inch pipe, and the same for each additional 10-foot fall. It will require about 12 horse-power to fill your 6-inch pipe at full flow, and four times as much power for a 12-inch stream with four times as much water.

(10379) C. N. M. asks how to make tracing cloth. A. 1. Boiled linseed oil (bleached), 10 pounds; lead shavings, ½ pound; zinc oxide, 2½ pounds; Venetian turpentine, ¼ pound. Boil for several hours, then strain, and dissolve in the strained composition 2½ pounds white gum copal. Remove from the fire, and when partly cold, add oil of turpentine (purified), sufficient to bring it to proper consistence. Moisten the cloth thoroughly in benzole and give it a flowing coat of the varnish. 2. Varnish the cloth with Canada balsam dissolved in turpentine, to which may be added a few drops of castor oil, but do not add too much, or it will not dry. Try a little piece first with a small quantity of varnish. The kind of cloth to use is fine linen; don't let the varnish be too thick.

NEW BOOKS, ETC.

PUNCHES, DIES, AND TOOLS FOR MANUFACTURING IN PRESSES. By Joseph V. Woodworth, M.E. New York: The Norman W. Henley Publishing Company, 1907. 8vo.; pp. 483. Price, $4.

This book has been written and compiled by a practical man for the use of all practical men who are interested in the working of sheet metals, designing and constructing of punches and dies, and the manufacturing of repetition parts and articles in presses. This book is doubtless the last word in the literature of the subject. It deals with the vast field of metal work, and does so in a clear, concise, and thoroughly practical manner. It treats of the fundamental principles of construction, and the numerous methods of procedure in practice. It is very well illustrated.

QUASI-PUBLIC CORPORATION ACCOUNTING AND MANAGEMENT. By John F. J. Mulhall, P.A. Boston: Corporation Publishing Company, 1906. 8vo.; pp. 199.

The evolution of business into corporate form, which is so large and important a phase of our modern social structure, necessitated a corresponding change in the methods of accounting and management. This is especially true of quasi-public corporations. The scarcity of data bearing on the accounting and management of such corporations led to the writing of this book. It should be of interest to those interested in corporations in an administrative or executive capacity, and especially to the accountant. It includes books, forms, and methods necessary for the proper organization and management of a business, and the recording of all essential details of Revenue, Operation, Maintenance, and Construction.

ROCKS OF CAPE COLVILLE PENINSULA, N.Z. By Prof. Sollas, F.R.S. With Introduction and Descriptive Notes by Alexander McKay, F.G.S. Vol. II. 4to.; pp. 215.

LA TELEGRAPHIE SANS FIL ET LA TELEMECANIQUE A LA PORTE DE TOUT LE MONDE. By E. Monier. Preface by Dr. E. Branly. Paris: H. Dunod et E. Pinat, Editeurs, 1906. 12mo.; pp. 115.

PHYSICAL ECONOMICS. By Erastus Eugene Holt, A.M., M.D., LL.D. Chicago: Press of the American Medical Association, 1906. pp. 29.

LOOKING FORWARD. The Phenomenal Progress of Electricity in 1912. By H. W. Hillman. Northampton: Valley View Publishing Company, 1906. 12mo.; pp. 320.

REPORT ON THE ADMINISTRATION OF THE DEPARTMENT OF STREET CLEANING OF THE CITY OF NEW YORK. Adopted by the Board of Aldermen, 1906. 8vo.; pp. 136.

ELEMENTS OF MECHANICAL DRAWING. In Two Parts. By Alfred A. Titsworth, M.Sc., C.E. New York: John Wiley & Sons, 1906. 8vo.; pp. 130. Price, $1.25.

ECONOMICS OF ROAD CONSTRUCTION. By Halbert Powers Gillette. New York: The Engineering News Publishing Company, 1906. 12mo.; pp. 49. Price, $1.

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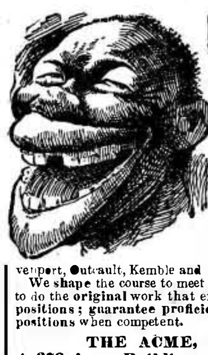

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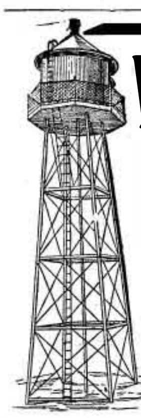

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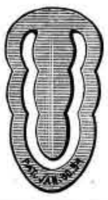

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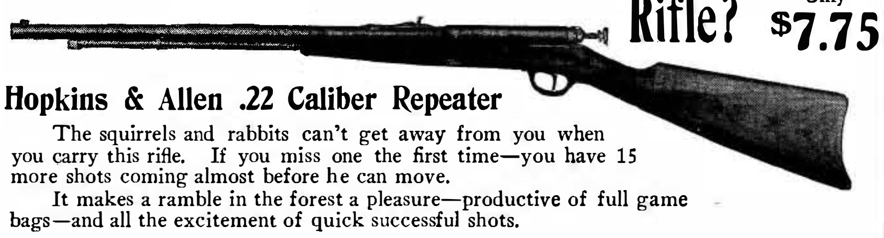

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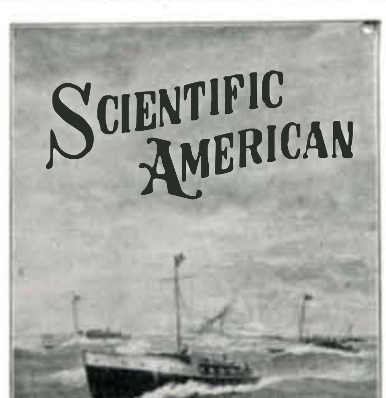

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Vasemeter, cardiac, respiratory, and metabolic stimulant, John Wyeth and Brother 60,197
Vegetable products, certain, M. G. Black... 60,186
Washing or soap powder, N. K. Fairbank Co. 60,074
Washing powders, N. K. Fairbank Co. 60,075
Watch springs, C. Robert 60,238
Wheat, cooked flaked, "Force" Food Co..... 60,099
Whisky, Charles Dennehy & Co. 60,211
Whisky, Garrett-Williams Co. 60,213
Whisky, Geo. Bieler Sons Co. 60,214, 60,215
Whisky, A. L. Lewin 60,216
Whisky, Maryland Distilling Company of Baltimore City 60,217
Whisky, J. H. Friedenwald & Co. 60,229
Whisky, Gottschalk Company of Baltimore City 60,233
Whisky, J. McGlinn 60,236
Whisky, Wm. Bergenthal Co. 60,243
Wine, grape juice, D. C. Brignole 60,224
Wood and metal cleaning and polishing preparation, O. C. Hassler 60,150
Yeast, H. Bendix 60,059

LABELS.

"Alaga," for syrup, Alabama-Georgia Syrup Co. 13,332
"Baume Analgesique Bengue," for proprietary medicine, T. Seltzer 13,335
"Judge Gaynor Cigars," for cigars, R. Eppstein and A. Wander 13,334
"Our Favorite" Enamel Bronzing Liquid," for a bronzing liquid, Gerstendorfer Bros. 13,339
"P. S. Alegretus Soft Creams," for candy, P. Smerlies 13,333
"Radiator Bronzing Liquid," for a bronzing liquid, Gerstendorfer Bros. 13,340
"Sapolin' Decorators' Bronzing Liquid," for a bronzing liquid, Gerstendorfer Bros... 13,337
"Star" Banana Bronzing Liquid," for a bronzing liquid, Gerstendorfer Bros..... 13,338
"Stearns' Electric Rat and Roach Paste," for a rat and roach paste, Stearns Electric Paste Co. 13,336

PRINTS.

"Baron's Welsh Rabbit," for Welsh rabbit, Samuel Baron Co. 1,900
"Be a Chulee," for chewing gum, Meek Company 1,899
"Men's and Boys' Apparel," for men's and boys' apparel, H. C. Lytton 1,898
"Tailor Exhibiting Cloth," for suitings, Ed. V. Price & Co. 1,897

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

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