SCIENTIFIC AMERICAN

[Entered at the Post Office of New York, N. Y., as Second Class Matter. Copyright, 1901, by Munn & Co.]

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. LXXXV.—No. 14.] ESTABLISHED 1845. NEW YORK, OCTOBER 5, 1901. [$3.00 A YEAR. 8 CENTS A COPY.

TRADE DOLLAR CONSOLIDATED MINING COMPANY'S ELECTRIC PLANT, SNAKE RIVER, IDAHO.

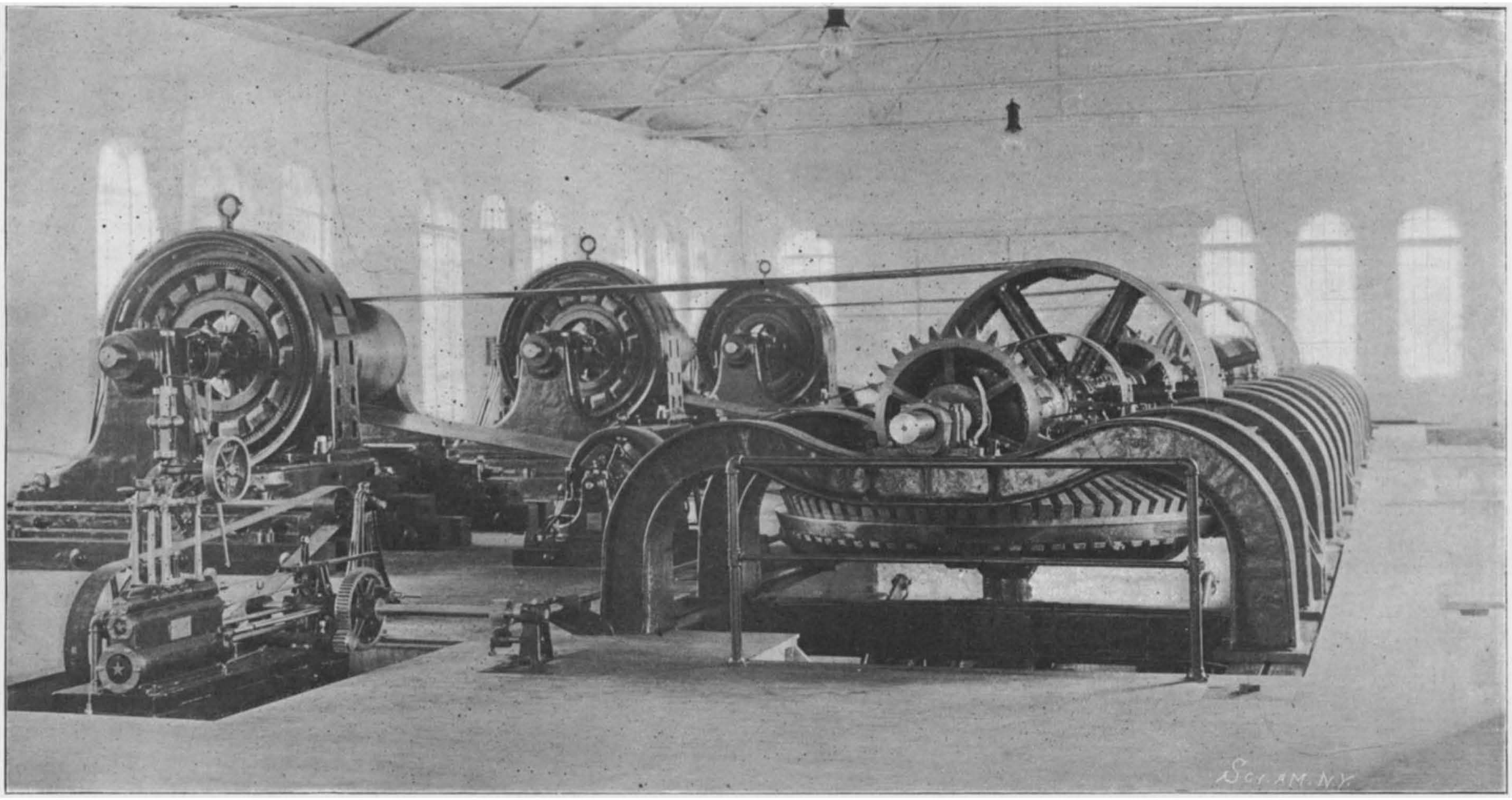
The choice of water power for running the Trade Dollar Consolidated Mines, which are situated in Silver City, Idaho, was rendered a necessity by the fact that, as this is an old camp, all the wood fuel supply has been exhausted, and that coal costs $17 per ton at the mines.

After examining all possible sources of power, Snake River was selected as the most available, and the point known as Swan Falls as the best site for the construction of works for the development of the power.

The river at this point flows in a lava cañon about 700 feet deep. It has a low-water flow of 7,000, and a high-water flow of 70,000 cubic feet per second. Swan Falls was merely a rapids caused by a lava dike extending across the river, with an island in the center dividing it into two equal channels, each about 450 feet wide.

It was decided to close the right channel entirely by a masonry dam, of which the power house forms a part, and to place in the left channel an overflow

(Continued on page 215.)



Interior View of Power House.

General View of the Dam and Power House.

THREE THOUSAND HORSE POWER ELECTRIC PLANT ON THE SNAKE RIVER, IDAHO.

Scientific American.

ESTABLISHED 1845

MUNN & CO., - - - EDITORS AND PROPRIETORS.

PUBLISHED WEEKLY AT

No. 361 BROADWAY, - - NEW YORK.

TERMS TO SUBSCRIBERS

One copy, one year, for the United States, Canada, or Mexico $3.00
One copy, one year, to any foreign country, postage prepaid. £0 16s. 5d. 4.00

THE SCIENTIFIC AMERICAN PUBLICATIONS.

Scientific American (Established 1845) .... $3.00 a year
Scientific American Supplement (Established 1876) .... 5.00 "
Scientific American Building Edition (Established 1885) .... 2.50 "
Scientific American Export Edition (Established 1878) .... 3.00 "

The combined subscription rates and rates to foreign countries will be furnished upon application.

Remit by postal or express money order, or by bank draft or check.

MUNN & CO., 361 Broadway, corner Franklin Street, New York.

NEW YORK, SATURDAY, OCTOBER 5, 1901.

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 TOWING TANK AND THE DEEP SEA.

Yachting enthusiasts who compared the behavior of "Shamrock II." and "Columbia," in the lumpy sea and light wind that prevailed in the first inconclusive contest of the season for the "America" Cup, must have been impressed with the great difference in the movements of the two yachts. The strong wind of the preceding day had died down and left a short, broken sea rolling in from the ocean. Beating to the outer mark, the yachts were taking this sea alternately on the starboard and port bow. They had no sooner crossed the line than it was evident that the relatively sharp bow with its V-sections of "Columbia" was better suited to meeting and lifting the yacht over the seas than was the more round and flaring bow of "Shamrock II." As "Columbia" pushed her nose into a sea she would rise with a gentle rhythmical motion, and as the crest passed amidships she would drop with the same easy swing into the trough of the next wave. The rise and fall of the vessel gave her mast something of the even beat of a pendulum. "Shamrock II.," as we have often remarked in these columns, is unusually full in her forward sections and unusually lean in her afterbody, the center of displacement, with regard to the length of the vessel, being considerably further forward than in "Columbia." Hence, when she met the seas her great displacement forward caused her to rise with a sharp jump, which was accentuated by the rapid drop into the trough of the sea as the wave passed to her shallow afterbody. She came down with a crash that must have tried every spar and rope throughout the vessel, and the effect was instantly noticeable, especially as the wind grew lighter, in a distinct checking of her way. As long as the breeze held true the result was not disastrous, and, indeed, for the first three hours of the beat to the outer mark she held her own fairly well with the "Columbia." During the last hour of the beat the breeze lightened rapidly and the "Columbia" drew away with remarkable ease, the pounding of "Shamrock II." serving to bring her at times almost to a standstill.

The peculiar lines of "Shamrock II." were determined by towing-tank experiments; and we have no doubt that for sailing in smooth waters, such as she has preferred in her tuning-up trials inside Sandy Hook, she is an admirably modeled craft. Yachting contests, however, are not carried on in towing tanks; and while we have not the slightest doubt that Mr. Watson had fully in mind the great difference between towing a model in smooth water and driving the full-sized yacht in a troubled sea, we cannot but think that the abortive contest on Thursday showed that theory has been pushed a little too far. We have already stated in this journal that "Shamrock II.'s" form would indicate that she would have difficulty in holding her own with "Columbia" when close-hauled in a short, broken sea, and the first attempt to sail a race has abundantly confirmed this impression.

The weather conditions were an exact repetition of those which rendered the contests of 1899 so enormously wearisome and disappointing—a fair sailing breeze at the start, which steadily fell away as the race proceeded, and dropped entirely when the leading boat was yet several miles from the finish. While the Sandy Hook course is, in the absence of shoals and currents, one of the finest and fairest in the world, we consider that for September and August racing the weather conditions are about the worst that could be conceived. Should the Cup remain on this side, as it seems more than likely to, we think that future contests should be arranged to be sailed in the earlier part of the summer, when better weather conditions are likely to prevail.

The first completed race of the series proves that there is little to choose between the two yachts under the prevailing weather conditions. In place of the short sea of Thursday there was a long ground swell, and the wind held true, with a force of from 7 to 9 knots an hour. At the start "Shamrock II." was slightly to weather of the "Columbia," but only two seconds ahead over the line. This advantage she held to the outer mark. She pointed equally high with the "Columbia," and for two hours and a half there was witnessed a magnificent contest between the two boats for the weather position, "Columbia" making three unsuccessful attempts to cross the "Shamrock's" bow. It was noticeable that "Shamrock" showed to best advantage when the wind strengthened—a fact which suggests that in breezes of over 10 knots she will prove the faster boat. To the outer mark "Shamrock II." made six tacks and "Columbia" twelve. After two hours' sailing they were so close together that the shadow of "Shamrock's" topsail was thrown on the mainsail of "Columbia." On the last board to the outer mark, "Shamrock II.," because of her windward advantage, was sailed with a freer sheet, and gained 41 seconds in two miles. Running home in a falling wind, "Columbia" pulled up and passed the "Shamrock II.," crossing the line about two lengths or 37 seconds in the lead, and 1 minute and 20 seconds, corrected time.

THE ROYAL TOMBS AT ABYDOS.

Recent Babylonian discoveries have challenged the primacy of Egyptian civilization. There is not, however, the same continuity of record in Mesopotamia as there is in Egypt. There was a time when scholars were apt to look askance at everything which antedated the Greek historians, and the first three dynasties were considered as a tissue of fables. The last two years have seen wonderful discoveries in Egypt, for the tombs of the kings at Abydos have been opened, and the treasures which have been found place us face to face with the beginnings of history. Dr. W. M. Flinders-Petrie describes the recent discoveries in the current issue of Harper's Monthly Magazine. He says that the oldest record of human history is the statement that ten kings reigned at Abydos in Upper Egypt during a period of 350 years before Mena, who has usually been considered as the founder of the first dynasty. In reality these earlier kings were the real founders of the Egyptian state, and we now know not only their names, but are able to obtain some idea of their mode of life and the culture which they attained. The date which Dr. Flinders-Petrie assigns to the pre-dynastic kings is from 4900 to 4800 B. C., and the names of the four whose tombs have been examined are given as Ka, Zeser, Narmer and Sam. Among the remarkable finds were a carved slate slab showing King Narmer smiting his enemy, an ebony tablet, a bar of gold, gold jewelry, including bracelets, and a royal scepter. The oldest group of jewelry in the world is undoubtedly the four bracelets of the Queen of King Zer (4715 B. C.), which was discovered with a portion of the mummy in a hole in a wall. This is 2,000 years earlier than any other jewelry thus far identified. The bracelets show a wonderful perfection in the soldering of the gold. In no case can the joint be detected with a magnifying glass, either by color or a burr edge. The proof that solder was used is in the inside of the ball buttons, where a wire shank is joined in and not hammered in one piece; the wire is hammered and not drawn.

It is surprising that this valuable jewelry should have been found, as the king's tomb was repeatedly plundered. It is probable that one of the looters thrust this fragment of the mummy into the hole in the wall, intending to return at some subsequent period and remove it. The bracelets show the turning point in the development of Egyptian art, the finest bracelets being formed of alternate plaques of gold and turquoise, each surmounted with a royal hawk. The turquoise plaques have a more archaic and lumpy form of hawk than do the gold pieces, and show that during a comparatively short period, little more than half a century, rapid crystallization in art took place, and at the end of his reign the forms are practically identical with what continued for more than 4,000 years later. Dr. Flinders-Petrie considers that this is comparable to the sudden fixation of the final forms which is seen in Greek art, where an interval of only forty years, between the time of the Persian war and the Parthenon, sufficed for the evolution from archaic work to the greatest perfection.

Each of the royal tombs had two large tombstones, bearing the name of the king, and private tombs of all the court and domestics were placed around that of their royal master. They are nearly all built of brick, in most cases with a timber lining to the chamber, sunk in the ground. They were originally roofed over with beams, matting and sand. They lie about a mile back from the Temple of Abydos and they were excavated by the Egyptian Exploration Fund. It is possible that many of the objects found will pass into American possession. Dr. Flinders-Petrie justly states that we now know far more about the civilization of these oldest-known kings than we do about the Saxon kings of England, and the reality of the very earliest part of the history of the world is now placed beyond question by these discoveries.

THE TRUE POINT OF VIEW.

One cannot but be struck, sometimes, with the fact that of late the English, or a large section of them, have shown an almost brutal frankness in criticising their own industrial methods and comparing them with those of this country to the disadvantage of the former. According to the popular idea, this betokens a want of patriotism; whereas, as a matter of fact, it is patriotism of the highest order. If there is one branch of its engineering work which the citizens of that great manufacturing country have been proud of, it is its railroads, and particularly the motive power. Although, judged by itself, the English engine is a beautifully finished and highly economical machine, it is not so strictly economical when considered as a part of the whole administration and operation of a railroad system as such. Col. Constable, the manager of one of the great railway lines of India, recently visited the United States to study her railway system. He is one of those British officials who are getting to look at the question of locomotive economy from the broader standpoint. In his report recently submitted to the Indian government and, through it, laid before the British Board of Trade, he states that while there is no doubt that the American engine burns more fuel and goes to the repair shop sooner than the English locomotive, the American builders do not construct their engines with the expectation of their lasting more than fifteen years, since they consider that at the end of that time the development in the size and power of engines, and in the loads to be hauled, will be so great that the fifteen-year-old locomotive will be somewhat out of date, unequal to the increased demands of traffic and therefore ready for the scrap heap. Col. Constable states that the great hauling capacity of our engines makes up for any defects in their details. He is further of the opinion that locomotives of light weight and small power are kept too long in service on the Indian railroads. The report hits the nail upon the head when it says that the first duty of the engine is either to run fast or to pull a big load. Its author says that he would rather have a roughly finished engine that would haul 3,500 tons than a highly finished, spick-and-span beauty that could only haul 600 or 700 tons in England or 1,200 tons in India. He considers that since the cost of coal is only one feature in the cost of carrying a ton of freight, the East Indian railway would be benefited by using cheap coal, and using engines that could haul loads of American dimensions, even should its coal consumption per engine-mile be doubled, and its engines have to be sent to the scrap heap at the end of fifteen years. The report concludes by saying that, as a matter of practice, the American lines prefer to run an engine for all it is worth, provided traffic is offering, merely allowing sufficient time for cleaning and repairing.

It is certain that American methods, as thus outlined by this British official, are destined to become prevalent in the colonies of Great Britain wherever the loading gage permits the use of more powerful locomotives. In Great Britain there is a limit set to the size of the engines by the low bridges and the comparatively narrow width between station platforms; but even under these restrictions, it is possible for British locomotive builders to greatly increase the size and power of their boilers above the limits which generally obtain to-day.

THE HOLLAND SUBMARINES FOR THE BRITISH NAVY.

The first of the five submarine vessels of the Holland type, now being constructed by Messrs. Vickers' Sons & Maxim for the British navy, will be placed in commission in the course of a few weeks. Each boat will measure 63 feet 4 inches over all, with a beam of 11 feet 9 inches, while the displacement will be 120 tons. The crew will comprise seven officers and men. The motive power consists of a 4-cylinder vertical gasoline engine for surface propulsion. The motor will have a speed varying from 200 to 300 revolutions per minute, and its maximum brake horse power will be 190. The storage capacity will enable the boat to travel 400 knots at 9 knots per hour on the surface. On the surface the boat will have a maximum speed of approximately 10 knots, while the speed when submerged will be about 3 knots less. For propelling the vessel when submerged a main motor of electric waterproof type is provided, the current being supplied from accumulators sufficient in capacity to enable the vessel to remain under water for a four hours' run at maximum speed. The accumulators are charged from a dynamo driven by the gasoline motor while traveling on the surface. At the bow of the boat is the torpedo-launching tube placed about 2 feet below the load line, while the vessel is on the surface, and in addition to the torpedo, which will always lie in position in this tube, four others will be carried. The boat is provided with a hull of sufficient strength to permit the submarine to descend to a depth of 100 feet, and the water tanks are of small dimensions, so that the size of the moving masses of water is considerably reduced, while at the same time there is every facility for filling and discharging them to readjust the balance necessary for stability when the vessel is diving or returning to the surface. The boat is fitted with four rudders, two of which are for steering on the surface, and the other two to be employed for diving. The official trial is to consist of a surface run of 10 knots, which is to be covered within the hour, while the submerged run will be 2 knots, to be accomplished at an hourly speed of 7 knots. When the runs have been undertaken a surface torpedo will be discharged at a target 150 feet in length by 16 feet deep, the upper edge of the target being awash and placed at right angles to the course of the submarine. While the boat is undertaking her submerged trials she will not rise to the surface on more than three occasions from the time of starting until the firing of the torpedo, the duration of each appearance not to exceed one minute.

BELLEVILLE VERSUS CYLINDRICAL BOILERS.

PRESIDENT OF BRITISH ADMIRALTY COMMITTEE'S REPORT.

Vice-Admiral Compton-Domville, the president of the committee appointed by the English Admiralty to investigate the efficiency and reliability of the Belleville boilers in comparison with the cylindrical boilers, has issued his report concerning the trial run that was undertaken from Portsmouth to Gibraltar and back by the two sister ships "Hyacinth" and "Minerva" at full speed. The former vessel is fitted with the Belleville boilers, while those of the latter are of the Scotch cylindrical type.

Representatives of the boiler committee embarked on board these two vessels at Devonport on July 6 last. Both vessels started from that port for Gibraltar at 3 o'clock in the afternoon of the same day and commenced working up to 7,000 horse power. It was intended that the ships should maintain 7,000 horse power till all the coal, except the 82 tons in the reserve bunkers, was exhausted. Three-quarters of an hour from the start the revolutions of the "Hyacinth" were 152 per minute and the horse power 6,994, and her trial started from this time. The "Minerva's" trial commenced a quarter of an hour later. The latter vessel soon showed that she was the faster ship, and steadily drew away from the "Hyacinth." By midnight on the 7th she was about four and a half miles ahead.

It had been arranged that the water in the reserve tanks of both ships should be used as the only make-up feed-water until it was reduced to 20 tons, in order that the amount of make-up feed used per day might be accurately determined. When the reserve had been reduced to 20 tons, this water was to be kept intact in the tanks ready for use in case of emergency, and all make-up required was to be obtained from the evaporators. Special reserve tanks had been fitted on the "Hyacinth" to hold about 100 tons; this, added to the original tank stowage, gave a total reserve tank stowage of about 140 tons. The total reserve tank stowage on the "Minerva" was about 170 tons.

When the amount was reduced to 35 tons on the "Hyacinth," the staff engineer asked to be allowed to start the evaporators, on account of the difficulty of getting the water out of the tanks by the special pump fitted for these trials. Two Weir's evaporators working with exhaust steam were started for the purpose.

At 1:15 A. M. on July 11, the staff engineer of the "Hyacinth" reported the engines would have to be eased on account of the large loss of water, and the trial was abandoned from 1 A. M. All the evaporators were working at this time, and in addition to the water from the reserve tanks, 25 tons of drinking water had been used for boiler make-up. The "Hyacinth" steamed into Gibraltar at slow speed, arriving there on the 11th, in the evening.

The "Minerva" continued steaming at 7,000 horse power till 11 P. M. on the 12th, at which time there were still 39 tons of coal in the bunkers, not including the reserve, and 20 tons of water remained in the reserve tanks.

The average horse power of the "Hyacinth" was 7,047 for 103¾ hours, with a coal consumption of 1.97 pounds, and the distance run was about 1,810 miles at an average speed of 17.6 knots. The "Minerva's" horse power was 7,007 for 147 hours, with a coal consumption of 2.06 pounds, and the distance run was about 2,640 miles at an average speed of 17.96 knots.

On the night of the 10th flaming occurred at the after funnel of the "Hyacinth," but no such flaming occurred on the "Minerva." When the boilers of the latter vessel were examined upon arrival at Gibraltar the openings in the Admiralty ferrules were seriously choked, the sizes of the openings in some cases being reduced to about one-third of the original.

The boilers and engines on both vessels worked well on the way out, with the exception of the breaking of the eccentric-strap bolt of the starboard intermediate engine of the "Minerva," which delayed her for about two hours. A number of leaks developed in the "Hyacinth's" boilers, which became worse when the vessel was eased up when entering a fog, on which occasion the steam pressure became sufficiently high to lift the safety valves. The loss of water was at first attributed to leaky feed-suction pipes, but during the stay at Gibraltar these pipes, the feed, and the hot well tanks, and the boilers and boiler blow-outs, were water-pressure tested, and no leaks, beyond those already known to exist in the boilers, were discovered. The leaky joints were remade by the ship's staff while at Gibraltar, and on the 16th the ship was taken out for a run at about 7,000 horse power, to test the amount of feed-water being lost. This was found to be at the rate of 55 tons a day, according to the record of the six hours' run. The boilers of both ships were thoroughly cleaned out at Gibraltar, so that the race home might be determined under the most advantageous conditions.

Both ships lay at anchor—the "Hyacinth" with two boilers alight for auxiliary purposes, and the "Minerva" with one alight. The homeward run was commenced at 4:27, by a previously unknown signal, on the 20th. Directly the signal was given the fires were lighted in the boilers not at work and the ships were headed for Portsmouth. Both ships started punctually at 4:30—three minutes after the signal. The "Hyacinth's" engines were worked slowly in accordance with orders from the deck, steam being supplied by the two boilers which were alight. At 4:52 the after group of boilers was connected up; at 5:05 the forward group; and at 5:09 the middle group were connected up, the steam pressure being 22 pounds. At 5:20—less than one hour from weighing anchor—the "Hyacinth" was proceeding at 150 revolutions per minute, the horse power being nearly 7,000.

When the "Minerva" set sail the boilers were also worked slowly. The second boiler was connected up at 4:55; the third at 5:02; the fourth at 5:07; the fifth and sixth at 5:10; seventh at 5:12; the eighth at 5:15. The engines were working up to full power at 5:16, but had to be eased several times during the next three hours, owing to the eccentric straps warming up.

At 5:15 on the 18th the "Hyacinth" was about six miles ahead of the "Minerva." Both ships, however, ran into a fog, and the "Minerva" caught up to the "Hyacinth," and at 9:30 A. M., on emerging from the fog, the "Minerva" was still ahead. Both ships then worked up to the maximum, but throughout the day the "Minerva" gained one-third of a knot per hour on the "Hyacinth." At 7 P. M. another fog was encountered, and the ships went slow through the night, keeping close to each other.

At 9 A. M. on the 19th they were again level, but during the day the "Minerva" again gradually drew ahead, traveling a quarter of a knot per hour faster. At 7 P. M. the "Hyacinth" again eased, owing to a fog, and went slow till 5 A. M., the "Minerva" being out of sight ahead. The "Hyacinth" then steamed at over 9,000 horse power till 6:10 on the 20th, when the fires of 10 boilers were drawn on account of a burst steam tube. At 9:50 P. M. the trial finished, the ship then being off St. Catherine's, and she arrived at Spithead at 11:30 P. M. The "Minerva" had anchored at Spithead 1 h. 45 m. previously. The coal consumed in the "Hyacinth" on the way home was 550 tons; on the "Minerva" it was 451 tons. The "Hyacinth" used her evaporators all the way; the "Minerva" utilized hers but very little.

The maximum power developed by the "Minerva" was 8,700 horse power, while that developed on the "Hyacinth" was nearly 10,000 for at least two hours, during which time the "Hyacinth" did not perceptibly gain upon the "Minerva." The "Hyacinth's" average power while running clear of fog was about 9,400 horse power, and the "Minerva's" about 8,400 horse power. From the results of the outward run it appears that the radius of action of each of these vessels at 7,000 horse power, as far as the coal is concerned, should roughly be: "Hyacinth," 2,930 miles; "Minerva," 3,000 miles. No difficulty was experienced in either ship during any part of either the outward or homeward runs to maintain a sufficient supply of coal to the fires.

Following the report of the president of the committee is one by Rear-Admiral W. H. Hay, Controller of the Navy, relating to the condition of the boilers after their unusual exertions. He draws the attention of the Admiralty to the following points in this trial:

(1) The very serious loss of water in the "Hyacinth," as pointed out by the president of the committee. This was due to leaky joints. A certain number were located at Gibraltar, and on examination at Portsmouth other leaks were discovered and reported.

(2) The state of the "Minerva's" tubes at the end of each run. On arrival at Gibraltar the cup ferrules were discovered to be partially choked, due to bird-nesting, and the ship could not have gone any further at that power (7,000). As it was, she was using up to 1.7 inches of air pressure, instead of ½ inch, to maintain the necessary combustion for this power. On arrival at Portsmouth practically the same thing occurred.

(3) The "Hyacinth" developed an average of 1,000 more indicated horse power than the "Minerva" on the run home. This should have given the former a substantial increase in speed, whereas there was a slight decrease. This extra indicated horse power must have been absorbed either in the engines, or on the main shaft's bearings, or in the hull. It is possible that the shape of the hull may have had something to do in the matter, but former trials do not bear this out. For example, when the "Highflyer" (same class) was tried against the "Minerva" last year, the former maintained a higher power and speed, except at 10 knots, when she had to exert more indicated horse power to obtain the speed.

The Controller of the Navy, in his conclusion, significantly remarks that this last feature of the Belleville boilers requires investigation. Although these trials were not conducted under the most satisfactory conditions, yet they conclusively established the relative merits and disadvantages of the two types of boilers, and the cylindrical boiler appears to have issued from the ordeal with the greatest success. It has been proved to be far more economical, in every respect, than the water-tube boiler.

SCIENCE NOTES.

The contest for the Pollok prize is now open, and it is to be hoped that this competition will result in the award of the prize to some American inventor.

An exhibition for accident, sanitary, and life-saving service is to be held at Frankfort October 5 to 21. It is to be exclusively scientific. Visits of workingmen will be arranged, as the chief aim will be to benefit those engaged in industrial pursuits.

Consul Haynes, of Rouen, under date of August 26, 1901, says that the metric system is to-day compulsory in twenty countries, representing more than 300,000,000 inhabitants—Germany, Austria-Hungary, Belgium, Spain, France, Greece, Italy, Netherlands, Portugal, Roumania, Servia, Norway, Sweden, Switzerland, Argentine Republic, Brazil, Chile, Mexico, Peru, and Venezuela—and advises American exporters in dealing with any of these countries to adopt the system.

The Italian government has definitely decided to restore Leonardo da Vinci's "Last Supper." Ordinarily the restoration of a masterpiece of painting would be regarded as dangerous in the extreme, but in this instance the conditions are peculiar. The picture is in such a bad condition that it would be difficult to spoil it, and the work will be done in the most careful and scientific manner. A celebrated expert has been engaged to give his services, and the first work will be to destroy the micro-organisms which are eating up the paint. The wall will then be treated so that it will not be damp in the future, and then the work will be "restored" with the help of the old copies of the fresco and the engravings of it.

The dangers attending laymen who undertake to act as judge, jury, and advocate in legal matters are well shown in a recent trial for infringement in England. A party had invented a pneumatic hammer and established a business in it, when other parties also embarked in the manufacture, having patented the same device. These last were sued, when they set up a defense of prior publication before the first, or original, patent was issued. The judge required the alleged infringers to prove the prior publication—they having admitted the infringement. It then appeared that the ostensible prior publication was not a fact; there had been no publication whatever in the legal meaning of the word, but merely a conversation between two tradesmen as to the commercial value of the hammer. Upon such a slender base as this the defendants had gone to considerable outlay with the belief that their view of the situation was correct. In cases of this kind it is much better to take professional advice than to act upon intuitions or beliefs.

THE "FOOL KILLER" TAKING SOUNDINGS.

In our last issue we described Peter Nissen's "Fool Killer," which is intended to be used in taking soundings in the Niagara River, and, if possible, pass through the Whirlpool Rapids. Nissen began making soundings on September 21. He maneuvered the "Fool Killer" in a satisfactory manner, showing that it was a very stanch craft. The boat was run repeatedly into the spray so that it was hidden for several seconds. Then it would emerge, and under a full head of steam would toss among the waves with the water dashing over it and threatening to capsize it. He found the rocky bottom of the river very uneven, its depth varying from 15 to 100 feet.

Crude Attempts at Telegraphy.

About seventy years ago, perhaps before the present mode of telegraphy had been thought of, an attempt in that direction was made by a Mr. Porter, a man of inventive faculties, who afterward became originator, proprietor, and conductor of The American Mechanic, the pioneer publication in that direction, and the predecessor of the present SCIENTIFIC AMERICAN.

The southern and ocean terminus was on Rhode Island on Rocky Farm, and the place of its location has since been known as Telegraph Hill. It was constructed wholly of wood, was in part a species of wireless telegraphy. It consisted of a series of upright posts, with a number of arms secured to the post at one end by pivots, permitting the arm to be moved in any direction desired, at the liberated part, up or down, and the information was derived from the relative position of these arms. The signals were placed on the summits of the highest hills, at desired intervals, an operator being required at each signal post to convey the signals to the next station.

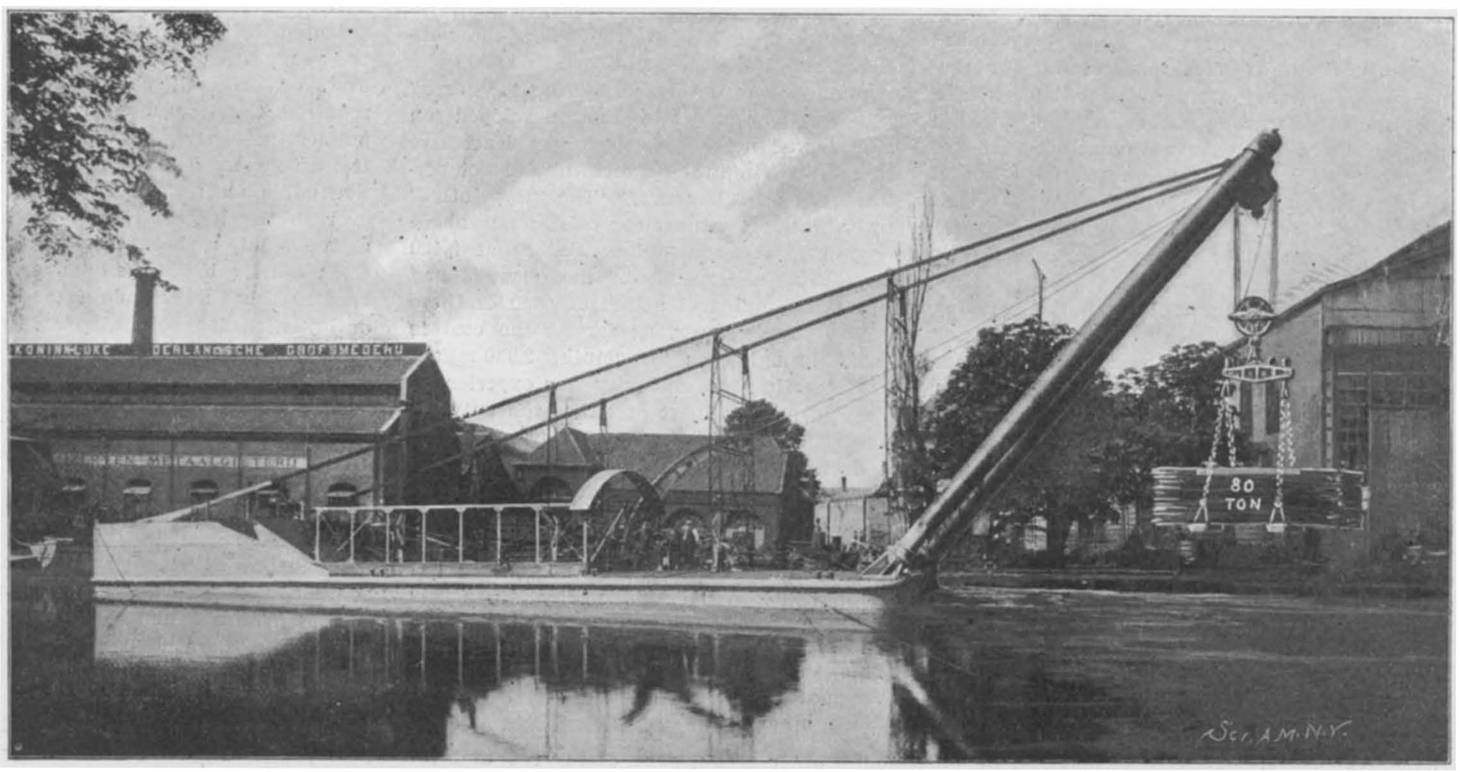
To reach Boston, as was intended, would require a large number of signal stations and operators, and the execution would have been necessarily slow and expensive. Of course, no approach could have been made toward the present manner and matter of telegraphy, at best being confined to the briefest expression of important information, to carry which to Boston, for instance, would have required a comparatively long time. It was put in operation, if the writer mistakes not, and for a sufficient length of time to test its availability, but not its practical value, and it was early abandoned. It is only within a few years that the southernmost signal post disappeared from Telegraph Hill.—Newport News.

EIGHTY-TON FLOATING CRANE FOR THE SANTOS HARBOR WORKS.

We present an illustration of an 80-ton floating crane which has been built by the Royal Dutch Forge Company at Leyden, Holland, for the Santos Harbor Works. Its principal dimensions are: Length of vessel, 100 feet; beam, 35 feet; depth, 7 feet 3 inches; outward overhang of shearlegs, 35 feet 3 inches; height of top of shearlegs above water level, 50 feet. The power needed is supplied by a vertical high-pressure engine, with two cylinders, each 12 inches in diameter by 15-inch stroke, and taking steam at an initial pressure of 120 pounds per square inch. The general appearance of the craft is shown by the accompanying engraving. The hoisting gear consists of two sets of wormwheel gearing and two sets of spur-wheels. The worms, of forged steel, are driven from the steam engine. The wormwheels are fitted on intermediate shafts, on which, on the other end, are fixed cast-steel pinions, driving the cast-steel spur-wheels, and bolted to the drums. Each drum, of cast iron, has a diameter of 3 feet 7 inches by a length of 3 feet 7 inches between the flanges, and weighs about 4 tons. All shafts are of forged steel; the bearings have large surfaces, and are lined with white metal.

The shearlegs are constructed of mild steel plates, the diameter in the middle being 2 feet 8 inches. The upper ends of the shearlegs are provided with cast-steel top pieces to take the upper shaft, which is of forged steel, 12 inches in diameter. The water-ballast tank, having a capacity of 130 tons, is divided into four compartments. Each compartment can be filled separately, and also all compartments together, by a duplex ballast pump, placed in the engine room. The hull of the vessel is built of mild steel, and special attention has been paid to the longitudinal stiffness of the vessel. The crane has been tested on the works with full load by a commission of engineers, and proved satisfactory in all respects.

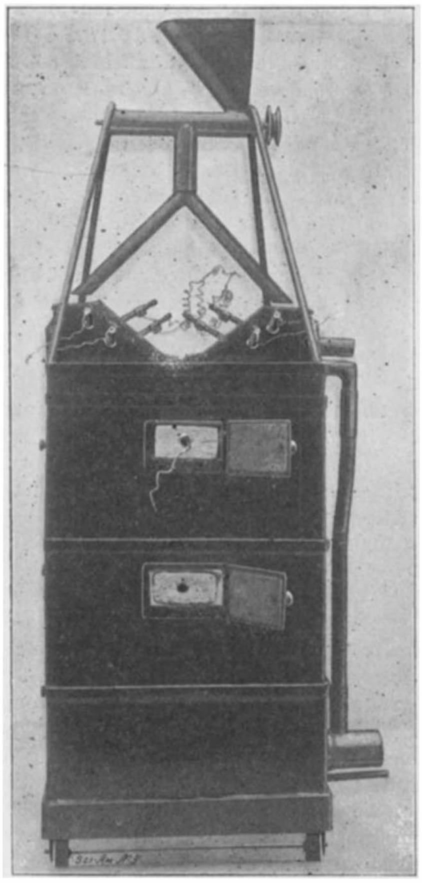
A mixture of two parts olive oil and one part turpentine gives an excellent furniture polish. It at once removes all finger marks, etc., from the furniture.



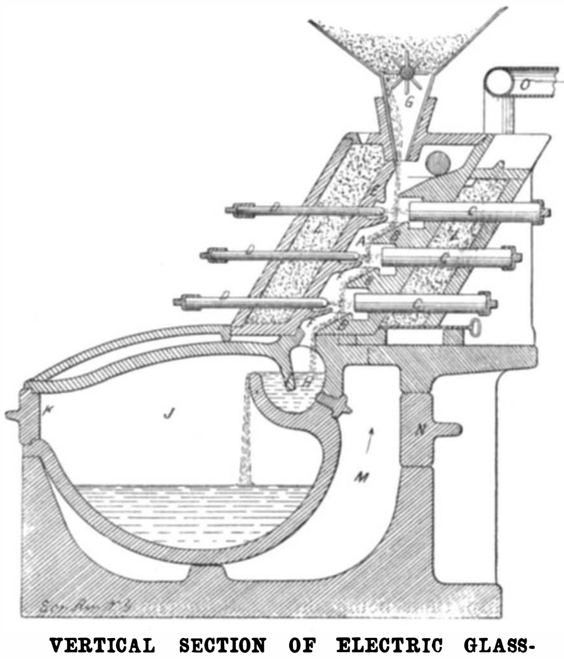
EIGHTY TON FLOATING CRANE FOR THE SANTOS HARBOR WORKS.

AN ELECTRICAL GLASS-FURNACE.

Most varieties of glass are largely composed of silica, often mingled with oxides of sodium and calcium. The glass from which ordinary tumblers, for example, are made is composed essentially of white sand (silica), soda (sodium carbonate) and lime (calcium carbonate). The raw materials are pulverized, intimately mixed, and subjected for 20 to 30 hours to an intense heat either in clay crucibles (glass-pots) or in large basins (tubs). However economical the most improved forms of glass-furnaces may be in the consumption of fuel, and however small the percentage of loss in glass, the fact still remains that the amount of fuel required and the quantity of heat radiated without any effect on the contents of the furnace are enormous. Moreover, the installation of a glass-furnace is exceedingly costly; valuable space is taken up both below and above ground; the health of the workmen is endangered by the fierce heat radiated by the furnace; and the plant must be worked continuously, so that the loss in heat may be reduced to a minimum.



AN ELECTRIC GLASS-MAKING FURNACE.



VERTICAL SECTION OF ELECTRIC GLASS-MAKING FURNACE.

A new type of glass-furnace recently attracted our attention, which seemed to mark a great onward step in the manufacture of glass and which seemed to be singularly free from the defects enumerated. Through the courtesy of Dr. Voelker of the Société Anonyme, L'Industrie Verrière et ses Derivés, Brussels and Cologne, we are enabled to present to our readers a clear account of this departure in one of the most important industries.

The invention is an electric furnace which can be made in various forms, and one type of which is pictured in our sectional view. The silica and other ingredients are finely pulverized, intimately mingled, and introduced into a hopper, in the discharge-opening of which a feed-wheel is mounted. If the hopper be long and the discharge-opening located at one end, a screw-conveyor is used. From the hopper the material to be fused is fed to an inclined melting-chamber, *A*, which is formed by the wall, *E*, and by a continuous series of hearths, *B*, so situated that one is placed above and slightly to one side of the one immediately below. The surfaces of the hearths are inclined to permit the fused material to flow off; and the edges of the hearths are made as sharp as possible to permit the escape of the bubbles of carbon dioxide gas. Through perforations in the wall, *E*, and in the hearth-wall, carbons, *D* and *C*, are respectively passed. Beneath the carbons, *D*, the wall, *E*, is formed, with pan-like projections, *F*, which receive the ashes and unconsumed portions of the carbons. The carbons, *C*, are mounted immediately above the corresponding hearths, *B*. Direct current generated by a 360-ampère dynamo with a voltage of 120 is passed through the carbons. The intense heat of the first arc melts the raw material fed from the hopper. The molten glass trickles down the first hearth; drops upon the second hearth; is there subjected to the heat of the second arc; falls upon the third hearth; and finally reaches the collecting cup, *H*, as an exceedingly liquid glass, free from all gases and impurities. Since it is of the utmost importance that no air be allowed to enter the melting-chamber, *A*, during the operation of fusing the silica, a compartment, *L*, is provided at the side of each wall, which compartment is filled with refractory material, packed so closely around the electrodes that no air can possibly enter. The gases which bubble from the molten glass are led through several passageways into the air space, *M*, surrounding the pot, *J*. In the air space, *M*, the gases are mixed with hot or cold air and burnt, the heat thus generated serving to warm the walls of the pot. The products of combustion pass through suitable channels to the out-take, *O*.

It is claimed for this electrical method of fusing silica that 60 per cent of the fuel formerly required is saved. But, even if this figure be possibly modified when accurate data are obtained, it cannot be denied that the remarkable compactness of the furnace, the unprecedented rapidity with which the materials are fused (bottles can be blown within half an hour after the hopper is charged), and the very small amount of heat lost by radiation are sufficient to predict a bright future for the electrical system. The pots, besides being small, and cheap in cost, last longer than has ever been the case in glass-making. The workmen are subjected to no fierce heat. The task of superintending the work of glass-making is considerably lightened, for the usual subterranean passage, batch chamber, and fuel inlet are entirely dispensed with.

THE "SANTOS-DUMONT NO. 6."

The "Santos-Dumont No. 5" was wrecked at the Trocadero on Thursday, the 8th of August last. On the very same day, the constructor, M. Henri Lachambre, received an order for the "Santos-Dumont No. 6" and agreed to deliver it by the 1st of September. Now, on Friday, August 30, M. Santos-Dumont had possession of his new balloon, and on Sunday, the day on which, according to contract, the balloon was to have been delivered, the latter was inflated and waiting under the Saint Cloud shed for the moment to take its flight. The balloon thus constructed in twenty days differs slightly from its predecessor. It has the form of an elongated ellipsoid, which was primitively that of the "Santos-Dumont No. 5"; but the latter, modified during the course of the experiments, and twice elongated at the center, finally assumed the form of a cylinder terminating in two ellipsoidal cones. The following particulars were given by M. Santos-Dumont in his letter of engagement for the Deutsch prize:

"Form: elongated ellipsoid of 16.7 feet short and 98.4 feet long axis, terminating at the two ends in cones 3.28 feet in height. Capacity, 21,925 cubic feet. Motor, gasoline of 20 horse power, cooled by a circulation of water. Screw with two blades of a spread of 13 feet. Keel formed of a beam 46 feet in length. Suspension by means of steel wires attached to the envelope here and there. The length of the preceding balloon was exactly the same as that of the new one, but the larger dimensions of its small axis gives the latter a greater capacity and proportionally increases its ascensional power, and the more so in that its envelope, which weighs 242 pounds, is lighter by 88 pounds than that of the balloon destroyed. This envelope is made of a fine and white Japanese silk.

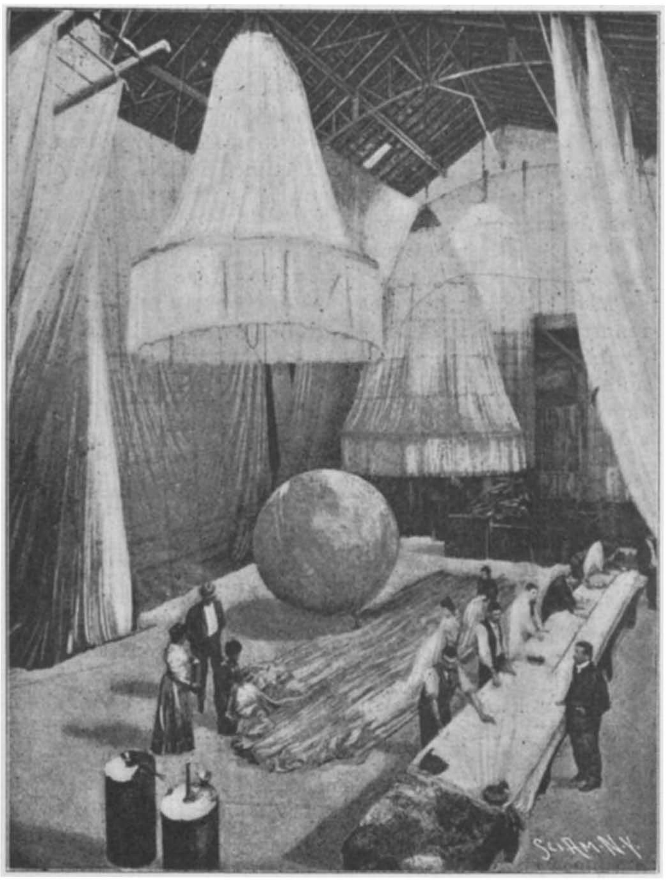
"From looking at and touching this pliable and translucent fabric one would never imagine that a man would dare intrust his life to anything so light and fragile. Nevertheless, it has a wonderful resistance, since it is capable of supporting a weight of at least 200 pounds to the square foot without tearing."

The Lachambre shops, at which the "Santos-Dumont No. 6" was constructed, are situated at the end of the Vaugirard in a quiet, narrow street. It is in these shops that was constructed the preceding balloon, and that of André. One of our engravings shows M. Santos-Dumont engaged in inspecting his motor.

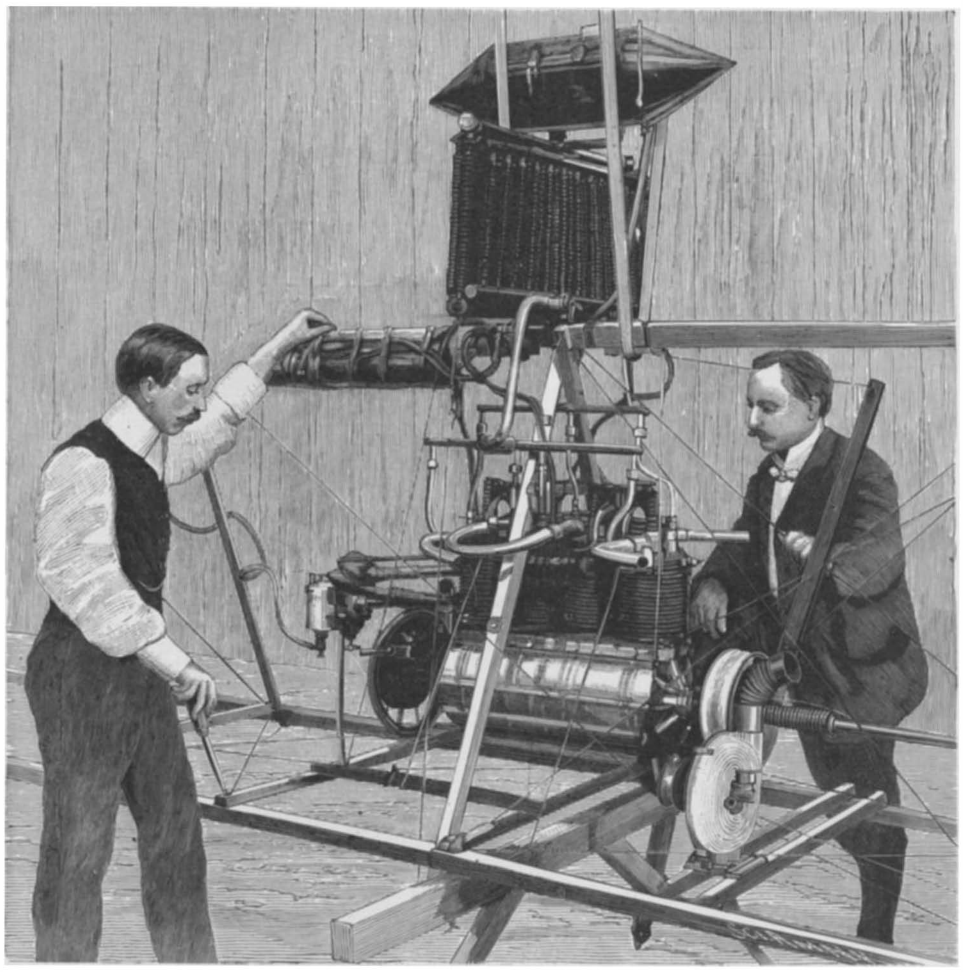
In the quiet of this remote quarter, and while in a manufactory of impermeable fabrics the beautiful white silk was undergoing its first preparation, and, through a special varnish, was being rendered impermeable to gas, M. Lachambre, provided with directions from M. Santos-Dumont, was drawing his plan; and, when the material for the balloon reached him varnished and dried by the improved process now in use, all that he had to do was to set himself to work to cut it. Upon the diagram, the surface of the balloon had been divided, at right angles with the long axis, into forty zones, each of which was subdivided into panels of trapezoidal form, exactly equal. It was then possible to cut out at once the thirty-two panels of two corresponding zones on each side of the short axis, in taking care to reserve a width for the seams all around. These panels were at once put into the hands of seamstresses in order to be sewed together by machine, by crowns or zones. From the hands of the seamstresses, the zones, assembled by fives or sixes, were sent to the varnishing room in order that the apertures made by the needles might be closed, and the silken fabric be rendered perfectly impermeable. Then the parts thus prepared were dried by stretching them over hoops and suspending them from the ceiling, where they looked like big bells, or, perhaps, more like ample crinolines. After they were dry, the parts were formed and the seams again carefully varnished. With the addition of the two points (two small cases of double silk) the envelope was this time complete, and appeared in the form of a long cigar, the tightness of which had to be verified by means of a centrifugal pump that forced air into it at the front extremity. For lovers of precise details let us say that in the entire cigar-shaped envelope there are no less than 5,000 feet of seams.

But this envelope, so simple in form, is provided with important accessories. In the first place, there is the compensating balloon, occupying at the base and center of the balloon a tenth of its volume, and which supplied with air through a compression pump, serves to keep the balloon well inflated. Then came the valves; the escapement valve of the compensating balloon opening from the interior under the too great pressure of the air; two automatic valves, which at the bottom and back of the balloon perform the same role for the gas, when need be; and at the top a maneuvering valve actuated by the aeronaut. Finally upon the top of the balloon, near the front and rear, are sewed two panels, which, through cords running to the car, can be abruptly removed in order to cause the descent of the balloon.

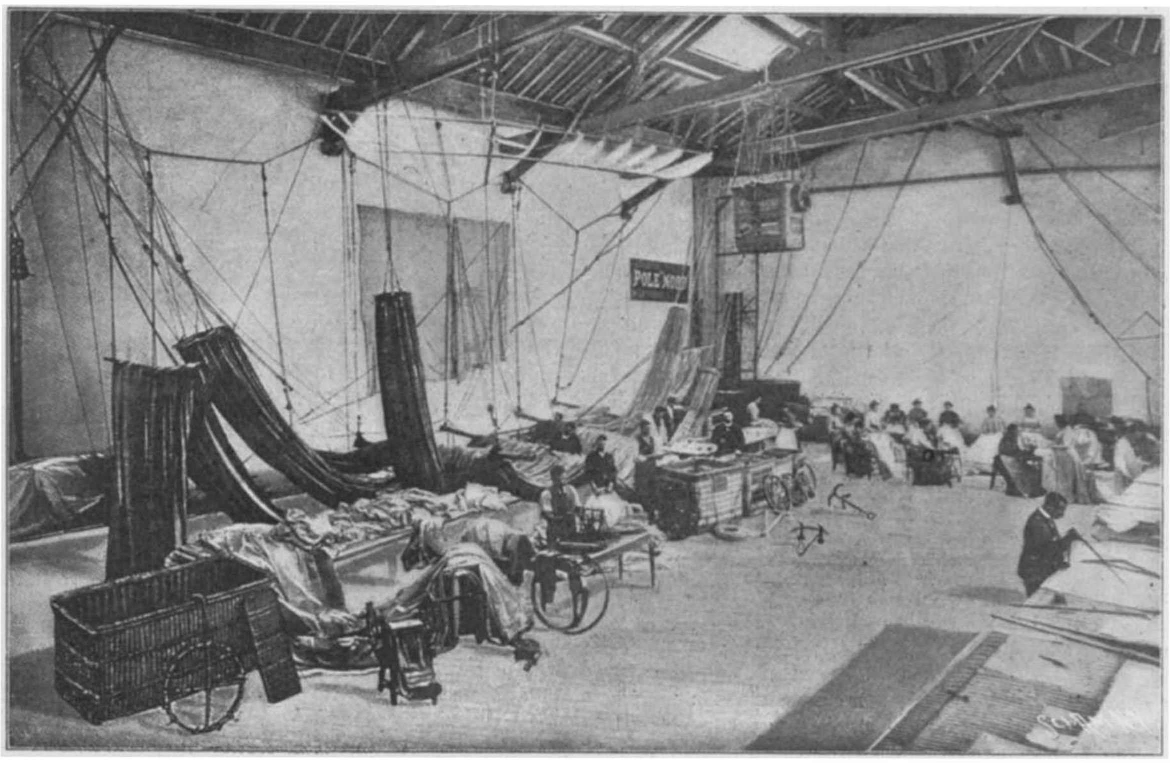
As for the system of suspension of the car and motor, that is the same as in the "Santos-Dumont No. 5."—For the above particulars and the engravings, we are indebted to L'Illustration.



THE VARNISHING ROOM OF THE LACHAMBRE SHOPS.



M. SANTOS-DUMONT INSPECTING HIS MOTOR.



MAKING THE BALLOON CASE.

Chloride of Neodymium.

M. Camille Matignon has lately made a series of experiments with the chloride of neodymium, and gives the results in a paper read before the Académie des Sciences. The chloride of neodymium, prepared for the first time by Shapleigh, crystallizes with $6H_2O$, like the chloride of didymium, of which it was the principal constituent; it has the formula $NdCl_3, 6H_2O$. The chloride presents itself in the form of large rose-colored crystals, deliquescent, of the clinorhombic system. They have a density at 16.5 deg. C. of 2,282. This salt is very soluble in water, and at 13 deg. 100 parts of water dissolves 246.2 parts of the hydrated salt, or 98.7 parts of the anhydrous, while at 100 deg. the same quantity of water dissolves as much as 511.6 parts of the hydrated salt. The chloride dissolves in water with disengagement of heat. The concentrated solution has the property of dissolving abundantly the insoluble oxalates of some of the rare earths, and upon cooling, crystals of oxalochlorides may be obtained. These latter salts have been examined by M. Job. The hydrated chloride cannot be dried by heating without being transformed into oxychloride, but the experimenter is more successful with a current of gaseous hydrochloric acid, and finds that when thus dried at 105 deg. C., the chloride loses $5H_2O$, when the action stops, and a new monohydrated chloride, $NdCl_3,H_2O$ is formed. At 130 deg. C. this chloride still preserves its water, and it is necessary to reach above 160 deg. to free it from the last molecule of water and obtain the pure anhydrous chloride. This process is much more simple than that of Muthmann and Stüzel, and the author has prepared as much as 8 ounces of the salt. The anhydrous chloride has the appearance of a rose-colored powder, extremely deliquescent, which melts at a red heat, giving a liquid which cools to a rose-colored transparent crystalline mass. It is not appreciably volatile at 1,000 to 1,100 deg. When projected into water, the anhydrous chloride dissolves with a noise like that of a red-hot iron, and a considerable quantity of heat is disengaged.

Wealth Made by Chemists.

The expert chemist is an important figure in the industrial world to-day, a writer in The New York Sun truthfully says. He can earn not only fame, but also a large income, and he saves manufacturers many millions of dollars every year. Of course, nine out of ten chemists stick to the old routine, but the tenth goes in for industrial chemistry, and either allies himself to some progressive and flourishing manufacturer, or independently conducts his industrial experiments and spends his time and brains in devising schemes for the utilization of by-products.

One doesn't talk much about waste products now. So little is wasted that it doesn't deserve mention. The Chicago joke that the packing houses utilize everything about the pigs save their squeals and are planning to make the squeals into whistles, has more point than most Chicago jokes.

Probably the great slaughter houses furnish the most familiar illustration of the modern thrift in the utilization of what was formerly considered waste; and even the smaller abattoirs, while they haven't attained the scientific perfection of the Chicago packing houses, are reformed characters. It was only a few years ago that the abattoir was usually built upon the bank of a stream, and all refuse was washed into the stream. In course of time neighbors were inconsiderate enough to protest against the practice. Sanitary bees invaded innumerable bonnets, and a howl of protest went up against the abattoirs. It was necessary to dispose of the refuse in some fashion.

Chemists were called in. Methods for drying the refuse and extracting all the grease were developed. The grease went into the manufacture of soap. The residue was converted into fertilizer. After jelly had been made from the hoofs, the hoofs and horns were used for buttons, knife handles, etc. The health of the neighborhood, and the income of the slaughter men, went up.

The development of the tremendous aniline color industry is altogether due to chemical experiment with waste products. In the dry distillation of coal or wood for gas, the gas passes through a succession of washers, which take out its impurities. These impurities, including ammonia, carbolic acid, acetic acid, and various nitrogen compounds were formerly waste, but are now separated and used. In fact, nearly all of the acetic acid in the market is secured from the dry distillation of wood. Five per cent of the coal used in gas manufacture is coal tar, and by experiment chemists found that this coal tar, always regarded as waste residue, contained substances useful in the making of dyes. Fully 10 per cent of the weight of the coal tar is available for this purpose, and upon the basis of this discovery the enormous coal tar color industry has grown. New plants have been put into many of the coke regions to collect the coal tar liberated in coke manufacture, and it will not be long before the open coke oven will be a thing of the past. Where coal is burned in an open oven no coal tar can be collected, and large profits are literally thrown away; but by burning the coal in closed retorts all the coal tar can be recovered and used.

This color industry, which chemists call the greatest of the modern chemical industries, has called for other chemical developments. It demands large quantities of sulphuric acid, of soda, etc., and chemists have sharpened their wits upon the problem of obtaining these products at a minimum expense. Until recently the greater part of the sulphur used in this country was imported from Sicily. Now, through chemical processes, the sulphur occurring with iron, gold, silver, and zinc is liberated and burned to sulphur dioxide, from which almost all of our sulphuric acid is made.

In connection with all of our mining development, chemistry has played an important part. Ores can be mined with profit to-day that would have been practically worthless a few years ago. In the old mining days only high-grade ore was profitable, and only a certain percentage of the gold contained in the ore was freed.

The tailings thrown aside held a considerable quantity of gold, but could not be worked by the ordinary processes, and were therefore piled mountain high and disregarded until chemists discovered that the gold was soluble in potassium cyanide, and that by washing in a very weak solution of potassium cyanide the tailing gold could be profitably separated from the refuse. The same process has led to the working of low-grade ores, running $4 to $5 to the ton, which could not be profitably worked by the ordinary mining processes.

The silver contained in lead has also been freed and utilized. It was found by chemists that when the melted lead was mixed with zinc the silver formed an alloy with the zinc and floated to the surface. When this mass was taken from the lead and heated in a retort, the zinc, being volatile, was freed, and left a deposit so rich in silver that it was easily purified.

The applications of chemistry to mining processes are legion, but it is in other branches of industry that practical chemistry is now making its strides. The Standard Oil Company is a hardy exponent of the merits of industrial chemistry and has expert chemists constantly employed. As for that matter, so have all the great gas plants, coke plants, sugar refineries, starch factories, etc. The original waste of the oil business was enormous; now it is next to nothing. Of course, the primary aim is the production of kerosene; but crude oil contains, on the one side, oils lighter than kerosene, such as gasoline and naphtha, and, on the other side, products much heavier than kerosene, such as paraffin. At one time all of these by-products were waste; now every one of them is utilized. By first distillation the lighter oils are freed and collected. Then the kerosene is distilled, leaving a product that is worked over into hard paraffin and soft paraffin or vaseline. A heavy oil, left after the collecting of the paraffin, is used for lubricating and fuel oil, much of it being made into car and axle grease. After all these processes a solid mass of carbon is left in the retorts, and this is used to a considerable extent in making carbon sticks for electric light. When one considers that until a few years ago every one of these products save kerosene was absolute waste, one can realize to some extent the place chemistry is taking in the industrial world.

The dairy business is one of the industries with which the chemist is busying himself, and the results so far have been most satisfactory, although a much broader field for the use of casein is prophesied. The large creameries, having turned out their cream and butter, were confronted by great quantities of skim milk for which there was apparently no use. Skim milk was a drug on the market, and in many cases was drained off into neighboring streams. The chemist stepped in and changed all that. The milk is curdled with alkali, and a dried product produced which is soluble in water. This casein has been used for paper sizing, kalsomining, etc., and successful experiments have been made with it in the manufacture of artificial foods. Moistened with water to a gelatinous consistency, put under a hydraulic press and then washed in acid, it forms a hard and insoluble substance, of which buttons and similar articles are made. Chemists say that the casein powder, which is like a fine tasteless flour, may be substituted for milk in cooking, and has a great future in this respect.

Chemistry applied to the sugar industry has been invaluable; and, particularly in connection with the beet sugar manufacture, has recently effected a wonderful saving. The waste in the making of beet sugar was at first enormous, because the molasses was absolute waste. It contains products from the beet roots which give it a very bitter taste, and is also rich in an alkali which spoils its flavor. So, although more than one-half of the weight of the molasses was sugar, it was unavailable save for fermentation and alcohol. Experiment proved that dry lime, mixed with the molasses, combined with the sugar, forming a product insoluble in water. Washing the molasses would then separate this product from all the other elements. The lime and sugar product being heated with carbonic acid, the lime combined with the carbon, forming an insoluble product, and leaving the sugar free to be easily separated. By this process to-day 90 per cent of the sugar is recovered from beet molasses, and there is practically no molasses in the beet sugar factories. In the manufacture of cane sugar the molasses is about as valuable as the amount of sugar contained in it would be, so there is no use for the process adopted in beet sugar making; but there is less weight of sugar in the molasses than there was formerly. This fact, and the fact that the molasses is now made in vacuum pans and cannot be burned or thickened as it was in the old-fashioned open pans, accounts for the fact that there is no more black molasses, and no more black gingerbread such as mother used to make.

The glucose manufacturers have called in chemists, and found a new source of profit. The corn grain has, in addition to its starch product, a tiny germ in which lies its life principle. This germ was formerly crushed with the starch and then separated and thrown aside as waste. Very lately it has been shown that this germ is rich in oil which can be utilized. The germ is now separated from the starch and crushed. The oil gathered finds a ready market, and within the last five years millions of dollars' worth of this oil has been exported to Europe, where all corn products are in great demand. After the oil is taken from the germ the gluten left in the cake is used for varnish, and the residue is used for cattle food.

The corn stalk also is ground and used for cattle food, but first the pith of the stalk is extracted and used for the lining of vessels, the theory being that if a fissure occurs in the framework of the vessel the pith lining, becoming wet, will swell and to some extent close the fissure.

The cottonseed oil industry has eliminated its waste almost entirely, although twenty years ago every part of the cottonseed save the oil was waste product. In the cottonseed oil factory, now, the seed is collected after coming through the cotton gin, and is first stripped of its lint, which is used in the manufacture of certain kinds of paper, felts, etc. Next the shell of the seed is removed and either ground for cattle food or used for fuel. In the latter case the ashes are collected for potash. The kernel of the seed is ground and pressed to extract the oil, and the residue is used for cattle food. The oil in process of refining gives off a waste which enters into soap making, and the making of oleomargarine.

Glycerine, used in such great quantities at present, was for years a waste product. All waste from fatty oils contains compounds of an acid with glycerine. The acid will combine with an alkali, leaving the glycerine in a watery solution, from which it is collected by evaporation and distillation. Immense quantities of this reclaimed waste product are used in the making of explosives.

When steel is melted in a Bessemer converter the phosphorus, which used to be a nuisance, is separated from the steel by the introduction of lime, with which the phosphorus combines readily. This phosphorus is then used as a fertilizer.

The slag from iron furnaces is converted into cement. The tin is taken from old tin cans by chemical process and is used over and over again.

Even the acids used for chemical purposes are not allowed to outlive their usefulness with the accomplishment of their purpose. The Standard Oil Company formerly wasted great quantities of sulphuric acid after it had been used to remove the impurities from the oil. The acid was drained off into the river. Now it is used in a fertilizer particularly adapted to soil where phosphate rock must be dissolved. Then again in certain great galvanizing works the iron was cleaned with sulphuric acid, which was then run into the nearest river. This method of disposing of the waste was forbidden, and chemists were consulted. The solution was made stronger so that it could be clarified and used repeatedly. Finally, when it could no longer be used for washing, it was evaporated and the sulphate of iron extracted from it. This by-product proved so valuable that it is now the chief product of the works.

The list might be protracted indefinitely, and there seems to be in the industrial world to-day no product so utterly worthless that it may not find profitable incarnation in some form or other.

Selenium Action of Radium Rays.

M. Eugene Bloch has studied the action of the rays of radium upon selenium. In a paper read before the Académie des Sciences he brings out the following points. Willoughby Smith discovered in 1873 that the electric resistance of selenium is diminished under the action of light, and M. Perreau has generalized this property (1899) by showing that the X-rays produce upon selenium an action comparable to that of light. It was therefore interesting to observe how selenium acted toward the new radio-active bodies. M. Bloch has been able to show the action of the rays of radium upon selenium, these being of the same order of magnitude as the preceding, but slower in their action. A selenium element which he formed by the usual method (a spiral groove formed between two parallel wires and filled with selenium) possessed a resistance in the dark of about 30,000 ohms. This resistance was put in equilibrium in a Wheatstone bridge, using a sensitive Thomson galvanometer. In one experiment the initial resistance was 30,100 ohms, and this diminished rapidly by 800 to 1,000 ohms under the influence of a weak diffused light, while an incandescent lamp at 10 inches distance made it fall to 15,000 ohms in a few minutes. In the dark it came back to its initial value, but very slowly. A sample of radiferous carbonate of barium was then placed about a millimeter from the selenium. It had about the same surface, and was covered by black paper. The resistance diminished slowly, and at the end of 10 minutes had fallen to 29,000 ohms. Upon removing the sample, the resistance increased progressively by 800 ohms, but only came back to the initial value in two hours. A second element resembling the former had a normal resistance of 654,000 ohms, and this fell to 640,000 in ten minutes under the action of the radium rays. In this case the action is scarcely inferior to that of a feeble diffused light. The sample of radio-active matter was not one of the strongest, and it is probable that others would have a more energetic action.

Large Contract for Watches.

An American firm has agreed to deliver 2,000,000 watches during the next year. This is by far the largest order ever given for timepieces.

TRADE DOLLAR CONSOLIDATED MINING COMPANY'S ELECTRIC PLANT, SNAKE RIVER, IDAHO.

(Continued from first page.)

weir with its crest at such a height as to give a working head of 17 feet on the wheels.

The rock dike itself was 4 feet above the water immediately below it; the height of the crest was fixed at 12 feet above the dike, and as the minimum flow of the river will give a depth of 2½ feet on the crest of the overflow dam when all the wheels are running, the extreme head on the wheels will be 18½ feet at low water and 17 feet at ordinary flood stage.

The dam in this, the left or main channel, is of the rock-filled crib type, 6 feet wide on top, with slopes of 2 to 1 on the upstream, and 1 to 1 on the downstream side; with an apron 17 feet long on the downstream side. The covering of the top is 12 inches thick, and of the downstream slope and apron 10 inches thick.

The cribwork is formed of 12-inch square timbers bolted with 1-inch square drift bolts into rectangles, 8 feet square between centers. The upstream slope is covered with 4-inch plank. The interior of the crib-work is filled with rock and gravel, and the entire upstream portion of the dam is covered with gravel on top of the planking. The cribwork and the apron sills are bolted to the bedrock. The overflow is 424 feet long, and ends in concrete abutments on both sides of this channel.

The dam in the right channel has its crest 12 feet above the crest of the overflow dam in the right channel. It is 450 feet long, 9 feet wide below the river bed, and 5 feet wide above, with buttresses on the downstream side at intervals of 22 feet extending 20 feet down the stream from the main wall. The entire construction in this channel is of concrete made of Portland cement and gravel, usually in the proportion of 1 of cement to 9 of gravel.

The power house is located over the deepest part of the right channel, with its floor 7¼ feet above the top of the masonry dam, which runs centrally beneath the power house.

The four 750 horse power wheels are 72-inch McCormick turbines, with vertical shafts driving one horizontal shaft through beveled pinions. The horizontal line shaft is belted to three generators of 300 kilowatts each, and to two exciters of 20 kilowatts each. The current from the generators is at 500 volts, and it is raised by the transformer to 22,000 volts.

The main transmission line is 27 miles long to the distributing station. The transmission line is three-phase, with three No. 4 copper wires with 50 poles to the mile. Glass insulators are used, and in the three months that the plant has been operated, not a single insulator on the line has been found in any way defective and not a particle of trouble has been experienced from the transmission system.

The power house is entirely of concrete and steel construction with concrete floor and slate roof. It is 49 x 134 feet on the floor plan, space being provided for future electrical extensions. Regulation is effected by a Lombard governor, run by electric motors, and is exceedingly satisfactory, although the changes in load are frequent and very great.

Regarding the operation of the plant, it may be said that this has been unusually satisfactory. It was formally opened on April 10, and has been running 24 hours per day continuously since that time, with the exception of a stop of a few minutes on one occasion, due to the loosening of the wooden cogs in the beveled drive wheels. The head at high water proved to be 17.10 feet, and is now 19 feet at low-water stage with only one wheel running.

The hydraulic part of the work was planned by Thomas T. Johnston, of Chicago, the consulting engineer, and the electrical installation was the design of Mr. L. B. Stilwell, of Niagara Falls, the consulting electrical engineer. A. J. Wiley, of Boise, Idaho, was chief engineer, and the work was done under his direction, no contractor being employed. The actual work of construction was begun July 1, 1901, the months of May and June previous having been used in road-building and preliminary work. The plant was put in operation on the 10th of April, 1901, although it was not entirely finished till the middle of May, 1901.

The aqueducts and reservoirs of Jerusalem show that there was abundant provision for running water in the ancient city. Within the last few weeks they have been brought again into the service of the city, which for many centuries has been dependent upon small accumulations of rainwater. The water is piped from Solomon's Pools, nine miles south of the city, drawing water from the sealed fountain mentioned in the Song of Solomon. It is a deep subterranean spring, which flows through an arched channel to a distributing chamber. This increase in the city's water supply will enable twelve ancient fountains in the city to be used.

Automobile News.

Mezieres, France, has probably the distinction of having the first automobile savings bank. It consists of an electric motor carriage containing four seats, one for the driver, two for the clerks and one for a cashier. The vehicle carries a small safe and folding shelves make a desk for persons standing outside the vehicle who are depositing. It travels about the country, making short stops in the villages on stated days, and receives such sums as the inhabitants of the neighborhood desire to deposit.

The French Minister of Agriculture has issued a circular relating to a competitive test of apparatus using alcohol, and especially automobiles and motors, which will be held in November. The circular states that the Minister, M. Jean Dupuy, desires to find new outlets for the use of alcohol in the interest of the rural production of the country, and has thus decided to open a concourse designed to encourage the constructors of motors and of apparatus using alcohol for the production of light and heat. The concourse includes a public exposition which will be held at Paris in the Grand Palais from the 16th to the 24th of November. The motors and apparatus exposed will previously have been tested at the Agricultural Station. This exposition will not only serve to bring out the different methods of utilizing alcohol, but will also make known the results of the experiments, and give the industry a series of scientific data which will be valuable in future work. Gold, silver, and bronze medals will be awarded. The concourse is open only to constructors residing in France. The first class includes all the applications of motive power. A. Stationary motors. B. Motors for navigation. C. Pumping motors, etc. D. Automobiles, divided into five sections: 1. Moto-cycles and light machines. 2. Voiturettes, etc. 3. Automobiles proper. 4. Industrial vehicles, hauling and delivery wagons, tractors, etc. 5. Carbureters isolated. The second class comprises the lighting apparatus of all kinds, using either incandescence or flame, and the third class the heating appliances. The automobiles will have their motors tested while stationary, and will also be tried on the road. The object of the tests is to make known the actual state of the use of alcohol for automobiles, and the competitors are advised to pay especial attention to good methods of utilizing the alcohol, without trying to reach undue speeds or to construct vehicles of a lightness incompatible with solidity or easy keeping in order.

A correspondent of The Auto-Vélo says that the question of automobile transports is now the order of the day in Madagascar, since the completion of the two main routes which unite Tananarive, the capital, with Majunga and Tamatave, on either coast. The western route does not seem as yet to be sufficiently well provided with bridges, etc., to allow it to be frequently used by automobiles, although these have been already tried with some success. The new type of 2-place quadricycle experimented with by M. Bigot, of the Panhard firm, did remarkably well, covering 150 miles in less than 14 hours. But it is especially the eastern route, now in very good condition, which attracts the attention of the experimenters. The Governor-General, before his departure on a tour of inspection across the island, had experiments made with two automobile hauling wagons which he had ordered from the Panhard house at Paris. This type gave very good results; it has an 8 horse power four-cylinder motor of the vertical type. However, a series of frequently renewed trials showed that this vehicle, which is recognized as excellent in France, cannot give the same performance upon the roads of the colony owing to the peculiar local conditions. Two points must be modified, namely, the motor-cooling devices and the brake system. These defects are not due to mechanical construction, but to the geographical configuration of the island and the climate. The country has a very irregular profile, and upon the steep grades, which are everywhere met with, the vehicle can scarcely make an average of over 7 miles an hour. This speed is insufficient to allow the current of air to cool the motor at the high temperature which prevails in the region, and hence the motor soon becomes overheated and stops. As an accident of this kind generally occurs on a steep incline the brakes are generally powerless to keep the vehicle from going down the slope. Again, the consumption of gasoline is considerable owing to the extra work of climbing grades, and this may reach as high as 0.1 gallon per horse power hour. The Panhard & Levassor wagons covered each about 2,000 miles in all, and the experiments have proved their resistance and good mechanical construction. This model with slight modifications will be quite useful. The experiments with transportation of passengers and mail matter between Mahatsara and Tananarive with 12 horse power brakes have been conclusive, the more so as they ran day and night and even in the rainy season over quite marshy routes. From the experiments which have been made it is concluded that a special type of automobile must be constructed for use in the colony, considerably different from that in ordinary use in France, and that the engineers should look especially for a special system of cooling the motor. The topography of the island does not permit speeds sufficiently great for the motor to cool itself, and the cold water reservoir becomes in fact one of hot water, raised still further by the ardent rays of the sun.

Engineering Notes.

The use of steel freight cars continues to grow in South Africa, says The Engineer. We learn that the Pressed Steel Car Company has made another shipment of steel cars. The destination of these cars is Durban, and they will be used on the Zululand Railway. The shipment consists of ten flat cars of 50,000 pounds capacity. The cars are 32 feet long, 6 feet wide, and 3 feet 3¼ inches high. This is the third shipment of cars to South Africa made by this company within the last six months.

Mr. Enoch Gittings, Jr., of the Wisemore Iron and Steel Works, Walsall, England, has discovered a new process of smelting iron. By his invention the puddling is dispensed with, so that a great economy in labor and time in manufacturing is effected. The iron made by this process is silky, pure and white when fractured. It will stand the greatest combined tests in tensile strain, elongation, and reduction of area of any steel in the world, and is superior to basic, Bessemer, or Siemens-Martin soft steel. The fiber is clear and close. It is exceptionally uniform, and it welds well, owing to this uniform texture. By this process the iron can be made much cheaper, since it is so simple. The iron is already being sold in limited quantities for test purposes, until the patent rights are fully secured, at the price of $100 per ton.

Licenses for stationary engineers, for those in charge of boilers in factories, are not to be required in England, a committee appointed to consider the subject having reported adversely. It says, in substance, that great care is taken by owners of plants to obtain desirable men, and the former are held responsible for any damage or loss of life that may occur through explosions; further, that if licenses were required it would be difficult, in some parts of the country, to get engineers at all. The proportion of accidents, arising from absolute ignorance, the committee say, is very small, and for these reasons it is asserted that they report against the measure. We may say, in regard to the clause that owners are responsible in case of explosions, according to the trials published in such disasters British juries are very lenient indeed, the fines seldom exceeding $50, very rarely amounting to $100.

According to the report of the British Consul of Nagasaki for 1900 the Japanese are making rapid progress in their shipbuilding industry. No expense is being spared to render the Mitsu Bitsu Shipbuilding and Engineering Works thoroughly up to date in every respect. It is being equipped with tools and appliances of the latest and most labor-saving description. In the machine shop alone eight steam hammers, ranging from seven tons to half a hundred weight, have been installed within the year. To encourage the young hands of the machine shops to evince an interest in their work a technical training school for the accommodation of 250 boys has been erected. A reef facing the yard has been reclaimed, and by the removal of vast quantities of rock from the hill behind, space for the building of two vessels of 600 feet in length and two of 300 feet in length simultaneously has been provided. During last year four ocean-going steamships ranging from 2,000 tons were constructed, and the list of vessels laid down at the end of the year included two passenger ships, each of 6,300 tons, for the American line of the Japan Mail Company.

The Royal Commission formed to investigate the port of London dock accommodation will pronounce its verdict upon this momentous question within the next two or three months. There are two points upon which the commission has to offer recommendations: 1, The present administration of the port of London and the water approaches thereto, the adequacy of the accommodation provided for vessels and the unloading thereof, the system of charge for such accommodation and the warehousing of dutiable goods, and to report whether any change or improvement in regard to any of the above matters is necessary for the promotion of the trade of the port and the public interest; 2, the deepening of river channels. Owing to the tendency to increase the draft of ocean-going steamers, the Thames Conservancy is prepared to provide a navigable channel of 30 feet below low water of spring tides up to Gravesend, if Parliament will sanction the scheme and will provide the means of raising the money to carry out the work. The estimated cost of the undertaking is $10,000,000. It is also anticipated that the commission will recommend the purchase of the London docks by the government at an expenditure of $125,000,000.

ELECTRICITY IN GOLD MINING.

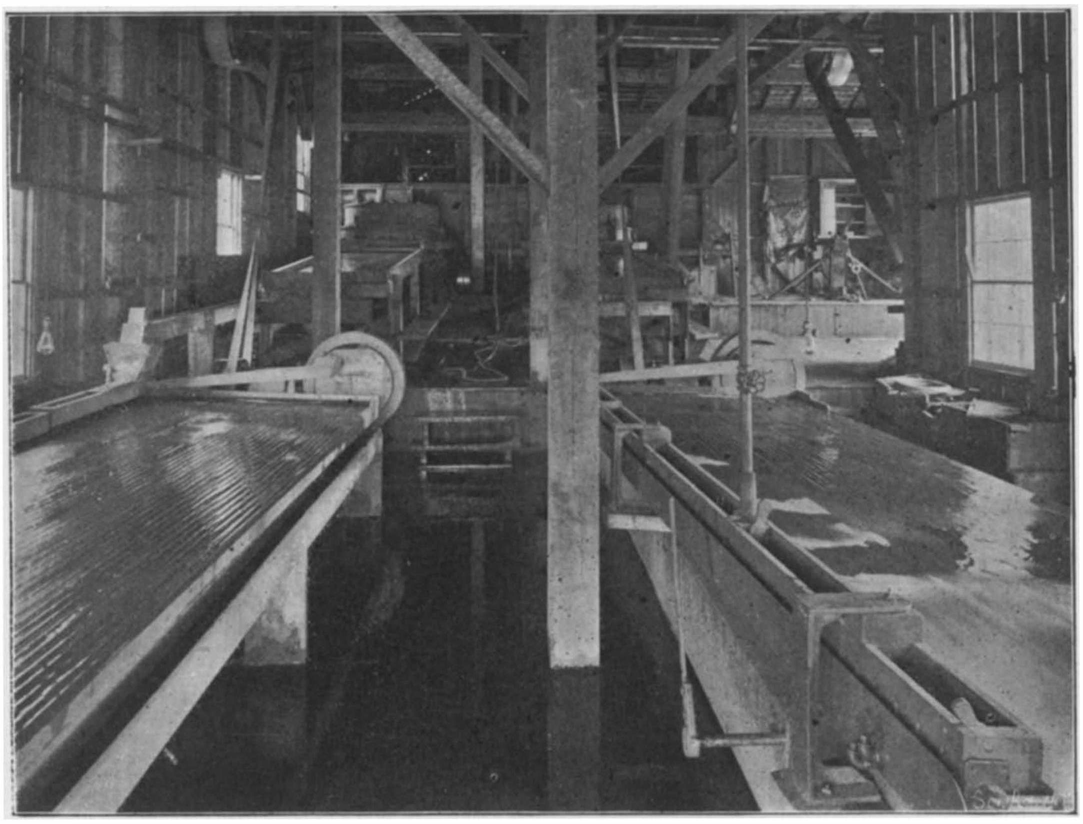
BY PROF. WILBER COLVIN, LL.D.

The Crown Mountain Gold Mining Company, of Dahlonega, Ga., has just put into operation a gold mining plant that differs much in many features from anything ever before undertaken in the South. Electricity is the motive power throughout, and is even used to provide the water for washing the ore from the mountain side, and for sluicing it down to the mills; and this electricity is conveyed by wire a distance of over twelve miles from the electric power plant.

The entire plant consists of the power plant for generating the electricity, the pump station for elevating water from the Chestatee River to a reservoir near the top of Crown Mountain, a large stamp mill and a mill fitted with Huntington mills, concentrators, giant hydraulics, flume lines, tram-cars and tracks, electric lines, motors, and other appurtenances.

The ore deposits of both saprolite and sulphuret gold ore are found on the sides of Crown Mountain and Findley Ridge, a mountain and ridge from 500 to 800 feet high, and within the corporate limits of Dahlonega, Ga. The gold deposits are both abundant and rich.

The mill is near the foot of the ridge on the side next to the town, and near a lake formed by throwing a dam across the narrow valley of Tanyard Branch. The mill plant consists of the Huntington mills for soft ore, and a 50-stamp mill for hard ore. The stamps are of 950 pounds weight, and have chrome steel shoes, dies and cams. The mill is so located on the hillside that the ore enters at the top, goes through a Dodge crusher, and moves by gravity to the stamps, and thence to the tables and concentrators. There are ten Wilfley concentrators. The mill is most substantially and perfectly constructed throughout. Water for the stamps and tables is furnished from the lake just mentioned.



CONCENTRATORS, HUNTINGTON MILLS.

Hydraulic mining is a distinctive feature of the work of this company; and it is the most economical kind when conditions permit. This company has made the conditions to fit the circumstances. It has supplied the heretofore lack of water by elevating water from the Chestatee River through a 12-inch iron pipe, 4,400 feet long, to a reservoir on the side of Crown Mountain, 560 feet above the river. This reservoir has a capacity of 750,000 gallons, and water is elevated and poured into it at the rate of 1,500 gallons per minute.

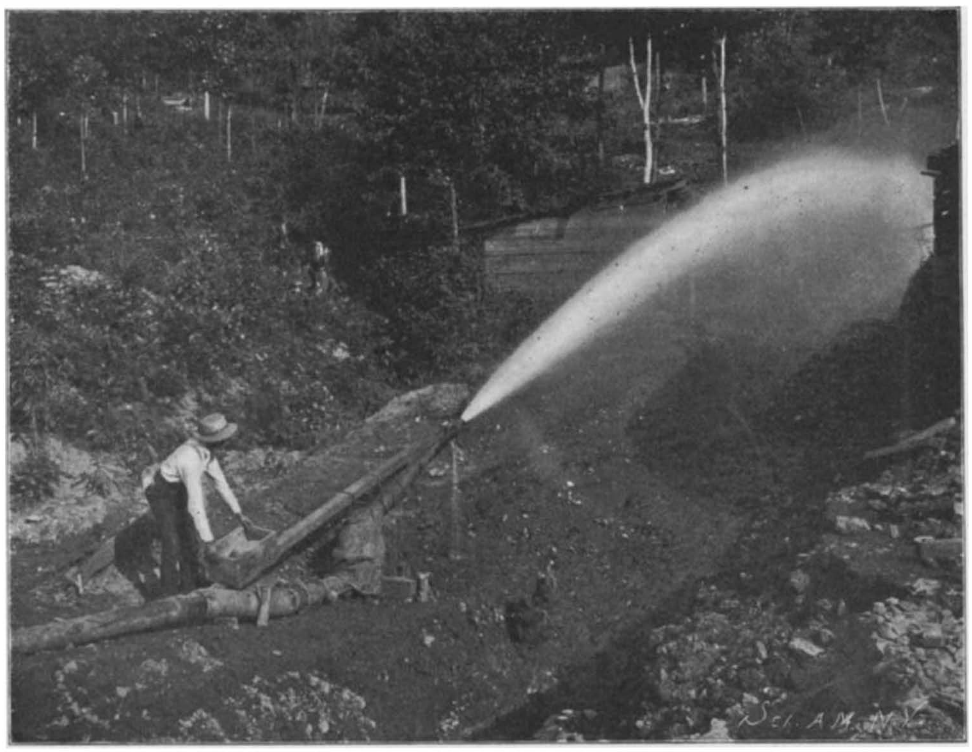
The pump station is located on the bank of the Chestatee River. The pump is a large Deane triplex, and is operated by a Westinghouse 300-horse power two-phase induction motor, constant speed, connected by steel cut gearing to the pump, the reduction being 20 to 1.

From the reservoir the water is conducted through 6-inch pipes to four giant hydraulics, with from 1½ to 2½-inch nozzles. The gold ore on Crown Mountain is found diffused through a large saprolite belt several hundred feet wide, and at least 300 feet deep, before a formation too hard to sluice is reached. This enormous body of ore has heretofore been untouched for the reason that water could not be had on the mountain at any reasonable cost, until this feat of modern electrical engineering made it possible to profitably work it.

These giants are used, first to sluice material from the saprolite belt; and, second, to cut out ore from the veins where it is not too hard to be worked by hydraulic cutting.

There are millions of tons of these saprolites, carrying from 50 cents to $2 a ton, exclusive of the quartz stringers scattered through it, which run from $5 to $50 a ton, on the top and sides of the mountain and ridge, which it will take many years to sluice down. And this work will then uncover the veins for deeper mining, which the company is preparing to do. The average cost of sluicing the matter to the mill is about 10 cents per ton. The flume lines connecting the saprolite belt with the mills aggregate over 4,000 feet in length, and are supplied with racks or riffles throughout their entire length to catch the free gold, which, being liberated by the sluicing, settles in the riffles.

About half way from the giants to the mills are grizzlies. The grizzlies separate the soft and hard ore in the following manner: The giant hydraulic, playing a stream of water upon the ore veins, cuts out and washes into the flume, earth and rocks of various sizes. The water running down the incline flume line washes and carries all this matter down by gravity to the grizzlies. First here there are iron plates



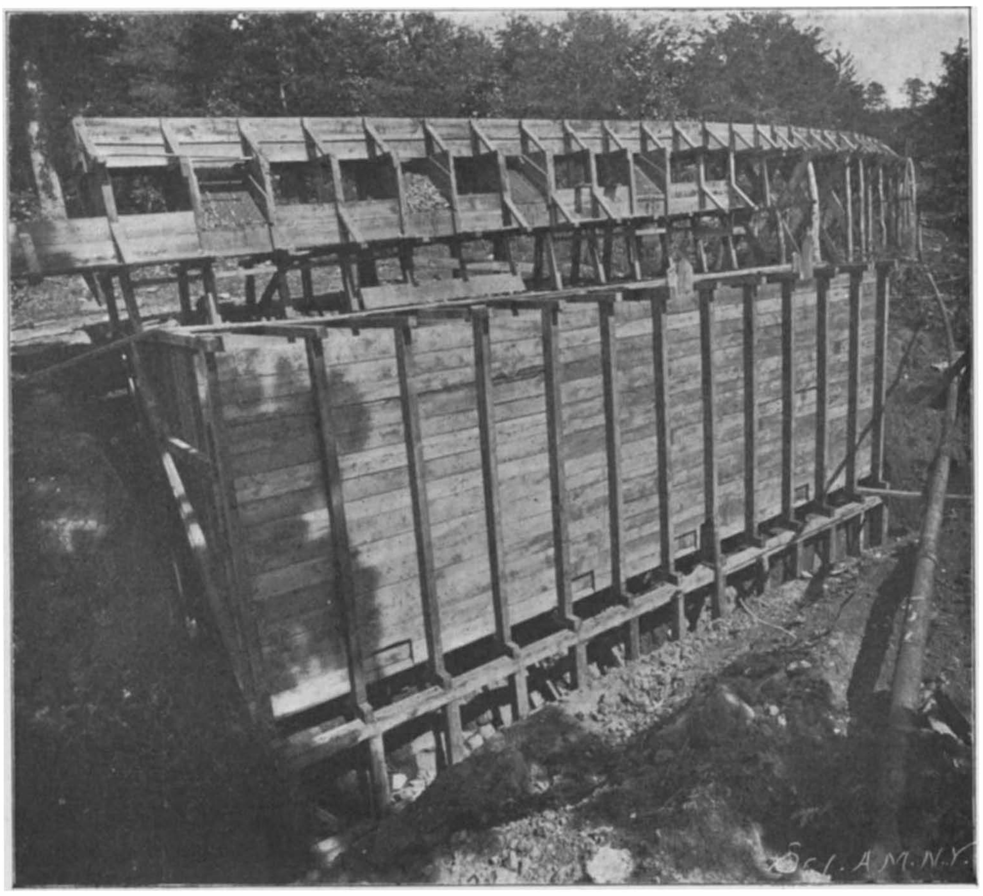
AN HYDRAULIC MONITOR AT WORK.

about 4 feet long in the bottom of the flume. These plates are full of round holes ⅝ inch in diameter; through these some of the water and finer matter fall about 4 feet to another flume beneath, that leads direct to the mills. A few feet beyond these perforated iron plates (in fact, some of the grizzlies omit these plates) there are iron gratings of ½-inch iron bars placed ½ inch apart. These gratings are inclined at an angle of 45 deg. across the direction of the flume line. Each grating is about 3 by 4 feet. The pieces of rock, ore, and matter too large to go through the holes in the iron plates are washed by the water and rolled by gravity over these gratings; the water and small pieces drop through, while the larger rocks roll down and off sideways into the ore bin and are ready to be carried by the tram-cars to the stamp-mill, while the finer matter that falls through is washed along the lower flume line, into which it has fallen, down to the Huntington mills.

The ore is dumped by gravity from the bottom of these bins into the tram-cars. One mule and a driver carry on these tram-cars 240 tons of ore from the bins to the stamp-mill per day. The mule-load or train is four 20-ton cars, and it makes thirty round trips per day.

The finer ore is carried from the grizzlies in flumes to the Huntington mills.

Between each of the Huntington mills and the concentrators are ordinary mercury amalgamation plates over which the crushed ore pulp from the mills is washed. These plates catch the free gold. Thence the crushed ore pulp is conducted upon and over the



FLUME LINE, GRIZZLIES, ORE BINS, PIPE LINES.

Wilfley concentrators with tables about 3½ feet by 8 feet, slightly inclined; upon these tables, running lengthwise of them, are wooden strips about ½ inch wide and ⅛ inch thick. These tables have a vibratory motion; water trickles over them, and as the crushed ore pulp is washed over and across them, the heavier gold-bearing particles are caught against the strips and are carried to the catch basin, while the lighter non-gold-bearing particles are washed over and pass off as waste.

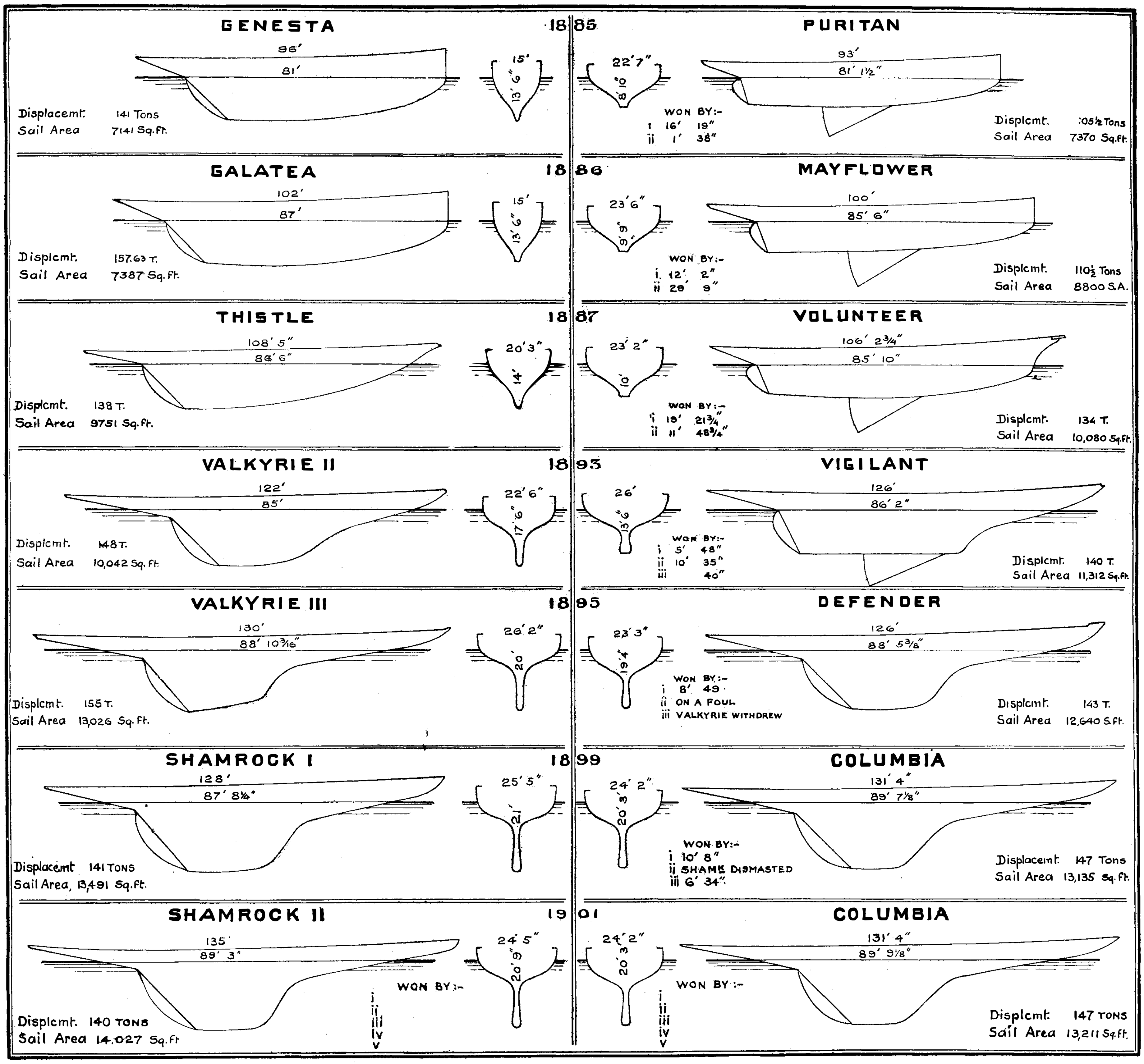
At the mill a 50 horse power motor runs the two Huntington mills; a 20 horse power motor the Dodge crusher; a 100 horse power motor the stamps; a 15 horse power motor the Wilfley concentrators, and a 10 horse power motor a rotary pump which supplies water from Tanyard Branch Lake to the stamp batteries. In addition to these there is a 125 horse power motor which operates an air compressor, that supplies air for drilling, pumping, and hoisting from two shafts that are being sunk on regular ore veins. All of these motors are Westinghouse, two-phase, constant-speed, induction type.

The power plant is located near Seabolt Shoals, on the Chestatee River, about twelve miles from the mills. The waters of three mountain streams are united by two canals, each about two miles long, but no dams are required. A fall of 97 feet is secured. From the bulkhead of the canal a wooden tube 5 feet in diameter conveys the water to the wheel, a Stillwell-Bierce, Victor type, capacity 800 horse power. The generator is a Westinghouse, two-phase, 500-kilowatt, 440 volts, direct connection on the water wheel shaft, excited by a 7½-kilowatt, 110-volt exciter. The velocity of the wheel and dynamo is 514 revolutions per minute, delivering 568 amperes per phase. The current is generated at 440 volts, transformed to 12,000, three-phase, and transmitted over three No. 6 wires twelve miles to the mills, and thirteen miles to the pumping station; and at both the mills and the pumping station it is again transformed to two-phase, 400 volts, at which pressure it is used on all the motors. There are lightning arresters at the power plant, at the mills, and at the pumping station.

Portions of the plant have been running for several weeks, but since August 29 the entire plant has been in operation, and in every detail the equipment is working perfectly.

FIFTY YEARS OF "AMERICA" CUP CONTESTS.

Once more the waters of Sandy Hook are witnessing a friendly contest between the representative yachts of England and America for the possession of the "America" Cup—unquestionably the most famous trophy in the history of yachting. The Cup itself—for the possession of which so many millions have been spent, and over which, it is no exaggeration to say, the whole world is periodically aroused to enthusiasm—is a rather insignificant piece of plate, whose claims to distinction are certainly not based upon its artistic beauty. It was won in the year 1851, at the time of the great World's Fair in London, by the schooner-yacht "America," which was designed by George Steers for John C. Stevens and others of the New York Yacht Club, for the purpose of crossing the water and engaging in yachting contests with the British boats of that day. She was 88 feet on waterline; 94 feet over all; 22½ feet beam, and her draft was 11½ feet. She differed very widely, both in model and sail-plan, from the English yachts of that day, which were built on the "cod's head and mackerel tail" theories, according to which the greatest beam of a yacht was placed at a point considerably forward of amidships. The British designers of those days believed that a bluff entrance and a long, finely-drawn-out run and quarters were conducive to speed; and it is a remarkable fact that the challenger "Shamrock II.," after fifty years of development in yachting, should show, as a result of the tank experiments on which she is modeled, some of the features of the early model, her point of greatest beam being rather far forward, her forebody rather full, and her afterbody relatively long and fine. The "America" had a long, sharp bow, and those broad, flat quarters which for many a decade were destined to be a distinguishing feature of American yachts. The English yachts of fifty years ago were poorly canvased and the beautifully-setting sails of the "America"—which, in the case of the mainsail and jib, were laced to a boom—were a source of great admiration to the Cowes yachtsmen. The cup for which the "America" sailed was one offered by the Royal Yacht Squadron, and the race was sailed without time-allowance. The course of 60 miles was laid around the Isle of Wight, and the "America" defeated the fleet of competitors—which varied from the big three-masted schooner "Brilliant," of 392 tons, to the little 47-ton cutter, the "Aurora"—with the greatest ease, coming in 24 minutes ahead of the "Aurora," which was the second vessel in a race which lasted 10 hours and 34 minutes. Had the race been sailed according to the modern method, which allows time according to the



FROM CUTTER AND CENTERBOARD TO CUTTER-SLOOP.

difference in size of the competing yachts, the "Aurora" would have been beaten by one or two minutes only.

The credit for issuing the first challenge for the "America" Cup, as it has come to be known, belongs to Mr. James Asbury, and the first race took place on August 8, 1870. Mr. Asbury sent over the "Cambria," a deep-keeled schooner which was launched from Ratsey's yards at Cowes. The "Cambria" was 108 feet on the waterline, 21 feet in beam, and had a draught of 12 feet. In a race across the Atlantic against James Gordon Bennett's "Dauntless," the "Cambria" won by 1 hour and 17 minutes. The race for the "America" Cup was sailed against a fleet of American schooners, which included six keel schooners and sixteen centerboard schooners. It was won by the "Magic," which beat the "Cambria" by 27 minutes and 3 seconds, actual time. On corrected time the "Cambria" was beaten by 39 minutes and 12 seconds, the old "America," which was one of the defending fleet, beating her by 13 minutes and 47 seconds.

By no means discouraged, Mr. Asbury built a second schooner, named "Livonia," whose dimensions were as follows: Waterline length, 115 feet 2 inches; beam, 23 feet 7 inches; draft, 12 feet 6 inches. Mr. Asbury asked for and secured from the New York Yacht Club the concession that the "Livonia" should sail against one selected vessel and not against a whole fleet. The first race took place October 16, 1871. There was a light wind blowing, and accordingly the "Columbia," a fine light-weather boat, was selected. She drew steadily away from the "Livonia," and won by 25 minutes and 28 seconds. The second race was won by the "Columbia," by 10 minutes and 33 seconds. For the third race there was quite a fresh breeze blowing, and accordingly the deep-keeled schooner "Dauntless," a heavy-weather boat, was chosen to meet the challenger. Just before starting she was disabled, and the light-weather "Columbia" was sent out in her place. The strong wind proved too much for her, and after a series of mishaps she came in 15 minutes and 10 seconds behind the "Livonia." In the fourth race, the challenger was beaten by the deep-keeled schooner "Sappho," of 310 tons and 120 feet on waterline. She beat the "Livonia" by 30 minutes and 21 seconds, and again, in the last race, the "Livonia" was beaten by 25 minutes and 27 seconds.

The next two challengers came from the Royal Canadian Yacht Club. Before these races were arranged, Canada secured a second important concession, to the effect that a single Cup defender should be chosen several days before the day of the first race. The challenger was a centerboard schooner of an overall length of 107 feet, called the "Countess Dufferin," and she was met by the centerboard schooner "Madeline," of 106 feet length over all. The Canadian boat did somewhat better than the "Cambria" and "Livonia," as was to be expected of a shallow, beamy centerboard craft. She was beaten by 10 minutes 59 seconds in the first race, and in the second race by 27 minutes and 14 seconds. The first race of the series took place August 11, 1876.

The fourth challenge came from the Canadians, who this time came to the line with a 64-foot centerboard sloop named "Atalanta." The New York Yacht Club instituted a series of trial races and selected from among the competitors the "Mischief," designed by A. Carey Smith, a centerboard sloop measuring 61 feet on the waterline, 20 feet beam, and 5 feet draft. The Canadian yacht was badly beaten in the first race by 28 minutes and 20¼ seconds, and in the second race by 38 minutes and 54 seconds.

The sloop races of 1881 introduced a new phase in the Cup contests, as from that time on the races were all between single-masted vessels of either the sloop or cutter type. The fifth race took place in the year 1885, when Sir Richard Sutton brought over his cutter "Genesta," one of the fastest racing yachts in British waters. To meet the "Genesta" two sloops —the "Priscilla" and "Puritan"—were constructed, and after a series of races the "Puritan" was selected to defend the Cup. At this time the "Genesta" and "Puritan" were distinctly typical of the widely divergent ideas of yachtsmen as to the best type of yacht for racing purposes. The cutter, under the influence of the Thames measurement rule—which put a limit upon beam, but none upon draft—had grown to be very narrow and deep in proportion to her length. On a waterline of 81 feet the beam of the "Genesta" was 15 feet and the draft 13 feet 6 inches. The ballast was carried outside in the form of a mass of lead bolted to the keel, and on a displacement of 141 tons she carried a sail area of 7,141 square feet. In the "Puritan" we begin to see that compromise between the American and English ideas, which in later years was to become so marked; her rig being the cutter rig in its entirety, and the bulk of her ballast being carried on the outside, in the shape of 22 tons of lead bolted to the keel. Her cross-section was that of the typical sloop; for, on a beam of 22 feet 7 inches, or 50 per cent more than the "Genesta," she had a draft of 8 feet 10 inches, or more than 50 per cent less than that of "Genesta." With 36 tons less displacement than the cutter, she carried 229 square feet more sail. As was to be expected, in light weather the small-displacement and large-sail-area sloop showed decided superiority to the large-displacement, moderate-sail-area cutter. The "Puritan" won the first race in a light breeze by 16 minutes and 19 seconds. In the second race, of 20 miles to leeward and return, sailed in a strong breeze, the easier form of the cutter enabled her to gain a few minutes in running down to the outer mark; but in the thresh homeward against the wind she was passed by the sloop, which won the race by 1 minute and 38 seconds. Sir Richard Sutton secured immediate popularity in America by his sportsmanlike refusal to take one of the races which was awarded to him because of his being fouled and disabled by the "Puritan" when starting for the line.

The sixth challenger, an 87-foot steel cutter called the "Galatea," was met by the centerboard sloop "Mayflower," built by Burgess, the designer of the "Puritan," and was easily defeated in the first race by 12 minutes and 2 seconds, and in the second race by 29 minutes and 9 seconds.

The seventh challenge was destined to arouse more apprehension in the minds of American yachtsmen as to their ability to retain the Cup than any race that had preceded it. The removal of the restrictions of the Thames measurement rule and the substitution of a rule based on water length and sail area gave Mr. Watson, the designer, a freer hand than his predecessors had, and he sent over the cutter "Thistle," which had a waterline length of 86 feet 6 inches, a draft of 14 feet, and beam 5 feet greater than that of "Galatea" and "Genesta." The effect of the increased beam was seen in the reduction of displacement from 157 tons to 138 tons and an increase in the sail area, as compared with the "Galatea," from 7,387 square feet to 9,751 square feet. To meet the "Thistle" Burgess designed the "Volunteer," a steel sloop of 85 feet 10 inches waterline, 10 feet draft, 23 feet 2 inches beam, and a displacement of 134 tons. The sail area was about 300 feet greater than that of "Thistle," and she was provided with the usual centerboard. In the first race, sailed in light weather, she showed the usual superiority to the challenger, winning by 19 minutes and 21¾ seconds; in the second race, sailed in a strong breeze over the outside course, the "Thistle" was beaten in a race of 15 miles to windward and return, by 11 minutes 48¾ seconds, 14 minutes of this gain being made in windward work, and a few minutes being lost on the run home. The failure of the "Thistle" was a bitter disappointment to British yachtsmen. It is evident that her poor performance was due to her being badly balanced for windward work. She could not be sailed as close to the wind as "Volunteer," and the fact that there was nothing wrong with her model was proved by the fact that she gained considerably on the run home of 15 miles.

The eighth challenger was a composite sloop designed by George L. Watson and owned by Lord Dunraven. To meet this yacht no less than four prospective Cup defenders were built. Two of these— the "Vigilant" and "Colonia"—were built for New York yachtsmen by Herreshoff, and the "Jubilee" and "Pilgrim" were built by various members of the Boston yacht clubs. The "Vigilant," which was subsequently chosen as the Cup defender, was built with steel frames and Tobin bronze plating, Tobin bronze being chosen for its great strength, its anti-fouling qualities, and its ability to take a fine polish. The "Colonia" was a keel schooner, the "Jubilee" a centerboard bulb-fin craft, while the "Pilgrim" had a shallow-hulled canoe-like hull with a small bulb of lead carried on a fin of exaggerated depth. The first race between "Valkyrie" and "Vigilant" was sailed to windward and return in a somewhat fluky wind and "Vigilant" won by 5 minutes and 48 seconds. In the second race, over a triangular course, sailed in a fresh breeze, "Vigilant" drew steadily away from "Valkyrie," winning by 10 minutes and 35 seconds. The last race, sailed to windward and return, in a 20 to 25-knot breeze, furnished one of the greatest surprises in the history of these cup contests; for the English cutter showed undoubted superiority to the centerboard in the beat to windward, rounding the outer mark with a lead of about 2 minutes. Running home, she had the misfortune, in setting her spinnaker, to catch it on her anchor bits and make a tear which extended right across the sail as soon as it was spread. She immediately set a light weather spinnaker, but this was blown to shreds and fell across the bows, checking the way of the yacht for several minutes. While this wreck was being cleared away "Valkyrie" was passed by "Vigilant," and, although she made a forlorn hope by setting a staysail, she was beaten on corrected time by 40 seconds.

Lord Dunraven came again in 1895, this time with a boat of extreme dimensions, both as to sail plan and hull. "Valkyrie III." had enormous overhangs, the deep draft of 20 feet, the exceptional beam of 26 feet 2 inches, a shallow hull, very hard bilges, and the unprecedented sail spread of 13,026 square feet. She was a fast light-weather boat, but her form proved too hard for driving at high speed, and she was easily beaten in a strong breeze by the old "Britannia" just before she left for America. The builders of "Vigilant" were commissioned to build a defender, and Herreshoff, profiting by the lessons of the last two seasons' racing, when the centerboard "Vigilant" was beaten to windward by the keel-boat "Valkyrie," and in England lost 11 out of 18 races to the keel-boat "Britannia," boldly abandoned the centerboard; added 6 feet to the draft as compared with "Vigilant," narrowed the beam down from 26 feet to 23 feet 3 inches, and to these changes of form added a system of construction which was probably the lightest ever attempted, or ever to be again attempted, on a yacht. The underbody was built of aluminium bronze, the top sides of aluminium plate, and aluminium was used in framing, deck strapping and miscellaneous fittings, wherever it could possibly be introduced. With 15 tons less displacement than the "Valkyrie," the "Defender" carried about 360 square feet less sail. In the first race, to windward and return, she won by 8 minutes and 49 seconds. In the second race "Valkyrie III." won by 47 seconds, but the race was given to "Defender" on a foul, "Valkyrie" having accidentally touched the topmast shroud with the end of her main boom, as she was straightening for the line. In the third race, "Valkyrie," after crossing the line, withdrew.

After an interval of three years, Sir Thomas Lipton challenged for the cup and commissioned William Fife, Jr., to build a 90-foot cutter. "Shamrock," as she was called, was built of steel and bronze, with top sides of aluminium, and with her was introduced the novelty of a steel deck. She had somewhat less beam than "Valkyrie III.," more draft, and about 460 square feet more sail area. To meet her Herreshoff designed an improved "Defender." The "Columbia" has about a foot more beam, a foot more draft and 500 square feet more sail area than her predecessor. In the trial races she showed undisputed superiority to "Defender," and after a long series of inconclusive races, she defeated "Shamrock" by 9 minutes and 47 seconds in a beat of 15 miles to windward, and by 24 seconds on the 15-mile run home. Allowing for a difference at the start, and her allowance of 6 seconds to "Shamrock," she beat that boat by 10 minutes and 8 seconds corrected time. In the second race, over a triangular course, "Shamrock" was dismasted; and in the third race, 15 miles to windward and return, "Columbia" won by 6 minutes and 34 seconds, five minutes of this time having been gained by "Columbia" on a beat back to the starting line. It will be seen that "Columbia's" victories over "Shamrock" were due to her greatly superior windward work, a quality which was to stand her in good stead in the trial races of two years later.

After waiting a year Sir Thomas Lipton challenged again. This time it was intrusted to George B. Watson to build a cup-challenger. The lines of "Shamrock II." were not laid down until Mr. Watson had made several months' exhaustive tests with models of previous English yachts in the towing tank at Denny's yard, Scotland, to determine which was the fastest and most easily-driven form. "Shamrock II." is built of Immadium bronze; she is 135 feet over all, being the longest "single-sticker" ever built. She measures 89 feet 3 inches on waterline; has a beam of 24 feet 5 inches and draft of 20 feet 9 inches. To meet the "Shamrock II." Mr. Herreshoff was instructed to build a new 90-foot yacht. "Constitution," as she is called, is modeled closely on the lines of "Columbia," the chief difference being that she was given about a foot more beam. She has also 1,300 square feet more sail area. In the series of races sailed between the two yachts, although "Constitution" showed decided superiority in light airs, she was so frequently beaten by "Columbia," which maintained all of her old-time steadiness and uniformly good performance, that the challenging committee decided that "Columbia" was the better boat to send against so formidable a competitor as "Shamrock II." "Shamrock II.," after several weeks' sailing against "Shamrock I," was tuned up to a point at which she was able to beat the earlier vessel by from 8 to 10 minutes over a 30-mile course.

It appears that Germany is to follow the example of France in prohibiting automobile races upon the public routes. A decree to this effect has lately appeared in the journals, signed by Baron von Hammerstein, Minister of the Interior. It is said that this decree has been provoked by a few accidents which have recently occurred, especially those of the Paris-Berlin race. The police of all localities of the Empire have been given orders not to permit any races of automobiles.

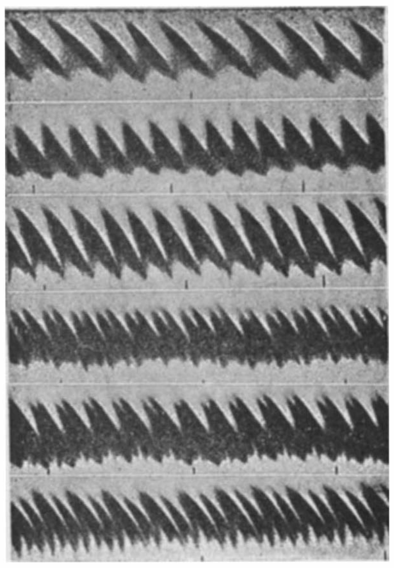
SYNTHETIC TALKING MACHINE.

Inventors who were working upon talking machines received a severe blow when the phonograph was invented, as it reproduced rather than imitated the human voice. Lately, however, there have been experiments made upon the production of a talking machine.

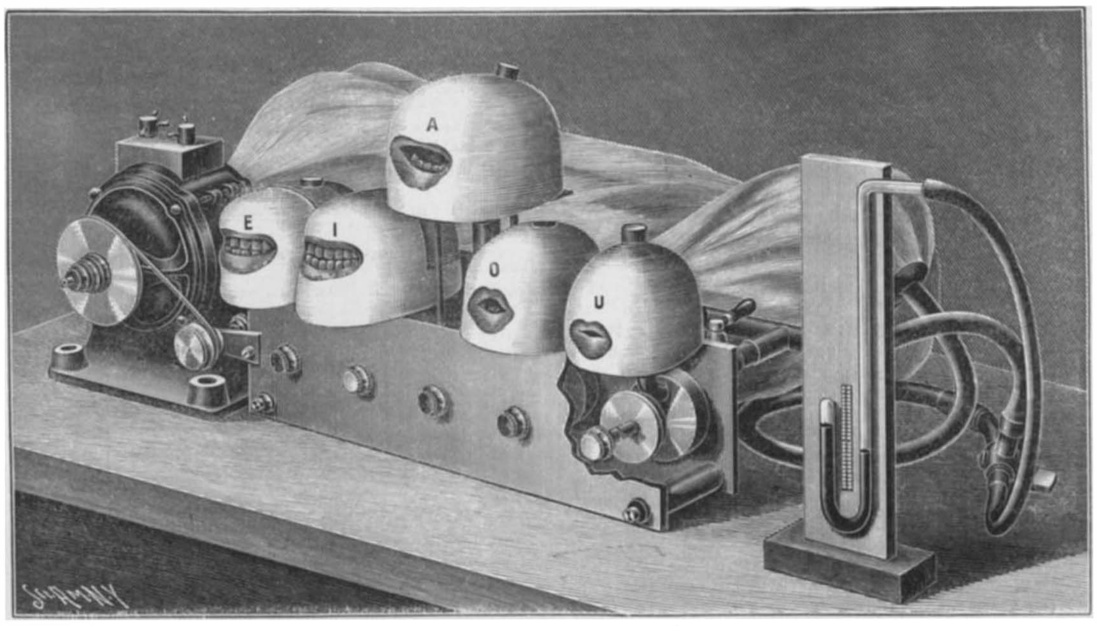
Dr. Marage has constructed an apparatus which is a step in the direction of producing a practical talking machine, although it is limited to the production of vowels. It reverses the whole series of experiments made for the analysis of sound and is constructed on strictly mathematical principles. It will be remembered that with the manometric flame of Koenig, a stretched membrane is placed at the end of a mouthpiece. On one of the faces of this membrane the air is caused to vibrate by means of sounds, and to the other some system of registration is applied. In general, this consists of a very long needle connected to the membrane and vibrating with it, tracing a curve on a moving sheet of paper or on a smoked disk. Dr. Marage reverses this method of procedure and produces the sounds synthetically. He does away with all parts of the apparatus not absolutely indispensable, so that it follows that the vibration takes place in direct contact with the membrane. Instead of using ordinary gas or a registering needle, he uses acetylene gas at a constant pressure. The gas is delivered on the reverse side of the membrane. When the membrane is vibrated the flame changes in intensity, when viewed in a revolving mirror or when received on a moving band of sensitized paper. By using the latter he obtained a graphic record showing the formation of different sounds. He found that certain vowels—*I, U, OU* (in French)—are formed by a series of vibrations of different intensity and separation, but regularly spaced. In other words, there exists for these sounds a series of continued and similar vibrations, as shown in the first, second and third lines of our engraving of the flames, demonstrating vowel formation. For *E* and *O* these vibrations are also regular, but each is formed of two oscillations, as shown in the fourth and fifth lines of our engraving. We thus have groups of double vibrations. Finally, in the case of *A* (see sixth line in flame diagram), these groups have three component vibrations. While these observations are not especially new, they confirm former results and render the graphic records clearer so that they become easier to follow.

Dr. Marage was not satisfied with the siren for the production of vowels. Not only the larynx but also the cheeks play an important part in the production of sound, adding the harmonies which give the voice its character. Other elements also contribute to this special characteristic of the voice, whereby that of each person present can be recognized. Dr. Marage constructed an apparatus to reproduce the interior of a person's mouth while pronouncing the different vowels, using the plastic substance employed by dentists. These false mouths, as it were, are made of plaster of Paris, and are fitted to sirens giving the appropriate combinations of sounds. He then sets his machine in operation, and the vowels are produced synthetically. Dr. Marage purposes to modify the steam sirens used on shipboard so they will imitate the vowel sounds. Thus different phonetic syllables may be obtained which may be used to form an international alphabet. Another important application of this synthetic process can be made in the construction of ear trumpets that will not fatigue the deaf, because they will not modify the grouping of oscillation adapted to the ear. Dr. Marage has also constructed the "acouometer," giving a typical sound of the vowel *A*, for example, which may be used as a standard to which certain other sounds may be referred.—We are indebted to La Nature for our engravings.

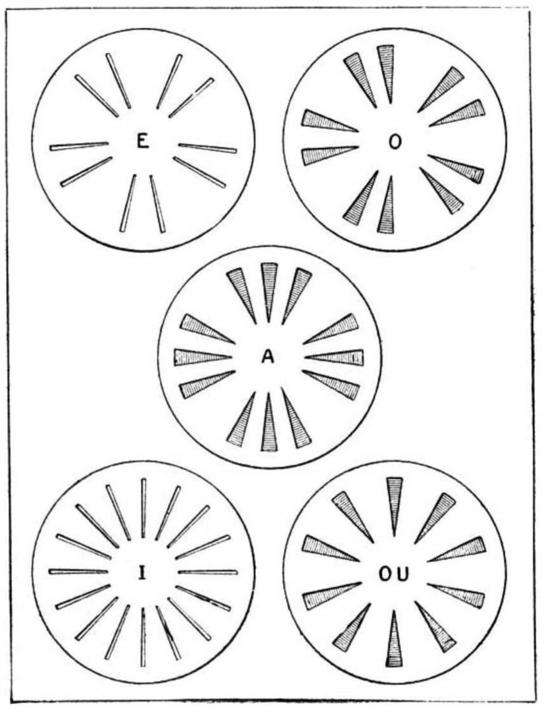
A new time-saving appliance for the embarkation and discharge of mails and baggage at Dover, England, and Calais, France, the terminal points of one of the cross-channel mailboat services, has been installed. It is an electrical gangway, and is constructed upon the system of an endless platform. It conveys packages of any weight ashore at the rate of one in fifteen seconds, when working at normal speed. Even the heaviest sacks of mail and baggage are brought ashore with remarkable celerity and facility. The saving in transshipment is more than half the ordinary time.



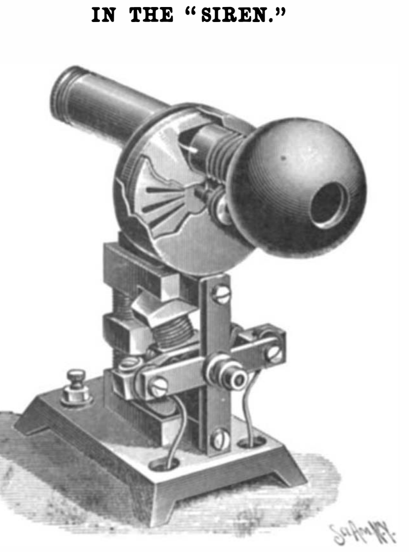
MANOMETRIC FLAMES OF VOWEL-FORMATION, I, U, OU, E, D, A (FRENCH).



SYNTHETIC APPARATUS FOR FORMING VOWEL SOUNDS.



MOVABLE PLATES FOR GIVING DIFFERENT VOWELS IN THE "SIREN."



"ACOUOMETER," GIVING STANDARD SOUND.

A New Self-Propelled Car.

The Northern Railroad Company is making a series of tests between Paris and Pontoise of a new type of self-propelled car which has lately been built to run upon the rails. These cars are intended to replace certain of the trains which have heretofore been running especially for the postal service, as, for instance, the Paris-Pontoise postal train. They will also be tried on some other lines. The new vehicle is complete in itself, with the motive apparatus, passenger and baggage compartments and brake-cabin. As it is arranged to run in either direction, the engineer's cab is placed in the middle of the vehicle and in an elevated position so as to give a good lookout on the track. The steam apparatus includes a Turgan 125 horse power boiler and a compound engine which has some modifications and special devices to adapt it to the present use. These vehicles will transport in all 80 persons, in three classes. The total length is about 85 feet, and the average speed 36 miles an hour.

Electrolysis of Sodium.

The Fischer process for obtaining sodium by the electrolytic method has been one of the most successful. The characteristic of the process is the use of a melted bath formed of a mixture of equal molecular weights of chloride of sodium and chloride of potassium. The addition of the latter chloride permits the bath to be kept at a lower temperature than when chloride of sodium is used alone, and this presents a decided advantage, as the loss of the sodium by volatilization is greatly diminished. As to the sodium which results from the electrolysis of this bath, it contains less than one per cent of potassium, provided the difference of potential between the electrodes is properly regulated. The inventor has made many trials of electric furnaces of different forms, and has been led to adopt the following type: A crucible, wide and not too deep, is divided into two compartments by a middle partition which does not reach the bottom. The walls of the compartment which contains the cathode are cooled by a system of water-circulation. The electrodes, which are placed horizontally, pass through the opposite walls of the crucible, each being thus in its own compartment and separated by the middle partition. The anode is formed of a solid carbon, and the cathode of a metallic tube whose axis is on a level with the surface of the bath. This tube is used at the same time to draw off the melted sodium produced by the electrolysis.

There recently died in England Mr. Oliver Morris, the well-known engineer and contractor, rendered most famous by his boring of the preliminary heading of the Severn tunnel, beneath the Riven Severn, seven miles in length. He encountered innumerable difficulties in the work, which he ingeniously surmounted, but his works were finally interrupted by the irruption of a great spring of fresh water which completely drowned them out. A curious fact in connection with this engineer was that he could neither read nor write, owing to lack of education.

The Current Supplement.

The current SUPPLEMENT, No. 1344, has a number of most interesting articles. The first page is devoted to the Buffalo Water Works. "Some Motions, Relative and Absolute," is by Oberlin Smith. "The Presidential Address of Prof. Swan" is continued. "Longevity of Insects" is by Carus Sterne. "The Intelligence of Our Wasps" is by A. S. Packard. "A Camping or Mess Wagon" describes a most curious vehicle. "Methods of Curing Tobacco" is by Milton Whitney. The usual Selected Formulæ, Trade Suggestions, and United States Consul and Trade Notes and Receipts are published.

Contents.

(Illustrated articles are marked with an asterisk.)

RECENTLY PATENTED INVENTIONS.

Agricultural Implements.

GRAIN-WEIGHER. — ANTON GOEHRING, Edgeley, N. Dak. The patent describes a weighing device adapted to receive grain from a threshing-machine, elevator, or storage bin. The device is operated entirely and automatically by the weight of the grain. A double bucket is provided in the construction, one section of the bucket being in position for filling, while the other section is discharging its contents. The grain-receiving bucket is supported on a scale-beam, and is held in position to receive the grain. When a proper amount of grain has been delivered, the bucket is released from the scale-beam. The gate at the outlet of the chute arranged to supply grain to the bucket is also operated from the scale-beam.

MOWER OR REAPER.—PATRICK H. LOVE, Fort Worth, Tex. The invention is an improvement in mowers which are provided with endless, flexible cutter-bars. The finger-bar has a fixed portion and an outer portion which is hinged to the other so as to be raised or folded in a vertical plane. An endless, traveling cutter-bar is arranged within the finger-bar and is provided with transverse joints which, when brought into alinement with the joint of the finger-bar, enable the cutter-bar to be folded with the latter.

Vehicle Accessories.

ELASTIC TIRE.—WILLIAM F. WILLIAMS, 17 and 18 Great Pulteney Street, Golden Square, London, England. Mr. Williams has combined with a hollow tire, an internal soldered elastic core of such different cross-section or shape compared with that of the space within which it is contained, that while affording a direct internal support to the tread of the tire, vacant spaces will be left at the side of the core, so that the core will have perfect freedom for expansion laterally when under compression by the load without liability of extension in the longitudinal direction.

Special Apparatus and Tools.

HERNIAL TRUSS.—GEORGE V. HOUSE, Mt. Vernon, N. Y. A novel front piece is provided which serves to keep the truss more steadily in position and provide more stable pressure to the pad than would be the case if the pad were attached directly to the web-band or a material having no stiffening.

PLANE.—THOMAS M. SEEDS, JR., and MARTIN FRINGS, Philadelphia, Pa. This plane is particularly adapted for smoothing floors. The invention comprises certain peculiar features of construction, by which the plane is carried on a wheeled-frame and is pushed over the floor by means of a long handle, thus enabling the operator to maintain an erect position during his work.

LEG-FASTENER.—PATRICK H. DUNN, Rome, N. Y. Mr. Dunn has invented a device for fastening legs to a bath-tub or the like, the device being of such construction that the legs can be rigidly attached or readily removed whenever necessary.

BREAD-CUTTER.—EDMOND N. CORRIVEAU, Stonington, Conn. The invention provides a knife-guide adjustable to different thicknesses of blades, which knife-guide will hold the blade straight across the board. The device can be readily set or arranged by cutting uniform slices of any desired thickness.

VACUUM-PAN.—ROBERT J. BOWMAN, Alexandria, La.—It is the ordinary practice to remove the vapor rising from the boiling liquid saccharine matter by means of an air-pump and a spray-condenser connected with the pan by a large pipe. The present invention provides a means for condensing and removing the vapor by the application of a freezing or cold-producing medium within the pan instead of by an air-pump and a spray-condenser. The medium is cold water or that received from an ordinary ice-producing machine.

APPARATUS FOR TRANSFORMING STEAM.—JACQUES O'BRIEN, 20 Rue des Pyramides, Paris, France. By the use of this apparatus it is possible to convert steam by economically imparting to it any required degree of temperature without increasing the density, and by causing the steam to circulate without too great a friction within a series of metal tubes whose surface operates upon the steam submitted to an exceedingly great division. The tubes constituting such apparatus are heated either by the waste hot gases escaping from the steam-generating furnace on their way to the chimney or by any convenient special furnace so as to distribute the heat as uniformly as possible.

Gas Apparatus.

METER.—JOHN S. WARDE, West New Brighton, Richmond, New York city. Mr. Warde has invented a meter with a valve at its inlet, so that if the meter be reversed on the service-pipe by the consumer, it will be prevented from operating its gearing and dial hands backward. A back draft from any cause, such as a break in the main, cannot reverse the dial mechanism.

INCANDESCENT BURNER. — JAMES J. BYRNES, Brooklyn, New York city. This single or multiple burner can be used with a mantle and is so constructed that the air is supplied in such manner as to cause the flame to engage with the mantle on all sides at its inner portion. Hence great brilliancy of illumination and economic consumption of gas is attained.

Furnace Improvements.

SMOKE-CONSUMER.—WILLIAM A. MARTEL, Brandon, Manitoba, Canada. The invention relates to improvements in devices designed to be attached to the stove or heater for consuming products of combustion—such as smoke, soot, and gases—arising from a coal or wood fire; and the object is to provide a device for this purpose that can be readily attached to a stovepipe and by means of which sparks can be arrested and the products of combustion burned and the heat therefrom utilized, thus resulting in an economy of fuel.

FIRE-POT.—JOHN W. GHEEN, Portland, Oregon. The subject of this invention is a fire-pot for heating soldering-irons or the like. The construction of the improved device is such that a number of irons can be held in vertical position over the fire-pot.

Miscellaneous Inventions.

BRIDGE-GATE. — JAMES CUMMINGS, 642 West Lake Street, Chicago, Ill. This improved automatically-operating bridge-gate is arranged to be projected across the roadway when the bridge is opened and to be readjusted clear of the roadway when the bridge is closed. The gate requires no watchman or other attendant. When the bridge is closed the gate is lowered to the level of the roadway, and the instant the bridge is opened the gate is elevated.

COIN-CARRIER. — ELLWOOD W. ROBERTS, Brooklyn, New York city. Mr. Roberts has invented a very simple and efficient envelop for the reception of a coin, which envelop is so designed that the coin-pocket is formed without any gumming. The coin-carrier consists of a main body portion, which can be used as a memorandum sheet for indicating the sender's intentions. At one end of its body a triangular-shaped money-flap is formed. Merely by folding this flap properly the coin is held securely.

RECEPTACLE FOR TRANSPORTING BOTTLES, ETC.—DAVID RICHARDS, Dynevor Tin Plate Works, Pantyffynon, South Wales, England. The bottle is provided with a horizontal partition or diaphragm apertured to receive the shoulders of bottles and separate the body portions. The body of the container is also recessed so that in conjunction with the diaphragm it will prevent the bottles' falling about. The case is made of sheet-metal; and the invention consists essentially in the mode of construction whereby the apertured partition or diaphragm is made integral with the sides of the main or upper part of the case.

COMBINED SINK AND WASHTUB.—WALTER J. MINNS, Brooklyn, New York city. The purpose of this invention is to provide a means whereby a sink can be combined with a washtub and each can be separately used to as much advantage as if they were entirely independent. The connections are so made that they are readily kept clean, and so that the usual sink strainer and its puttied joint are dispensed with. No water can possibly splash up and run down at the top of the sink.

DUST-EXCLUDER.—JOHN P. MARTIN, Ely, Nev. The device is to be used by persons in a dusty atmosphere to prevent the dust entering the throat and lungs during the process of inhalation. To this end the device consists of a box which can be placed in communication with the mouth or nostrils and which is provided with devices for permitting the passage of air and at the same time excluding dust.

PIPE.—JOHN F. KENNEFICK, Cripple Creek, Colo. The purpose of the invention is to provide a means for keeping the pipe clean and rendering the smoke cool before it reaches the mouth of the smoker. The pipe has a main bowl and a supplemental bowl removably secured therein. The adjacent walls of the main and supplemental bowls are spaced apart to form an air chamber. A perforated flange extends between the upper edges of the main and supplemental bowls.

FLOOR OR SIDEWALK.—RICHARD FLEMING, Corning, Ohio. The floor or sidewalk is formed of sections or blocks of artificial stone not liable to crack or scale and arranged in such a manner that a worn-out or broken section can be readily removed and renewed without disturbing the remaining sections. A workman will not be required in the construction of a section of the floor to prepare a large amount of cement, but merely a sufficient quantity for a single block at a time. The material is readily smoothed down while it sets to give each section a smooth, ground-like appearance.

DEMIJOHN-FRAME. — ALLAN L. WOOD, Brooklyn, N. Y. The invention provides a folding frame particularly adapted as a pivotal support for demijohns and the like and their casings, which frame is exceedingly steadfast when placed in position for use and light and durable in construction. A simple and effective means is provided for limiting the outward movement of the members of the frame. The pivot pins of the frame serve as fulcrums for the articles to be supported.

Designs.

PARCEL-CARRIER.—WILLIAM CARRY, Newport, R. I. The carrier consists of a single piece of wire bent to form two hooks for engaging the twine of the parcel and a central loop for the finger.

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.**

Business and Personal Wants.

READ THIS COLUMN CAREFULLY.—You will find inquiries for certain classes of articles numbered in consecutive order. If you manufacture these goods write us at once and we will send you the name and address of the party desiring the information. **In every case it is necessary to give the number of the inquiry.**

MUNN & CO.

Inquiry No. 1411.—For manufacturers of an electrical apparatus for filtering water.

Inquiry No. 1412.—For castings for kerosene engines to run an automobile.

Inquiry No. 1413.—For dealers in the Herans electrical pyrometer.

Inquiry No. 1414.—For manufacturers of aluminium articles, such as spoons, etc.

Inquiry No. 1415.—For dealers in sheet iron stampings for field and armature for small alternating power and fan motors.

Inquiry No. 1416.—For an engine and dynamo to supply electric lights for a town. Outfit to be either second-hand or new.

Inquiry No. 1417.—For pencil holders to hold a round soapstone pencil. Also for soapstone pencil manufacturers.

Inquiry No. 1418.—For manufacturers of machines for making rope and cord.

Inquiry No. 1419.—For manufacturers of roofing slag.

Inquiry No. 1420.—For dealers in butcher knife and razor handles.

Inquiry No. 1421.—For manufacturers of small, portable machines for reboring engine cylinders.

Inquiry No. 1422.—For manufacturers of electric welding machines.

Inquiry No. 1423.—For dealers in a pressure pump for forcing grout into cracks on stone or concrete walls. It is similar to a bicycle pump, but larger and can be loaded from the top.

Inquiry No. 1424.—For two hydraulic rams, pipe and fixtures for supplying water from a spring.

Inquiry No. 1425.—For manufacturers to make a model wind and water pump from blue-prints.

Inquiry No. 1426.—For manufacturers of excelsior machines.

Inquiry No. 1427.—For manufacturers of novelties for the mail order business.

Inquiry No. 1428.—For dealers in new or second-hand Italian harps.

Inquiry No. 1429.—For manufacturers of rubber novelties, as toy balloons, etc.

Inquiry No. 1430.—For dealers in typewriter repairers' tools.

Inquiry No. 1431.—For manufacturers of souvenir buttons.

Inquiry No. 1432.—For manufacturers of water motors.

Inquiry No. 1433.—For a filter paper to purify grape juice; in sheets of not less than 20 inches.

Inquiry No. 1434.—For a hand machine for grinding almonds; and for other confectioners' machinery.

Inquiry No. 1435.—For American pictorial post cards.

Inquiry No. 1436.—For manufacturers of an apparatus for testing cables of houses after being wired; it should be a small roraty magneto, and should be able to work up to 100 megohms.

Inquiry No. 1437.—For a pantograph "routing" machine for engraving purposes.

NEW BOOKS, ETC.

SOME NOTES ON CHEMICAL JURISPRUDENCE. A Digest of Patent-Law Cases, Involving Chemistry. By Harwood Huntington. Published by Harwood Huntington, 1 West 54th Street. Price 25 cents.

THE ART OF CANNING AND PRESERVING AS AN INDUSTRY. By Dr. Jean Pacrette. Jersey City, N. J.: J. H. Bommergue, Publisher. 1901. 8vo. Pp. 203. Price $10.

In all technical literature there is no subject where the literature is so inadequate as on canning. It is almost impossible to obtain any formulas which are of the slightest value, so that any treatise on the subject may be warmly welcomed. The book before us has a large number of formulas for making preserves of all kinds. It also gives directions for the canning of vegetables, meats, preparations of mustards, canning of fish, oysters, soups, etc.

Notes & Queries

HINTS TO CORRESPONDENTS.

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

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

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.

(8373) R. D. McC.: 1. Is a large number of coils on the armature better to run a dynamo than a small number? A. Yes. 2. What is the voltage of an Edison dynamo? A. The old Edison dynamo as used for incandescent lighting upon the three-wire system was wound for about 110 volts.

(8374) T. D. H. writes: Among the queries noted in No. 7, SCIENTIFIC AMERICAN, current volume, No. 8318, W. J. B. Supposing a hole to be bored through the earth and the effect produced upon a ball being dropped into it. I beg leave to differ from the philosophy given in the answer. The ball will fall with an increasing velocity until it has passed the center of gravitation, and only so far past that point as the force of inertia will carry it, but not as far as it has fallen to reach it. It will then return, but with a decreased velocity owing to the shorter distance it has to drop again toward the center. It will not return to the point from which it was first dropped, and thus it will continue to shorten its vibration until it will stop at that point known as the center of gravity. Its motion will be exactly like that of the pendulum of a clock when the spring or weight is broken; it will continue to swing with a gradual loss of energy until it comes to a standstill. A. We regret that we are not able to coincide with these views regarding the ball falling into a hole bored through the earth in which by some means there is no resistance whatever to its motion. Its motion is like that of a pendulum from whose path all resistance is removed. We infer that such a pendulum would swing forever under the law known as Newton's First Law. A body at rest will remain at rest, and a body in motion will continue forever in motion unless stopped by some external force. Inertia is not a force. It expresses simply the inability of matter to start or stop itself, and if there is no external cause of loss of energy that motion must continue forever.

(8375) B. W. S. asks: Will you please inform me why it is necessary to bond the rail joints of an electrical railroad, when said rails are joined by fish plates upon both sides? A. The joints at the fish plates are not close enough for electrical connections, and are oxidized so that the resistance is entirely too great. Even if the joint were made good enough the rust would soon spoil it for electrical purposes.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Issued for the Week Ending

September 24, 1901,

AND EACH BEARING THAT DATE.

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

Adjustable screen, E. C. Linck 683,307
Alarm. See Burglar alarm.
Alarm mat, electric, A. D. Shaw 683,341
Alimentary extract and making same, E. C. L. Kressel 683,210
Armature core for electrical machines, G. Koppelmann 683,052
Auger post, coal, C. R. Anderson 683,193
Bank, coin savings, G. Havell 683,396
Bank draft, M. Hyman 683,403
Barber chair, J. B. Lowry 683,309
Bayonet, T. A. Fidjeland 683,030
Bearing, antifriction, D. E. Kempster 683,408
Bed bottom, P. B. Rooney 683,333
Bed bottom and upholstery support, J. Hoey 683,175
Bed netting support, F. Sim 683,344
Bed pan, R. E. Holder 683,044
Bed spring, O. H. Watkins 683,360
Bedstead corner fastening, A. E. Myers 683,137
Bicycle, A. Chamberlin 683,381
Binder, F. M. Ho-glen 683,176
Binder, temporary, R. J. Buchanan 683,019
Boat, life, J. E. Dysart 683,260
Boat, submarine, J. P. Holland 683,400
Boiler cleaning compound, J. Richards 683,330
Boiler pipes, tubing, etc., mechanism for the production of, O. Klatte 683,050
Boring instrument for building or mining purposes, E. Hartung 683,275
Box lid holder, Neubauer & Grisham 683,321
Brick, self-centering building, A. I. Svan 683,233
Bridge gate, E. Einert 683,261
Broom bridle, J. R. Ross 683,071
Brush polishing attachment, shoe, T. O. Grills 683,038
Bung hole stopper or seal for metallic kegs, J. H. McClelland 683,182
Buoy, night light, C. C. A. E. Wiese 683,238
Burglar alarm, W. G. McClure 683,319
Butter cake forming and printing machine, F. Krabal 683,298
Caisson, W. H. McFadden 683,219
Cane elevator or loader, portable sugar, A. H. Schierholz 683,334
Car checking device, A. M. Acklin ..683,370, 683,371
Car control system, electric, C. Hochenegg. 683,279

(Continued on page 221)

Car draft rigging, J. M. Waugh 683,236
Car seat, L. Janson 683,288
Carbureter, J. Stubbers 683,232
Carbureter, W. P. Houze 683,401
Cartridge, gun, W. F. Cole 683,384
Cartridge priming or depriming apparatus, I. Silvis 683,150
Cash register, E. H. Jahnz 683,048
Cathode plates, electrolytic production of, Elliott & Kishner 683,263
Cement walk constructing frame, C. J. Sullivan 683,081
Chair. See Barber chair.
Chair and couch, combination, B. Franklin. 683,032
Check cutting or punching machine, J. F. Werle 683,363
Chimney cleaner, G. O. Tucker 683,358
Chuck for lathes, etc., Lehureau & Porcher. 683,303
Chuck, rock drill, F. Long 683,127
Churn, I. M. Murphy 683,136
Cigar or cigarette holder, R. Thompson 683,234
Cigar wrapper cutter, N. Du Brul 683,201
Cigar wrapper cutting machine, W. S. Gleim 683,272
Clamp, J. P. Rockwell 683,184
Clock, electric program, B. Dubinski 683,257
Clock, recording, F. Williams 683,090
Closet seat lid, R. R. Cowles 683,421
Closure controlling apparatus, J. A. Miller 683,135
Cloth cutting machines, adjustable guide and flattener for, A. I. Jacobs 683,047
Clothes line clamp, G. Park 683,138
Clutch, friction, V. R. Browning 683,169
Clutch, traction engine, M. J. Todd 683,357
Coal or rock drill, I. Wantling 683,158
Cock, automatic cylinder, S. P. Grey 683,273
Coffee or tea making apparatus, C. G. & L. P. Durel 683,259
Coin controlled machines, fraud preventing device for, M. Hofheimer 683,280
Collapsible tube for containing semi-liquid substances, O. Mussinan 683,410
Collar turning and ironing machine, Weinschenker & Schoeller 683,159
Coloring yarns, W. Shaw 683,229
Coloring yarns, apparatus for, W. Shaw 683,228
Composing stick, H. H. Stalker 683,079
Compressor, W. F. Singer 683,185
Computaing apparatus, H. W. Byron 6 3379
Conveyor, A. M. Acklin 683,372
Cooking apparatus, gas, E. W. T. Richmond 683,331
Corn husking machine, J. E. Goodhue 683,174
Corset attachment, D. Kops 683,297
Coupling device, J. Marquardt 683,312
Crate, fruit shipping, M. Kilian 683,209
Cream separator, Lugibihl & Kibele 683,128
Cultivator, wheel, E. S. Slough 683,151
Curb for sidewalks, lawns, etc., L. A. Levin 683,305
Curtain fixture, window, H. D. Schmid 683,335
Cutter bar, W. H. Hodges 683,118
Cutting articles from sheet material, machine for, J. J. Breach 683,376
Cycle driving mechanism, V. Gourny-Wysocki 683,037
Damper and damper controlling mechanism, R. G. Latham 683,180
Direct acting engine, vertical, H. A. Jensenius 683,407
Discoidal engine, F. W. Jaeger 683,406
Display rack, A Todd 683,356
Display stand, W. H. Shrader 683,343
Diving apparatus, J. L. Watson 683,361
Door operating device, Colby & Peelle 683,102
Drawing roll, F. M. Marcy 683,311
Dredges, means for conveying power to, W. O'Brien, Jr 683,063
Drenching bit, T. H. Rush 683,147
Drying apparatus, J. G. Gardner 683,269
Drying apparatus, vacuum, E. Storch 683,189
Drying cylinder, J. H. Whittle 683,237
Dust collector, J. E. Mitchell 683,313, 683,314
Dye and making same, brown, R. Taggesell 683,190
Dye, black disazo, Kaltwasser & Jaesschin. 683,120
Dye, blue monoazo, Kaltwasser & Jaesschin 683,119
Earth box, movable, S. Adsit 683,096
Edge, straight, D. Gilliom 683,115
Educational medium, H. B. Froehlich 683,267
Educational purposes, transmitter for, C. S. Comins 683,171
Electric cloth or fabric, L. Baecker 683,098
Electric coupling for conductors, C. Holzmann 683,045
Electric display apparatus, interchangeable, G. L. Mason 683,133
Electric generator or motor, P. J. Darlington 683,253
Electric switch, Mansfield & Thompson 683,213
Electromagnetic brake, A. A. Honey 683,284
Electromagnetic brake, A. A. Robertson 683,332
Electromagnetic traction increasing apparatus, A. A. Honey 683,283
Elevator. See Cane elevator.
End gate catch, J. E. Camp 683,020
Engine, W. A. Hill 683,399
Engine vaporizing device, explosive, Laurent & Clerget 683,125
Engines, mixing and vaporizing device for explosive, F. W. Felbaum 683,110
Evaporating apparatus, O. Hofmann 683,281
Excelsior making machine, A. A. Dekin 683,199
Expansion bolt, J. C. Summerer 683,082
Explosives, making, A. C. Girard 683,116
Eyeglass or spectacle case, J. Weinstein 683,417
Eyeglasses or spectacles, J. C. Durouaux 683,108
Feed apparatus, self-acting boiler, F. Woerner 683,366
Feed regulator, boiler, O. E. & E. E. Clark 683,021
Feed water regulator, J. E. Walsh 683,359
Feed water regulator and alarm, C. B. Crabtree 683,251
Feed water regulator, boiler, R. Schulz 683,148
Fence post, R. H. Geiger 683,270
Fertilizers, making, Angstadt & Cleaver 683,014
Filaments for incandescing electric lamps, manufacture of, W. L. Voelker 683,085, 683,086
File band clasp, E. L. Sibley 683,414
Filing case, W. D. & J. D. Kelly 683,295
Filling machine, J. & D. Baxter 683,016
Filter, W. E. Corlett 683,386
Filtering apparatus, portable, H. Nordtmeyer 683,061
Firearm, automatic, Roth & Krnka 683,072
Fire engine feed pump attachment, F. N. Raggio 683,328
Fire extinguishing compound, O. C. Lacey 683,211
Fireproof partition, A. G. Beam 683,195
Fireproofing compound, O. C. Lacey 683,212
Fluid pressure brake, M. W. Hibbard 683,205
Forge die, K. Prott 683,068
Frog for cars or locomotives, replacing, J. F. Hanigan 683,041
Fruit drier, Thomas & Thompson 683,083
Fruit squeezer, P. F. Smith 683,347
Garment stretcher, W. K. Mackey 683,055
Garter clasp, man's, P. B. Tingley 683,191
Gas, apparatus for the manufacture of, H. Lane 683,300
Gas burner, acetylene, A. C. Einstein 683,262
Gas engine, B. F. Stewart 683,080
Gas engine, explosive, V. St. John 683,152
Gas generator pressure regulator, H. Gerdes 683,034
Gas heater, E. W. T. Richmond 683,144
Gas, making, H. Lane 683,409
Gas meter, prepayment, J. D. Forster 683,393
Gas, producing illuminating, G. Ottermann. 683,065
Gear, compensating driving, A. E. Osborn 683,323
Generator. See Electric generator.
Girders, angle irons, etc., machine for cutting or dividing, H. John 683,289
Glass cutting apparatus, T. J. Donovan 683,023
Glass washer, Fisher & Weinshenker 683,111
Golf ball tees, means for forming, W. K. & W. J. Boda 683,244
Grain curing or drying apparatus, L. S. Burbank 683,101
Grain decorticating machine, F. H. Schule 683,336
Grain germinating apparatus, M. Weisenfeld 683,362
Grain shocking machine, Wooley & Fox 683,095
Grain, steeping and washing, W. H. Prinz. 683,326
Grain steeping and washing apparatus, W. H. Prinz 683,327
Grain treating apparatus, G. R. Gorham 683,036
Graphite lubricator, F. Gielow, Sr 683,114
Grater, W. W. Kronheim 683,299
Grinding machine, tool or cutter, J. Bath 683,194
Gun, machine, F. Alessi 683,240
Gun sighting apparatus, barbette or other, H. Grubb 683,204
Gun sighting device, H. Grubb 683,203
Hammer, pneumatic, J. Beche 683,374
Handle. See Saw handle.
Hat case, A. R. Du Boise 683,258
Hat hanger, W. V. Bleha 683,168
Hatters' kettles, hair strainer for, M. R. Foster, Jr 683,265

(Continued on page 222)

Hay or grain unloader and stacker, A. F. Haynes 683,043
Hearing, apparatus for assisting the, A. F. Watch 683,192
Heat, system for collecting and utilizing solar, K. C. Wideen 683,088
Heel, B. Loderer 683,054
Hinge, J. M. Pearson 683,222
Horseshoe, M. R. Thurber 683,084
Horseshoe, E. von Marsovszky 683,131, 683,132
Horseshoe, elastic, S. McCloud 683,318
Hose, bath, W. L. Simmons 683,076
Hose coupling, H. B. Sherman 683,342
Hose nozzle, J. McBoyle 683,317
Hot air furnace, J. Timms 683,355
Hub attacher, T. G. Mandt 683,310
Hydrocarbon burner, J. A. Mason 683,134
Ice cream freezer, W. C. Harrison 683,042
Impact and reaction motor, J. L. Hornig .. 683,285
Ingot mold, F. W. Wood 683,367
Ingot stripper, F. W. Wood 683,368, 683,369
Insect catcher, E. N. Wood 683,092
Insulating construction, T. New 683,060
Insulating material, composite, G. Kelly .. 683,208
Jack, J. A. Johnson 683,290
Kneading machine kneader, dough, O. Droschutz 683,390
Knitting machine take-up mechanism, J. C. Brewin 683,377
Lamp burner, petroleum incandescent, Pittner & Richter 683,067
Lamp for burning petroleum, kerosene, etc., B. H. Copeland 683,420
Lamp protector, incandescent, J. M. Howley 683,046
Lamp, signal, R. J. Armour 683,243
Lamps, inclosing structure for electric arc, W. H. Northall 683,062
Lathe, handle turning, W. H. Johnson 683,292
Level, spirit, E. E. Frederick 683,033
Lighter or barge for handling coal, etc., J. Campbell 683,246
Lime, treating, F. N. Spear 683,188
Lock, M. F. Hutchison 683,206
Locomotive ash pan, R. M. & J. A. McElroy 683,218
Loom dobby, J. Highton 683,398
Loom thread parting mechanism, C. H. Draper 683,423
Lorgnette, Osborn & Uhry 683,064
Machine tool, C. Jackson 683,178
Mail bag mouth or closure, S. P. Steele 683,153
Mangle, C. R. Hoyt 683,402
Marking machines, feeding device for article, F. J. Hagen 683,039
Match safe, S. F. Estell 683,028
Match safe, H. J. Noyes 683,322
Matches, device for automatically igniting and delivering, E. Kottusch 683,053
Mechanical movement, F. W. Jaeger 683,405
Melting furnace, reverberatory, W. J. Brown 683,378
Metal bars or rods, machine for polishing or burnishing, C. S. Dutton 683,109
Milk dispensing machine, C. W. Winther ... 683,091
Milling tool, S. D. Keene 683,207
Mirrors, making curved, K. C. Wideen 683,163
Molding and hook, H. O. Chase 683,248
Motor generator, R. Thury 683,235
Mower, lawn, J. Braun 683,197
Mowing machine, E. P. Durand 683,025
Musical instrument, H. McCrea 683,320
Musical instrument string fastener, G. Holt 683,282
Musical instruments, note sheet for stringed, Wood & Stiles 683,093
Nozzle, D. F. Leahy 683,301
Obstetrical appliance, P. F. Cassidy 683,380
Oil cake press, E. C. Bisbee 683,196
Oils and their distillates, refining crude mineral, F. C. Thiele 683,354
Ore separator, A. J. Perry 683,412
Oxids or other metallic compounds, reducing, K. C. Wideen 683,089
Packing, apparatus for facilitating, L. S. Burbank 683,100
Packing case for butter, etc., F. E. Wattles 683,416
Packing for hydraulic presses, piston, J. J. Crawford 683,252
Padlock, W. S. Houser 683,286
Paint pot, B. R. Woodley 683,094
Paint removing composition, P. J. Hope 683,177
Paper-like material and making same, T. Rosenthal 683,070
Photographic films, apparatus for developing and fixing, R. Fleischer 683,031
Photographic plate holder, W. L. Robertson 683,146
Photographic printing frame, E. W. McCaslin 683,059
Photographic retoucher, A. Swan 683,351
Photographic shutter, C. G. Woodhead 683,166
Photoprinting frames, fastening for canvas aprons employed in, J. Halden 683,040
Pictures, building, J. A. Lee 683,302
Pile fabric, producing figured double, R. Schwartz 683,340
Pipe. See Tobacco pipe.
Pipe coupling, A. H. Hutchinson 683,287
Pipe mold, B. R. Davisson 683,389
Pipe mold forming apparatus, J. K. Dimmick 683,255
Pipes, external joint for escape, G. T. Cooper 683,385
Pipes, means for packing leaks in, J. Dunn 683,024
Piston, valved, S. M. Fulton 683,394
Pitman connection, E. A. Johnston 683,049
Planter, cotton seed, A. F. Trimble 683,157
Planter, seed, A. F. Trimble 683,156
Plastic material, cutting-off mechanism for, W. E. Saunders 683,226
Plow and brush cutter, combined, L. R. Annett 683,242
Plow guide, R. C. Patterson 683,139
Plow riding attachment, walking, E. B. Winters 683,364
Plow stock, B. P. Hatchell 683,277
Pneumatic dispatch apparatus terminal, O. S. Pike 683,141
Pneumatic dispatch tube apparatus, J. T. Cowley 683,022, 683,387
Pneumatic dispatch tube apparatus terminal, O. S. Pike 683,140
Pocket, safety, G. L. Estes 683,029
Polishing wheel, C. A. Knill 683,122, 683,123
Portable table, J. M. Flemister 683,264
Powder charge, P. Du Buit 683,106
Precious metals from their ores, extraction of, H. J. Phillips 683,325
Preserving fruit, A. P. Gaines 683,112
Printers' furniture and lock-up, R. B. Cochran 683,249
Printing block, polychrome, W. G. & R. A. A. White 683,161
Printing machine, polychromatic, W. G. & R. A. A. White 683,162
Pulp making, disposing of the spent liquor in wood, W. M. Stone 683,350
Pulverizing mill, J. W. Druitt 683,256
Pump, W. M. Rhoades 683,143
Punch, etc., hydraulic, E. Graves 683,395
Rail bond, electric, S. P. Cowardin 683,250
Rail joint, T. E. Brown 683,018
Rail joint, J. Gillen 683,035
Railway danger signal, C. S. Dean 683,422
Railway frog, portable, W. H. Pritchard ... 683,223
Railway switch, J. M. Clifford 683,383
Railway switch, automatically operated, I. Robbins 683,224
Railway tie, B. F. White 683,160
Railway tracks, electric circuit closure for, F. Sock 683,230
Ratchet, reversible, L. Adams 683,167
Reducing furnace, C. Bishop 683,375
Reel latch, W. L. Norden 683,411
Reflector, curved, K. C. Wideen 683,164
Refrigerating machine, absorption, W. Wilson 683,239
Roadway, Malette & Seybolt 683,056
Rock drilling machine, M. C. Jackson 683,404
Rope socket, J. C. Swan 683,353
Rule attachment, compound, G. Y. Carter .. 683,247
Sad iron, K. A. Kaiser 683,293
Saddler's clamp, G. H. Thompson 683,155
Saw, crosscut gang, W. F. Barnes 683,015
Saw guide, band, W. E. Allen 683,373
Saw handle, L. K. Haak 683,117
Sawdust, etc., treating, J. G. Gardner 683,268
Scissors, C. Stamm 683,231
Screen. See Adjustable screen.
Screw slotting machine, automatic, W. H. Gates 683,113
Seal, car, L. A. Brown 683,245
Separator tooth, H. C. Clay 683,170
Sewing machine tension device, C. A. Crist 683,103
Shade hanger, window, H. H. Stratton 683,154
Shears or scissors, P. Desnoyers 683,105
Sheet metal edging machine, J. H. Schlafly. 683,227
Shoe, cushion, A. Reed 683,142

(Continued on page 223)

Showering pot, portable automatic, M. H. Lichten 683,306
Shutter worker, H. Osborne 683,221
Sifter, flour, E. B. Siskron.... 683,149
Signal system, Mansfield & Thompson.... 683,214
Signal system, electrical block, S. L. Foster 683,172
Signaling mechanism, R. Herman.... 683,397
Sliding block or bearing, C. V. Linquist.... 683,126
Smelting furnace, L. S. Dumoulin.... 683,107
Soap cakes, making, H. E. Mereness.... 683,181
Soda, apparatus for drying bicarbonate of, E. Solvay 683,187
Spark arrester, M. Moore 683,315
Speed changing mechanism, J. M. Anck.... 683,241
Spinning yarn, C. H. Arnold.... 683,418
Squaring purposes, combination tool for, A. Delin 683,254
Stairway, elevating, H. O. Lange.... 683,124
Stone, apparatus for the production of compressed artificial sand, W. Schulthess.. 683,338
Stone, making artificial sand, W. Schulthess 683,337
Street sweeper, A. J. Reynolds.... 683,413
Stud for glove fasteners, etc., spring, J. R. Smith 683,346
Stud, lacing, J. S. Kitchell.... 683,121
Sulfite digester, W. A. Luke.... 683,129
Swinging gate, adjustable, W. M. Smith.. 683,348
Syringe, A. E. Bonesteel.... 683,099
Table, C. E. Pugh.... 683,069
Tag, O. Konrad.... 683,296
Tank, B. F. Ellis.... 683,391
Tap, throughway, J. Westley.... 683,087
Target trap, H. C. Lord.... 683,308
Teeth cleaning appliance, A. Schneider.... 683,075
Teeth, means for fastening artificial, J. G. Burchell 683,198
Telegraph mechanism, paper carriage feed device for printing, O. L. Kleber.... 683,051
Telephone receiver, S. J. Friedman.... 683,266
Therapeutic battery, J. A. Minturn.... 683,216
Thermostatic switch, W. F. Singer.... 683,186
Timepiece winding indicator, C. E. A. Schnake 683,074
Tire, cushion, F. W. Skinner.... 683,345
Tire, vehicle, W. J. Wittmann.... 683,365
Tobacco pipe, F. L. Schulz.... 683,339
Toy graphophone, T. H. Macdonald.... 683,130
Transporting rigid bodies, means for, H. C. Spalding 683,078
Trolley catcher, C. I. Earll.... 683,026
Tube expander, T. R. Johnson.... 683,291
Tube expanding apparatus, F. G. Hampson 683,274
Tube welding device, electric, O. Parpart.. 683,066
Umbrella cover, detachable, E. B. Murdock. 683,316
Urinal screen, E. E. Burson.... 683,419
Underreamer, J. S. Swan.... 683,352
Valve, air, J. P. Marsh.... 683,215
Valve device, J. Kelly.... 683,179
Valve, reducing, N. Curtis.... 683,388
Valve, steam engine, C. M. Wilcox.... 683,165
Vapor burner, J. R. & C. W. Pensyl.... 683,324
Vehicle brake, T. J. Emerson.... 683,027
Vehicle brake, automatic, L. H. Rickles.. 683,145
Vehicle, motor, Dore & Evanovitch.... 683,200
Velocipede, free wheel, A. Gibbs.... 683,271
Velvet, manufacture of, Cleff & Langen.... 683,382
Vending machine, automatic, E. C. Grewer 683,202
Ventilator, J. H. Francis.... 683,173
Ventilator, D. J. Rosen.... 683,225
Vessels, device for preventing refilling of, W. J. Murray 683,057, 683,058
Voting machine, C. De Croes (reissue).... 11,933
Wagon skein nutting and facing machine, A. L. Warner 683,415
Washer. See Glass washer.
Water heater, F. Schifferle.... 683,073
Water heating apparatus, E. W. Higbee.... 683,278
Water purifying apparatus, A. Sorge, Jr.. 683,349
Weaner, calf, D. Daggett.... 683,104
Weather strip, A. E. Brown.... 683,017
Weather strip and sash fastener, F. Allen 683,097
Weighing device, automatic grain, J. T. Lemon 683,304
Weighing machine for railway trucks, C. Emming 683,392
Wheel, Neill & Tinker 683,220
Whip braiding machine tension device, C. W. Hassler 683,276
Window, J. P. W. Patillo.... 683,183
Window cleaners or the like, seat or stage for, Allder & Streater.... 683,013
Window fastener, J. Redman.... 683,329
Window frame and sash, H. C. Smith.... 683,077
Window guard, F. B. Mower.... 683,217
Wrapper, H. C. Karr.... 683,294

DESIGNS.

Brush, hat, T. Pedrini.... 35,129
Game board, E. Mikkelsen.... 35,131
Pencil, W. R. Schupp.... 35,128
Post tamper, J. Allison.... 35,130
Trimming, A. H. Kursheedt.... 35,132

TRADE MARKS.

Boots and shoes, leather, Carruthers-Jones Shoe Co 37,106
Creamery products, certain named, St. Charles Condensing Co.... 37,115
Disinfectants and germicides, G. A. Stoehr.. 37,110
Dry goods, certain named, T. G. Hill & Co.... 37,100, 37,101
Fabrics, certain named, G. Willis.... 37,102
Flour, Ansted & Burk Co.... 37,116
Garments, fur and fabric, Clark & Weinberg 37,103
Machines, certain named, Addressograph Co. 37,119
Medicine for certain named diseases, Dr. J. C. Brown Medical Co.... 37,108
Ointment, A. C. Stewart.... 37,109
Paint, composition, Holzapfels Compositions Co.... 37,117
Remedy for skin and blood diseases, G. E. Remick 37,107
Ribbons, velvet face and satin back, Hoeninghaus & Curtiss 37,099
Sauce, Yeatman & Co.... 37,114
Shirts, S. Liebovitz & Son.... 37,104
Soap, toilet, A. Conkling.... 37,111
Tobacco, cigars, cheroots, and cigarettes, smoking and chewing, B. Muratti, Sons & Co.... 37,112, 37,113
Tools, W. Julsrud & Co.... 37,118
Underwear, excepting therefrom hosiery, Cooper Underwear Co.... 37,105

LABELS.

"Anee Samee Biscuit," for biscuits, H. L. Schlesinger 8,693
"Anti Cyst," for a medicine, H. L. Miller.. 8,703
"Champion Tomato Catsup," for tomato catsup, E. C. Flaccus Co.... 8,695
"Daniel's Conct. Tinct. Passiflora Incarnata or May Pop," for a medicine, J. B. Daniel 8,702
"Dr. Baker's Liquid Food for Vitality," for liquid food, B. F. Baker.... 8,694
"Excelsior," for cotton goods, H. Mills.... 8,692
"Glorio Soap," for soap, A. T. Smith.... 8,696
"Half Price," for cigars, Schmidt & Co.... 8,697
"Louisiana Purchase," for canned goods, cigars, and beer, E. G. Cherbonnier.... 8,698
"The Bactericidal Remedy Co.'s Choleroup," for a medicine, Bactericidal Remedy Co. 8,701
"Whiskey," for whisky, J. Moroney.... 8,700
"Wine," for wine, J. Moroney.... 8,699

PRINTS.

"Factory to Pocket," for watches and jewelry, H. Doll 401
"French Doll," for toys and novelties, French Novelty Co. 402
"Woodland Violet Specialties," for perfumery and toilet supplies, G. E. Tooker.... 403

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. In ordering please state the name and number of the patent desired, and remit to 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.

THOROUGH INSPECTIONS AND INSURANCE AGAINST LOSS OR DAMAGE TO PROPERTY AND LOSS OF LIFE AND INJURY TO PERSONS CAUSED BY STEAM BOILER EXPLOSIONS

HARTFORD STEAM BOILER INSPECTION AND INSURANCE CO. CONN.

J. M. ALLEN, PRESIDENT. W. B. FRANKLIN, VICE PRESIDENT. J. B. PIERCE, SECRETARY. F. B. ALLEN, 2ND VICE PRESIDENT. L. B. BRAINERD, TREAS. L. F. MIDDLEBROOK, ASST. SEC'Y.

Serviceable AT ALL Seasons

In sunshine or rain, in hot or cold weather, in any climate the

WINTON MOTOR CARRIAGE is of service to its owner. It is safe and easy to operate, simple but strong in its construction, elegant in design—perfect in every detail. Hydro-Carbon System. Illustrated catalogue free.

PRICE $1,200.

THE WINTON MOTOR CARRIAGE CO., 486 Belden Street, Cleveland, Ohio, U. S. A. EASTERN DEPOT, 150-152 East 58th Street, New York.

The Haynes-Apperson Company

The Run-About Carriage shown herewith is our latest production. It is the strongest combination of Lightness, Strength, Durability, and Speed, as well as elegance of design, that is on the market in any country. This carriage, as well as our full line, is on exhibition at the Pan-American Exposition.

THE HAYNES-APPERSON CO., - KOKOMO, INDIANA.

THE AUTO-CARBURETTOR made upon a new principle furnishes a reliable explosive mixture. No pump required. Uses any grade of gasoline with no waste. Especially adapted to automobile and cycle motors. Write us for prices and booklet on Carburettors. Gasoline and Steam Engines and Automobiles built to order and repaired. THE AVERY & JENNESS CO., 60 So. Canal St., Chicago.

GRAND PRIZE, PARIS, 1900.
HIGHEST AWARD POSSIBLE.

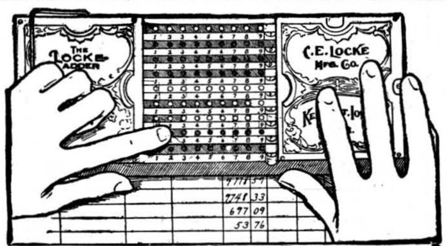
AN OUTLINE OF THE GOOD POINTS

MECHANICAL ACCURACY.
COMPLETE KEYBOARD.
EASE OF OPERATION
PERMANENT ALIGNMENT.
REMOVABLE PLATENS.
AUTOMATIC TYPE CLEANING.
SIMPLICITY AND DURABILITY.
A DOLLAR OF SERVICE FOR EVERY ONE OF COST.

OF THE SMITH PREMIER TYPEWRITER.

ILLUSTRATED CATALOGUE FREE.

THE SMITH PREMIER TYPEWRITER CO. SYRACUSE, N.Y. U.S.A.



The Locke Adder

Fastest, simplest, handiest, most practical and durable low-priced calculating machine. No business complete without it. Adds, Subtracts, Multiplies, Divides. Easily learned, lasts a lifetime. Saves time, labor, money, and

QUICKLY PAYS FOR ITSELF

Ensures accuracy, releases from mental strain. Adds all columns simultaneously. Capacity 999,999,999.

An Unsolicited Letter:

EXECUTIVE DEPARTMENT, AUSTIN, TEXAS. C. E. LOCKE M'F'G CO., August 12, 1901. Kensett, Iowa.

GENTLEMEN:—When one cannot afford to pay several hundred dollars for an adding machine, the LOCKE ADDER is a most satisfactory substitute. It is a valuable aid to the busy accountant, and as this useful machine can be had for only $5.00, one should be in every business office.

Very respectfully, JOE LEE JAMESON, (State Revenue Agent).

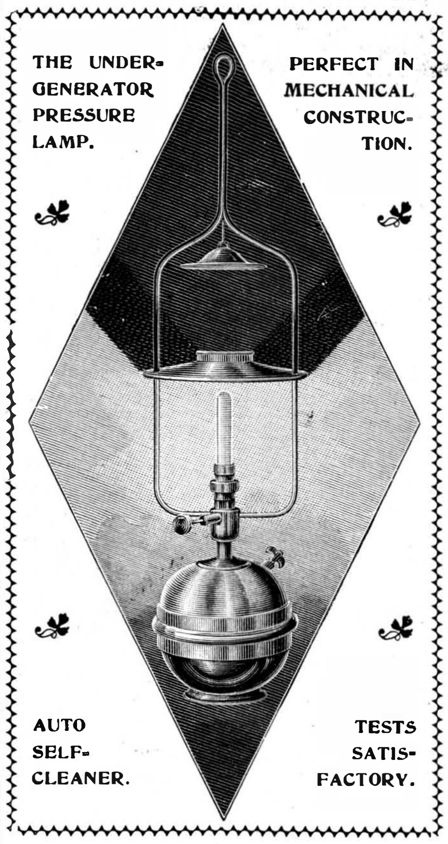
Price $5.00, Charges Prepaid. Descriptive booklet FREE. Agents wanted.

C. E. Locke Mfg. Co. 25 Walnut St., Kensett, Ia.

The "LITTLE WONDER"

GASOLINE LAMP for FACTORIES and STORES

"TRUE AND TRUSTWORTHY"



The Most Light for the Least Money

COSTS ONLY 1-3c. PER HOUR

600 (actual) CANDLE POWER

No installation required. Total cost, $9.80. Self-generator of hydro-carbon gas. Can be used just as well without any glassware. Simple, handy, guaranteed. Certificate with each lamp. Have met all insurance requirements for safety. It is time for lights at 5 o'clock now, and we can make factories, stores and other buildings brilliant with a steady, clear, soft light, saving from one-half to two-thirds on monthly light bills.

ONE LAMP FREE FOR 30 DAYS

While we agree to send one lamp on trial, prepaid, we can do so to only those parties requiring three or more lamps. We want orders large enough to pay us under this plan. Try this lamp and you will adopt it. We take all chances of your experiment. You risk nothing. Rare chance for agents; it sells itself.

Write at once for liberal terms and agencies

THE TURNER BRASS WORKS, 102 E. Kinzie St., Chicago, U. S. A.

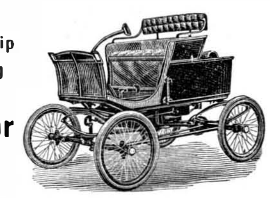
FOR MEN OF BRAINS Cortez CIGARS -MADE AT KEY WEST-

These Cigars are manufactured under the most favorable climatic conditions and from the mildest blends of Havana tobacco. If we had to pay the imported cigar tax our brands would cost double the money. Send for booklet and particulars.

CORTEZ CIGAR CO., KEY WEST.

BEVEL GEARS (No Chain)

Enclosed Mechanism
Superior Workmanship
A Card Gets a Catalog



Century Motor Vehicle Co.
Syracuse, N. Y.

JESSOP'S STEEL THE VERY BEST FOR TOOLS, SAWS, ETC. WM JESSOP & SONS, LD 91 JOHN ST. NEW YORK

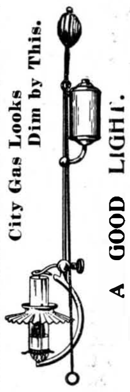
NEW ENGLAND WATCHES

Made for the WORLD

Send for Booklets

BLUE FOR LADIES... ...RED FOR MEN

THE NEW ENGLAND WATCH CO.,
New York, 37 Maiden Lane. Chicago, 149 State Street.
San Francisco, Spreckels Building.



A GRAND LIGHT.

Greatest, Safest and Cheapest Light of modern times is the

PENTONE

kind. Write for our booklet and become familiar with this grand lamp. Nickel finish.

PENTONE GAS LAMP CO.
141 Canal Street, Grand Rapids, Mich.

A GOOD LIGHT. BURNS 10 HOURS FOR 1c.

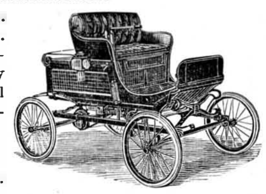
A SAFE LIGHT.

STEARNS STOOD THE TEST

394·3 MILES IN 32 HOURS 21 MINUTES

New York to Buffalo Endurance Test

Model A, Runabout. Model B, Dos-a-Dos. Model C, Delivery Wagon. Model D, Buggy Top Runabout. Model E, Victoria Top Runabout.



Prompt Deliveries.
Write for Catalog.

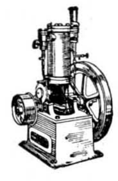
STEARNS STEAM CARRIAGE COMPANY, Syracuse, N. Y.

CHARTER ENGINE USED

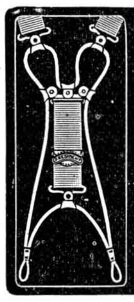
ANY PLACE BY ANY ONE FOR ANY PURPOSE

FUEL—Gasoline, Gas, Distillate. Stationaries. Portables. Engines and Pumps. Hoisters

Send for Catalogue and Testimonials.
State Your Power Needs



CHARTER GAS ENGINE CO., Box 148, STERLING, ILL.



NOT an ordinary suspender

PRESIDENT SUSPENDER

has a principle of its own. Refuse imitations. If it has "President" on the buckles it's genuine. Trimmings can not rust. Sold everywhere, 50 cents, or by mail. C. A. EDGARTON MFG. CO. Box 222, Shirley, Mass.

PATENT AERIAL

WIRE ROPE TRAMWAY

(Trade Mark Registered.)

For Transportation of Ore, Coal, Dirt, Timber, etc.

Perfect Grip Clip. Absolutely Safe. Loads Automatically. Unloads Automatically. Operated by One Man. Cost of Maintenance Low. Capacity Largest Obtainable.

A. LESCHEN & SONS ROPE COMPANY, Home Office, 920-922 North Main Street, St. Louis, Mo.
Branch Offices, 47-49 South Canal Street, Chicago, Ill. 92 Centre Street, New York.

Crestmobile

PRICE $550

Simple and Comfortable.

CREST MFG. CO. Cambridge, Mass.

MAGIC LANTERNS

STEREOPTICONS and VIEWS for Public Exhibitions, Church Entertainments, for illustrating sermons. Many sizes, all prices. Chance for men with little capital to make money. 260 page catalogue free.

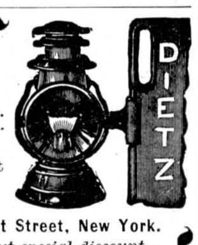
McALLISTER, Mfg. Optician, 49 Nassau Street, N. Y.

RUST ON GUNS TOOLS & CYCLES PREVENTED BY MANNOCITIN C.H. BESLY & CO. CHICAGO ILL. U.S.A.

TUBULAR DRIVING LAMP.

IT is the only perfect one.
IT will not blow or jar out.
IT gives a clear, white light.
IT is like an engine headlight.
IT throws the light straight ahead from 200 to 300 ft.
IT burns kerosene.

Send for book (free).



R. E. DIETZ CO., 60 Laight Street, New York.

Mention this paper and get special discount.

ESTABLISHED 1840.

We Guarantee Our Telephones or Money Refunded.

2 Battery Call Telephones for $4.50

Good for 600 feet

Metallic Circuit.

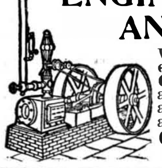
2 Generator Call Telephones for $7.50

Good for 3 miles single Iron Wire.

"Batteries included." Sent C. O. D. if $1.00 sent with order.

FARR & FARR, 119 W. Jackson Boulevard, CHICAGO.

ENGINES, BOILERS AND MACHINERY.



When you want good rebuilt machinery at bargain prices, write for our Catalogue, No. 323. We carry all kinds of engines (gas, gasolene and steam power), boilers, pumps and mill supplies in general.

CHICAGO HOUSE WRECKING CO., West 35th and Iron Sts., Chicago.

Scales All varieties at lowest prices. Best Railroad Track and Wagon or Stock Scales made. Also 1000 useful articles, including Safes, Sewing Machines, Bicycles, Tools, etc. Save Money. Lists Free. CHICAGO SCALE Co., Chicago, Ill.

— TO — Typewriter Buyers

The makers of the "Standard Remington" Typewriter, placing great value and dependence on the name "Remington," have just obtained (subject to appeal) a decision of the United States Circuit Court in Vermont, looking to the suppression of the names "Remington-Sholes" and "Rem-Sho" upon, and in the sale of, the

"Rem-Sho" Typewriter

Depending not upon the name and advertisement, but upon actual trial to sell our machine, we defend this litigation in vindication of our rights. The excellent names of our founders, Messrs Remington and Sholes, could not sell their machine in 1895, when it was young and crude. Now that it is perhaps the most perfect made, the possible loss of these names cannot stop its sale.

We, therefore, unhesitatingly call public attention to this litigation as the greatest endorsement of our machine and best proof of our good faith in selling. We shall promptly obey the ultimate order of the Court, and, if we must, shall try to find better names. It would be hard to find a better machine.

If you are interested in Speed-Writing, Billing, Index Card Writing, Etc., send for our McTurran Booklets.

Remington - Sholes Company
Dept. P, 127 Rees Street, Chicago.

Our Choicest Knife.

Chauncey Depew's Pet.

3 blades (1 is a file), razor steel, German silver back and ends, pearl sides, finest temper, price $1.50 in chamois case, postpaid. Nothing finer made. 2 blade jack knife, 50c. Mechanic's 2 blade shop knife, 75c. Illustrated 80-page List free and "How to Use a Razor."

MAHER & GROSH CO., 40 A St., Toledo, Ohio

ARE YOU DEAF? There is hearing for you in using Wilson's Common Sense Ear Drums

Thousands testify to their benefit. Physicians recommend them. Invisible, comfortable, safe. They fit in the ears. *Beware of imitations.* The WILSON is the genuine. Information and letters from users, free. Wilson Ear Drum Co., 420 Trust Bldg., Louisville, Ky.