twist. A cylindrical groove is cut near the rear end, into which the copper band is forced by hydraulic pressure.

The United States has not yet succeeded in securing a domestic supply of armor-piercing projectiles, but experiments are in progress which may result favorably.

But as far as that which concerns the supply of modern high-powered ordnance, our sketch shows how thoroughly the Bethlehem Steel Works and the Washington gun factory have released us from dependence upon foreign industries and what strides we are making to regain our lost prestige in the science and art of gun making.

The New Fire Boat New Yorker.

This splendid addition to the fire department of the city of New York, which was illustrated and described in the last number of the SCIENTIFIC AMERICAN, had the first opportunity to prove her efficiency at a fire on March 5. A large steamer, the City of Richmond, loaded with cotton, rubber, sugar, etc., took fire at a pier near the great suspension bridge over the East River. The fire spread with great rapidity, and the steamer was quickly enveloped in flames. As described by the New York *Sun*, "All was blazing merrily when the fire boat came up opposite the end of the pier, her whistle wailing like a lost soul. While yet a long way out in the stream she brought the fire in view. There was a movement of the captain in the pilot house, the men at the standing pipe at her bow gave a valve a whirl, and in an instant such a stream of water as the people along shore never saw before burst from the four and one-half inch nozzle. Over the corner of the pier, over the host of harbor tugs gathered there, and straight into the heart of the blazing mass of woodwork, the stream drove with all but irresistible power. It was as large as a man's body where it struck the fire. The flaming walls and bulkheads of cabin and staterooms about the bow went down before it like paper, and splintered boards were hurled in all directions. It was almost as if cannon were battering at the wreck. From a position on the port bow the New Yorker worked her way slowly into the slip among the tug boats until she had literally raked the City of Richmond from stem to stern. Next she turned her liquid battery on the nearest pier shed, tearing the blazing roof to pieces and drowning out the fire there before the spectators had noticed that she had left the steamer."

How to Cure a Headache.

In case of the ordinary nervous headache, from which women suffer so much, says an authority, remove the dress waist, knot the hair high up on the head, out of the way, and, while leaning over the basin, place a sponge soaked in hot water, as hot as can be borne, on the back of the neck. Repeat this many times, also applying the sponge behind the ears, and, if the assertion of the writer is not a mistaken one, in many cases the strained muscles and nerves that have caused so much misery will be felt to relax and smooth themselves out deliciously, and very frequently the pain promptly vanishes in consequence. Every woman knows the aching face and neck generally brought home from a hard day's shopping, or from a long round of calls and afternoon teas. She regards with intense dissatisfaction the heavy lines drawn around her eyes and mouth by the long strain on the facial muscles, and when she must carry that worn countenance to some dinner party or evening's amusement, it robs her of all the pleasure to be had in it. Cosmetics are not the cure, nor bromides, or the many nerve sedatives to be had at the drug shop. Here, again, the sponge and hot water are advised by the writer quoted, bathing the face in water as hot as can possibly be borne; apply the sponge over and over again to the temples, throat, and behind the ears, where most of the nerves and muscles of the head center, and then bathe the face in water running cold from the faucet. Color and smoothness of outline come back to the face, an astonishing freshness and comfort is the result, and if a nap of ten minutes can follow, every trace of fatigue will vanish.—*Analyst.*

A Smart Iowa Boy.

An ingenious youth out in Iowa tied a thread to a nickel, dropped the nickel in a slot machine, got what he wanted, then, withdrawing the nickel by the thread, repeated the operation until he had made a clean sweep of the receptacle's contents.

He was arrested on a charge of theft, but the judge who tried him held that he had committed neither burglary, larceny, nor robbery, nor even obtained property under false pretenses. He had merely done what the inscription on the machine told him to do—drop a nickel in the slot—and had kept on doing it. Nothing was said about leaving the coin where it was dropped. The decision will probably abate a nuisance.

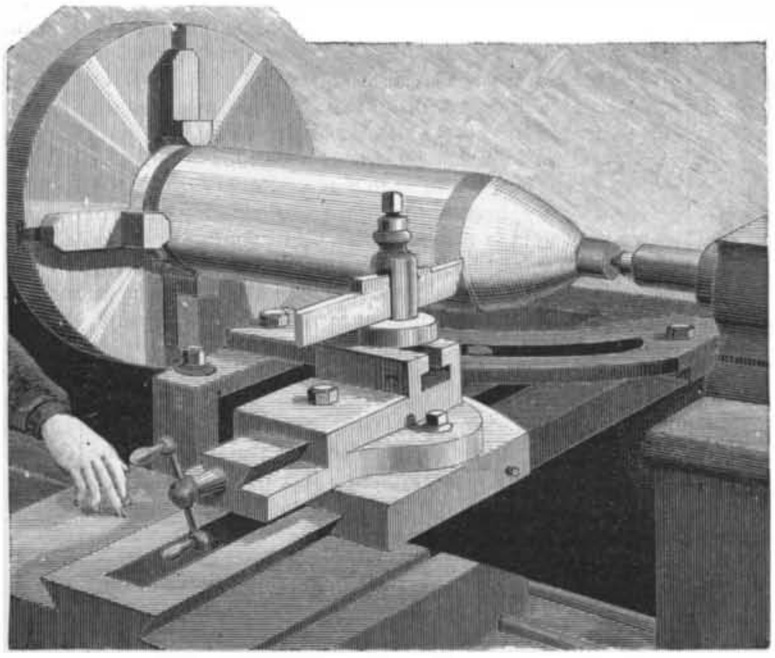
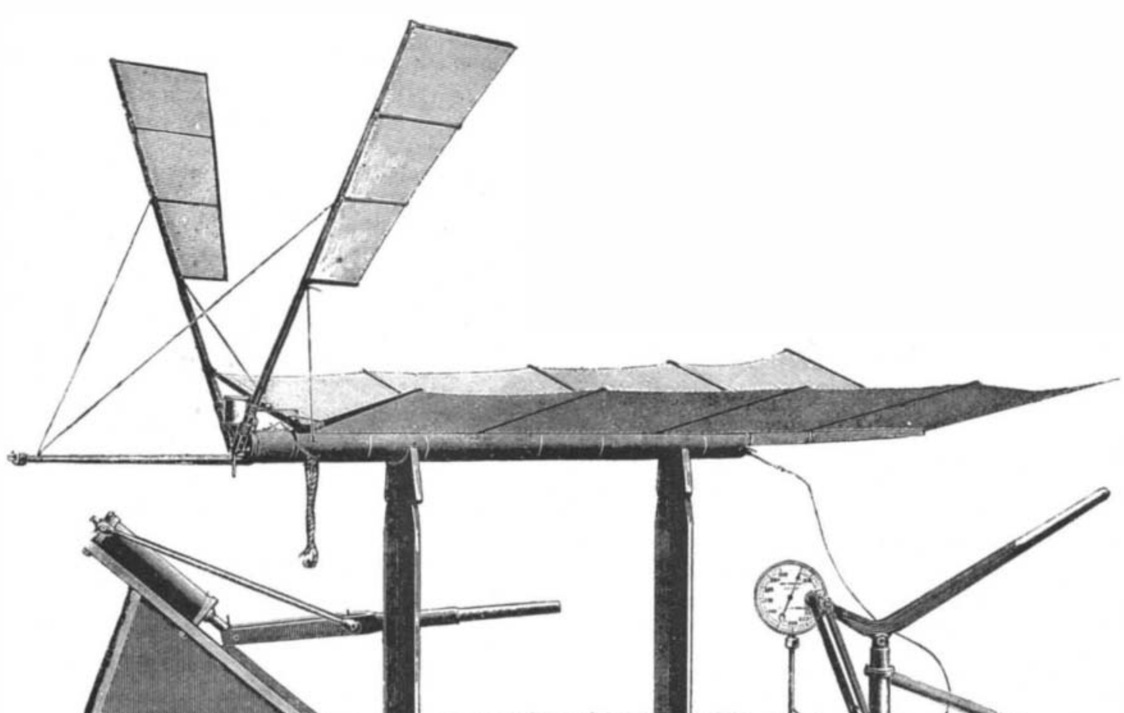


Fig. 10.—TURNING 10-INCH PROJECTILE.

A PNEUMATIC FLYING MACHINE.

This is a flying machine constructed by Mr. Lawrence Hargrave, of Sydney, N. S. W. It is propelled by an engine fed with compressed air, and, as will be seen from the engraving, which is from *Engineering*, the machine is a marvel of lightness and ingenuity.

The compressed air is stored in a tube which forms the backbone of the whole construction. This tube is 2 inches in diameter, $48\frac{1}{4}$ inches long, and has a capacity of 144·6 cubic inches. Its weight is 19·5 ounces, and the working pressure 230 pounds per square inch.



A PNEUMATIC FLYING MACHINE.

The engine cylinder has a diameter of $1\frac{1}{2}$ inches and a stroke of $1\frac{1}{4}$ inches, while the total weight of the engine is only $6\frac{1}{2}$ ounces. The piston rod is made fast to the end of the backbone, and the cylinder moves up and down over the piston. Two links connect the cylinder to the Canadian red pine rods which carry the wings. The air is admitted to the cylinder, and exhausted by means of a valve worked by tappets. The period of admission continues through the entire stroke. The cylinder and receiver ends are pressed, and the piston is made of vulcanite, with a leather cup ring for packing.

The wings are made of paper, and have no canting or feathering motion other than that due to the springing of the material of which they are made. The weight of the wings is 3 oz. To find how much the wings deflected, one was held by the butt and a weight of $7\frac{1}{2}$ oz. was put on the membrane 24 in. from the fixed point and $1\frac{5}{8}$ in. abaft the wing arm. The deflection produced, due to torsional stress, was $3\frac{1}{2}$ deg. By moving the weight half way across the wing it was twisted $8\frac{1}{4}$ deg. The area of the body is 2,128 square inches; the area of the wings 216 square inches; and the total area, 2,344 square inches.

When first made, the machine had its center of gravity so placed that the percentage of area in advance of it was 30 per cent of the whole area, but continued disaster caused its reduction to 23·3 per cent. In a dead calm the machine flew 368 feet horizontally.

The engraving shows also two forms of pump for compressing the air. Each has a bent lever handle and long links on the principle of the Stanhope press, so that the most powerful leverage acts on the cylinder full of air when it is reduced to its smallest volume. The ram is $1\frac{3}{8}$ inch in diameter, and the stroke about $4\frac{1}{2}$ inches. The receiver is charged in six minutes to 230 pounds, and 400 pounds pressure can be obtained by this pump.

A New Name and Draught Law for Vessels.

By the act of Congress approved February 21, 1891, the name of every documented vessel of the United States shall be marked upon each bow and upon the stern, and the home port shall also be marked upon the stern. These names shall be painted, or carved and gilded, in Roman letters in a light color on a dark ground, or in a dark color on a light ground, and to be distinctly visible. The smallest letters used shall not be less in size than four inches. If any vessels of the United States shall be found without these names being so marked, the owner or owners shall be liable to a penalty of ten dollars for each name omitted: *Provided, however*, that the names on each bow may be marked within the year eighteen hundred and ninety-one.

The draught of every registered vessel shall be marked upon the stem and stern post, in English feet or decimeters, in either Arabic or Roman numerals. The bottom of each numeral shall indicate the draught to that line.

The owner, agent, or master of every inspected sea-going steam or sail vessel shall indicate the draught of water at which he shall deem his vessel safe to be loaded for the trade she is engaged in, which limit as indicated shall be stated in the vessel's certificate of inspection, and it shall be unlawful for such vessel to be loaded deeper than stated in said certificate.

Blowing up a Wreck.

Ever since the collision, on September 28, just off the New Jersey coast, between the steamship Vizcaya and a schooner, the wrecks had formed an obstruction to navigation, although the government had placed whistling and spar buoys near by. Considerable portions of the masts of both vessels projected above the water, which had gone down where the depth was about sixty feet. The Yantic, of the U. S. navy, was sent to remove the wreck, which lay quite in the line of considerable coastwise navigation. Two boats were sent out, with torpedoes, each containing thirty-four pounds of gun cotton, equal to four times that weight of gunpowder, and two of these torpedoes were sunk alongside the schooner's masts. An electric wire from the torpedoes was fastened to the stern sheets of the boats, and the latter were rowed a distance of about two hundred yards away, when the wires were connected with an electric battery. The circuit was then closed, the explosion followed, throwing up a great volume of water, and all signs of the wreck of the schooner had disappeared. The same course was then followed with regard to the wreck of the steamer.

Trial of Another New Gun Boat.

On February 28, the Bennington, a sister ship of the Yorktown and Concord, had a highly successful trial trip in Long Island Sound, for the testing of her machinery and the development of her maximum horse power. She is the last one of three twin-screw, coal-protected cruisers, of about 1,700 tons displacement and fourteen feet draught, designed to be readily available for the ordinary work of cruising in time of peace and effective commerce destroyers in case of war. The Yorktown * and Concord have already been added to the ships in active service in the navy.

The Bennington made her trial trip of a four hours' continuous run in a southwest gale, which caused her decks to be frequently swept by heavy seas, the water being driven into the ventilating funnels and flooding the fireroom floor. The board of trial consisted of Commanders Bridgman, Bradford and Hemphill, Chief Engineers Hine, Lowe and Heaton, and Naval Constructor Varney. The conditions were not favorable for attaining a high speed, but the vessel made 17·2 knots the first hour, and averaged sixteen knots per hour for the other three hours. The boilers and machinery are said to have worked splendidly during the entire performance, and the vessel is reported to have done better than did the others of her class on the official trials. The approximate result of the trial of the Bennington, in comparison with the Yorktown and Concord, is as follows, in round numbers, the official reports not being yet made up:

	Yorktown.	Concord.	Bennington.
Collected indicated horse power of main engines	3,205	3,314	3,361
Indicated horse power of air and circulating pumps	118	27	32
Indicated horse power, blowers	52	34	43
Indicated horse power, feed pumps	16	17	25
Indicated horse power, dynamos	..	8	8
Indicated horse power, steering engine	..	2	2
Aggregate collective horse power of main engines and auxiliaries	3,391	3,402	3,471

The Bennington was required to show an average of 3,400 horse power for four consecutive hours, and exceeded this by seventy-one horse power, which entitles her contractors to a premium of $7,100. After the test for horse power was finished, two hours were spent in putting the vessel through a series of evolutions to test the steering apparatus, the quick starting and stopping of the engines and the working of the twin screws against each other. The Bennington did the best on record in stopping at full speed and reaching full speed backward, using both engines. She stopped in one minute and six seconds while at full speed, while going a length and a half. Turning by using one screw with the other at a stop, and with second reversed, stopping and backing and steering by hand and by steam, taking sharp turns at full speed, were all found satisfactory.

The hull of the Bennington was built at the Delaware River Iron Works, Chester, Pa., the engines were built by N. F. Palmer, Jr. & Co., of the Quintard Iron Works, New York City, and the electrical apparatus was furnished by the Edison Electric Light Company.

Some Applications of Photography.

An interesting lecture on this subject was delivered lately at the Royal Institution by Lord Rayleigh, F.R.S. The lecturer, after referring to Mr. Muybridge's photographs of animals in motion taken by means of a movable shutter, said that rapidly occurring phenomena might also be photographed by the exposure of the lens to a flash of magnesium light or to the electrical spark. Neither of these flashes of light was absolutely instantaneous. Their degree of instantaneity might be estimated by means of a wheel with black and white divisions revolving at a great speed. If the flash were of sufficiently short duration, the wheel would appear to be stationary. A series of teeth cut in the edge of the wheel allowed the rapidity of their motion to be calculated by means of a siren. With a flash of magnesium light the wheel appeared of a gray color, and the flash was shown to last from one-tenth to one-fiftieth of a second.

A spark from a Leyden jar, however, made the wheel appear stationary. It had been shown that the duration of the principal part of such a spark was less than 1-25,000,000th of a second. Some idea might be formed of such a duration by considering that it was nearly the same fraction of a second as one second is of a year, as a year contains roughly 25,000,000 seconds.

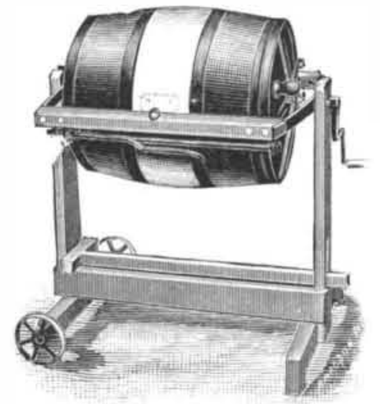
Multiple discharges from a Leyden jar might, however, last for 6-1,000ths of a second. In using the spark of a Leyden jar for instantaneous photography, it was better to connect the plates of the machine with the inside coatings of the jars, and photograph the object by a spark taken between the outside parts of the jars. There was thus no high potential, and less chance of losing the effect of the discharge.

By means of instantaneous photography, it was seen that a jet of oxygen on passing through water was at once split up into bubbles on its first issuing from the tube. A jet of water, when made to issue into the air from a nozzle of drawn-out glass, was at first cylindrical, and then, becoming swollen or varicose owing to surface tension, was broken up into drops, each drop being connected with the cylinder by a thin ligament before it was separated. The vibrations of a tuning fork caused a column of water to break into drops at an earlier period. The ligament itself was afterward formed into one or two drops. Mr. Chichester Bell and Mr. Boys had observed these effects by taking instantaneous photographs of the shadow of the jet. When, however, a jet of any fluid is forced into a vessel containing another fluid the jet becomes sensitive, and is broken up into a series of coils. Under the vibrations of a heavy tuning fork, the jet becomes unstable nearer the nozzle. Under less pressure, and with regular vibrations, the jet forms a sinuous band, with a horn at the summit of each wave. Such a jet always gives way by becoming sinuous, whereas the jet of water issuing into air gives way by becoming varicose. A soap film might be photographed in the act of breaking, but as this occupied less than one-tenth of a second it was more difficult to photograph than jets of liquid. A dry shot was shown to pass through a soap bubble without breaking it, but a shot wetted with alcohol would break the film at once. By means of the dropping of weights suspended from an electromagnet, it was possible to make the breaking of the film and the flash of the spark simultaneous, and thus photograph the film in the act of breaking.

* For illustration and full description of the Yorktown see SCIENTIFIC AMERICAN SUPPLEMENT, No. 687.

AN IMPROVED CHURN.

The churn shown in the illustration, patented by Mr. James McBride, of Bavington, Pa., is designed to make butter quickly, with the minimum of labor, while it is readily opened to receive the cream or for the removal of the butter. The barrel-shaped body of the churn has trunnions on its opposite sides which turn in keepers in a hoop, the hoop having flattened ends pivoted in the standards by projecting trunnions, to one of which is connected a crank. The body has a suitable lid or cover, readily secured in position or removed, and through which is a glass-covered opening, for convenience in observing the condition of the contents of the churn, and also an air vent closed by a stopper. Within the body of the churn are inwardly projecting longitudinal ribs, designed to form currents in the cream as the body is rotated, thereby hastening the separation of the butter. An adjustment may be made by which the body will be given an end-over-end motion if desired, but the position shown in the illustration is preferred, in which an axial motion is given by the crank, while at the same time the body swings lightly in the opposite direction, the churn turning very easily.



McBRIDE'S CHURN.

Terpene Iodide in Acute Diseases of the Lungs.

BY WILLIAM H. ●RE●●, M.D., NEW YORK.

For the past two or three years I have carried on a series of therapeutical investigations in search of some antiseptic agent that would act as a specific against the development of acute diseases of the lungs, more particularly acute congestion, pneumonia, and those catarrhal and throat affections which are so often the premonitory symptoms of more serious mischief.

While I have demonstrated to my own satisfaction that these diseases may be cut short, I am not so sanguine that the remedy will prove curative in all cases where a disease is once fully developed, yet further investigation may prove that it possesses specific properties even in these cases.

It has been my desire only to suggest some drug or combination of drugs which will prevent the ravages of the various cocci that are carried into the lungs through the agency of those septic storms which are so frequent in this climate, before an actual disease of the lungs has been established.

The great disadvantage the physician has to contend against in the administration of medicines is the changes they are liable to undergo when taken into the stomach before they finally enter the circulation. It would therefore appear that we ought to administer all of our remedies hypodermically, and perhaps this is the more rational way of obtaining their full benefit. But this mode has its objections. In the first place, it requires more or less skill; besides, it is painful, and at times is followed by unpleasant effects.

I believe that terpene iodide enters into the circulation unchanged, from the fact that it acts as quickly as if it were administered hypodermically. It is my judgment that the remedy offers greater success and produces happier results than any other of this class of remedies. While it is a powerful antiseptic, it is comparatively harmless, for, after prescribing it for several years, I have yet to meet with any unpleasant effect.

In acute affections of the throat it may be used in spray, while in other cases it may be given to adults in ten drop doses, on a teaspoonful of sugar, once or twice a day—in the morning and at bedtime. The morning dose should be followed by a glass of milk or bouillon. Larger or more frequent doses are apt to excite too great a discharge of urine.

I have no doubt that terpene iodide will, should it come into general practice, find a wider range of usefulness than that above indicated. As to its value in phthisis pulmonalis, diphtheria, and other zymotic diseases, I am unable to speak.—*N. Y. Med. Journal.*

Electricity from Light.

At a recent meeting of the Physical Society, London, Professor Minchin showed some experiments in illustration of his paper on "Photo-Electricity," read at the previous meeting. In one of these a seleno-aluminum battery, illuminated by the light of a taper, deflected an electrometer needle, thereby actuating a relay and ringing a bell. He afterward exhibited one of his "impulsion cells" in action, and showed the change from the insensitive to the sensitive state produced by a Hertz oscillator at a distance.

In the discussion, Mr. Tunzelmann said Kalischer and Von Uljanin had worked at the same subject, the former being the first to make experiments on a photo e.m.f. in selenium. His cells were made by winding brass wires on glass tubes and coating them with selenium, which was subsequently annealed. These cells lost their power after some time, and would not respond to feeble lights. By using two wires of different metals, he obtained better results. Fritts, in 1883, used brass and gold plates coated with selenium, and Uljanin employed platinum plates deposited so thin as to be transparent. The latter experimenter found that the e. m. f. was proportional to the square root of the intensity of the light. He also observed that the orange-yellow of the prismatic spectrum produced the greatest effect, whereas the yellow-green and green rays of the diffraction spectrum gave the maximum e. m. f. Comparing these results with Langley's observations on the energy of the spectrum, it would appear that the e. m. f. bears no relation to the maximum energy falling on the surfaces. Speaking of the cause of the phenomena, he said the electrolytic idea of Von Uljanin seemed inapplicable to Professor Minchin's results, and he inquired whether a mixture of selenium and aluminum would undergo a gradual change by exposure to light.

Dr. Gladstone said such a change, if it occurred, would be very slow, for nearly all difficult chemical reactions take time to complete. The fading of colors was adduced as an instance of slow chemical change produced by light.

Dr. Waller thought the subject might throw light on the changes occurring in the retina, and asked if it was possible to separate thermo-electric and photo-chemical effects.

Dr. Burton said he had suggested that the action of light on the retina was a photo-chemical one some time ago, but hitherto it had been difficult to obtain substances sensitive to any but the blue and violet rays, whereas the eye was most sensitive to green and yellow light. In the photo-electric batteries, however, the e. m. f. may generate a current, and therefore energy, and the important question seemed to be—Where does this energy come from? Is a chemical change precipitated by the action of light, or does a direct conversion of light into electric energy occur?

Professor Minchin, in his reply, said he thought his cells really transformed the incident energy. They were usually kept on open circuit, and there appeared to be no deterioration with time, the only change being a sluggishness in developing their maximum e. m. f.

Origin of the Word Bronze.

From an examination of texts due to the Greek alchemists, extracted from a document of the 16th century, Mr. Berthelot came to the conclusion, especially after comparing them with certain passages in Pliny the elder, that the name of bronze was derived from the city of Brundusium, the seat of certain manufactures in which this alloy was employed. Now, Mr. Berthelot has found a text that is more ancient by three centuries (for it dates back to the time of Charlemagne), and the indications of which are still more decisive. It is a question of a MS. found in the library of the chapter of the Canons of Luynes, and reproduced by Maratori in his *Antiquitates Italicæ.* In the Latin text it is expressly specified as "Composition of Brindisi:" Copper two parts, lead one part, tin one part—a traditional formula that has come down to our time. It would, then, seem indeed as if the word bronze was derived from the city of Brindisi, where bronze was manufactured on a large scale.—*La Genie Civil.*