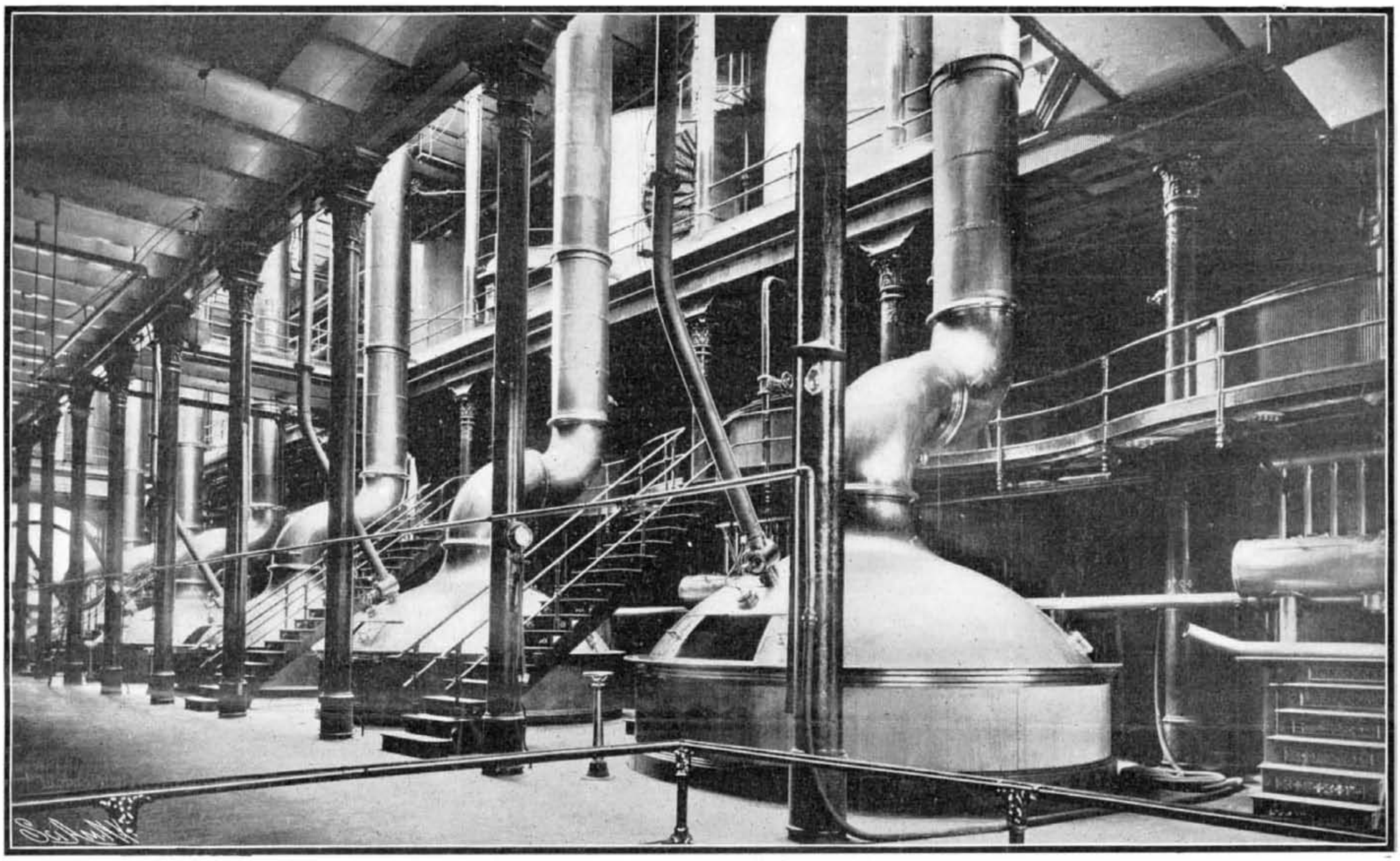
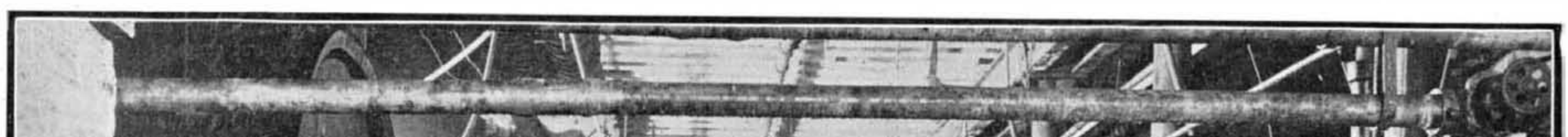
SCIENTIFIC AMERICAN

[Entered at the Post Office of New York, N. Y., as Second Class Matter. Copyright. 1904, by Munn & Co.]

Vol. XC.—No. 25. ESTABLISHED 1845. | NEW YORK, JUNE 18, 1904. | [8 CENTS A COPY $3.00 A YEAR.]



The Great Brew Kettles—Capacity, 2,500,000 Barrels a Year.



The Manufacture of Pure Beer from Pure Barley Malt and Hops.

MALTING AND BREWING CONDUCTED ON SCIENTIFIC PRINCIPLES.—[See page 480.]

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 Monthly (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, New York.

NEW YORK, SATURDAY, JUNE 18, 1904.

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

MILITARY AND STRATEGICAL VALUE OF OIL FUEL.

It is for very weighty reasons that the United States navy has been engaged in a most searching investigation of the question of oil fuel for the navy. Although it is true that the whole industrial world will be benefited by the voluminous data of the most reliable character that will be available, it was, primarily, to learn the exact value to the navy as regards the efficiency of its ships, both individually, considered as fighting units, and collectively, in respect of their strategical efficiency in relation to the fleets and fortifications of friend and foe, that this investigation was begun some two years ago.

The superior advantages of oil fuel over coal as affecting the design of warships and their subsequent handling are well known. In the first place, oil, because of its superior heating qualities, weighs less and occupies less bulk, compared on a basis of total thermal value, than coal. Therefore, the difference in weight and bulk in a ship designed to use oil fuel represents so much weight that may be worked into that ship to improve her qualities, either by building her stronger in the hull, or by making a proportionate increase in the weight of her armor or in the number of her guns, or by providing her with a larger fuel supply.

Oil fuel has, moreover, the valuable quality that it can be stowed in the water-tight compartments of the double bottom of the ship, thereby permitting the very considerable space which is taken up by coal bunkers to be utilized by the naval constructor for other purposes, if he so desires. The effect of the substitution of oil fuel on the personnel of the ship would be to make a great reduction in the fire-room staff, the crowd of stokers being replaced by a few men with some slight engineering knowledge, who would be easily able to look after all the necessary pipe connections and burners for carrying the oil to the boilers and properly burning it in the furnaces. Furthermore, much of the delay, and all of the dirt and inconveniences, which make the work of coaling a ship the *bête noir* of the naval man, would be removed; since the oil could be piped by gravity from the tanks of the fuel supply station, or pumped from the fuel supply ship, directly into the tanks of the warship. Finally, there is the welcome riddance of ashes, with their necessary installment of ash hoists and chutes, to say nothing of the labor involved in their removal.

The question of the extensive use of oil fuel in the navy has a special strategical importance for the United States, and this for the reason that we are next to the largest, if not the largest, producers of oil fuel in the world. Comparing our position with regard to this question with that of other great naval powers, it may truly be said the oil fuel question is paramount, no other leading naval power being able to tap its supply of oil directly from so many widely-scattered centers. Thus, the great oil fields of Louisiana and Texas lie within pipe-line distance of the Gulf of Mexico, the value of the naval control of which by the United States is universally admitted, particularly with reference to its relation to the Panama Canal. The oil fields of Pennsylvania are connected by pipe line with the three great ports of Baltimore, Philadelphia, and New York, thereby serving the ships of the North Atlantic station at three different points; while on the Pacific coast, the port of San Francisco is similarly connected with the oil fields of California; and, from this last source, it would be possible to keep supplied the storage tanks of fuel stations at three widely distributed points, namely, the Hawaiian Islands, the Philippines, and the Aleutian Islands. Of course, it must be recognized that the storage of fuel at various stations answering to coaling stations would require special provisions as compared with the storage of coal, since the oil must necessarily be placed beyond the reach of shell-fire from a hostile fleet. To this, however, oil fuel would lend itself admirably, since the tanks could be placed inland, beyond the range of hostile fire, and the oil piped from these tanks to the docks. A further valuable advantage of the use of oil would be that the most important problem of coaling at sea would be simplified; since it would be sufficient to connect the tanks of the fuel supply ship by flexible hose with the fuel tanks of the warship, and pipe the oil from one to the other while the supply ship was in tow.

SURFACE INDICATIONS OF OIL.

The discovery of new oil fields in Kentucky, and the bringing in of gushers from time to time in fields hitherto unsuspected of being oil-bearing, has served to create great excitement in a part of the public mind. Prospectors study the trend of the land, and owners of real estate easily become convinced that their holdings will produce oil in vast quantities, if only some company could be persuaded to drill. It is a fact that large oil producers do not prospect; they leave that dangerous business to the professional "wildcatter," and when he has located a new, rich territory, they buy him out.

The greater part of the facts with which geologists have to deal possess for the general public a recondite character. They concern things which are not within the limits of familiar experience, and are usually treated in such a manner as to befuddle the understanding of the unschooled in geological lore. Perhaps no question pertaining to geology has been so earnestly and so often asked as, "What are the signs that reveal the presence of oil?" But the Sphinx of geology remains silent, notwithstanding wealth beyond the dreams of avarice waits upon him who, judging from surface indications, might infallibly point out the presence of oil beneath. So eager are men to have the question answered, that they strain the facts that are well known to exist, and persuade themselves that they have discovered the secret sign which nature has set upon her treasure house. When this thirst for wealth takes hold of one, nothing will quench its fire but actual experiment.

It may be generally said upon the highest authority, and in the light of experience in every oil field in the world, that surface indications cannot be relied upon to reveal the presence of petroleum in the underlying strata. It would seem that nothing has been more positively and definitely settled than this; and yet with the spread of discoveries of new fields, also spreads the belief that such and such localities are situated over inexhaustible quantities of the fluid. Every day brings confirmation of this.

Now, in countless neighborhoods, and practically in every State in the Union, there are "signs" of oil that incite the finder to extravagant statements and rouse his wildest hopes. The spring that trickles from the rocks bears upon its clear water little globules of oil, apparently brought from the depths of the earth; the stagnant pond nestling among the little hills has an oily cast, and a smell of oil pervades the air about the place. These signs are taken to mean that there is an immense reservoir of oil, so full that it is fairly bursting, and some of the overflow has appeared upon the surface. No heed is given to the fact that in order to reach the surface those few drops of oil would have penetrated hundreds of feet of rock and shale which overtop the oil-bearing strata in every field and form an impervious cover to prevent the escape of oil. Those surface indications mentioned are common manifestations. They indicate the presence of decaying or decayed vegetable or animal matter in the depths from which they spring. A rotting carcass in the pond will create a gas, and ultimately globules of oil will float to the surface. In the absence of animal matter, then, the appearance of the oil signs may be accounted for by rotting vegetable matter, which has accumulated year after year, until the chemical change has been effected, and oil appears where once was vegetable life. In the case of the spring bursting from the depths of the earth bearing particles of oil upon its surface, it must be admitted that there are some very creditable and learned geologists and oil experts who insist that it is a "sign" of oil in immense quantities. It cannot be taken as an infallible sign, however, nor should any importance be given it at all. As has been said, though, so eager are persons to discover a deposit of oil in their land, that even slight indications produce a very great hope and incite to wildest speculation. The spring water in percolating through the rocks has come in contact with a slight deposit of decayed vegetable matter, which it has caught up and carried to the surface of the earth. Geologists' theories in some instances controvert this statement, and credit the presence of oil on the water of a spring to the fact, which is claimed to be self-evident, of the uprising of oil particles from a reservoir below. It seems altogether probable that the oil found in the rocks at various depths is of widely different ages, according to the location in which it is found. That which is observed to rise above the surface on the streams of springs may be but comparatively a few years old, while that found in the stratum underlying the shale and rock certainly is centuries old. There are Cambrian, Ordovician, Silurian, Devonian, Carboniferous, Triassic, Jurassic, Cretaceous, and Tertiary petroleums. Each of these varieties is found in a geological structure which is unlike any of the others in points of age and formation. Hence the position seems well taken that the surface oil appearing on streams of water may be of comparatively recent creation. The best authorities agree that the oil found in the reservoirs underlying the overtopping and impervious shales is not being added to, that its volume remains stationary, and when it is exhausted there will be no source from which the supply can be renewed.

The facts of geology seem to show, too, that it is exceedingly improbable that oil has been transferred in a large way from one formation to another in the geologic column. That there has been some transfer of oil in the rocks is beyond question. It is associated with water, and gravitation will always raise it to the highest point in the stratum in which it happens to be. As in the case of the spring, the water in rising to the surface caught up the particles of oil, and conducted them to the exit in its formation. Doubtless, or at least very probably, the oil had appeared in the stratum which contained the water from a substratum, from which it had escaped through some crack or orifice, and assisted thereto by a mounting stream of water or shale gas, which latter is to be found in almost every crack and crevice of stratified rock of a porous nature. If the reservoir in which the modicum of oil was contained were fractured at the summit of an arch, the oil, which is very mobile, will follow the lines of escape to the surface, and, as a matter of course, diffuse itself through any porous beds of stone or shale which the fracture crosses. With these escapes of oil we are very familiar. We call them surface indications, and some geologists aver that they may lead to the storehouse from which they escaped. This has never been proved, so far as known, and it is extremely doubtful if its truth can be demonstrated; for it would be a devious course to follow the track of a particle of oil through cracks in the rock so fine as to be all but imperceptible. A porous rock is often found stored with petroleum or its by-products, evidently derived from a stratum or bed directly underlying it. The most common form of such occurrence is a sandstone overlying a carbonaceous shale.

When such a series rises to the surface, the porous rock is often charged with maltha, resulting from the oxidation of the original petroleum. If this sandstone is used for building purposes, the tar is often seen exuding from it, even for a term of years. Tar springs, so called, have a like origin, the escaping water of the porous rock carrying out some of the inspissated petroleum.

So much for the actual and visible presence of oil on the surface in relation to its value as an indication of the stored reservoirs of the fluid below. The usual forms of surface indications are as described, but there are others said to be vastly superior to the foregoing. To repeat the reported experience of Capt. Lucas, who discovered the great Beaumont, Texas, field, will sufficiently describe these "superior" indications. Capt. Lucas is said to have followed the surface indications from Louisiana to Beaumont. This was done with full knowledge that when the signs appeared for which he was looking, oil would be discovered in exhaustless quantities. The probability is that this story is not correctly stated. He is said to have followed the synclines, monoclines, and anticlines from Louisiana to Beaumont, in spite of the fact that those structures are far below the surface of the earth, the contour of which has never been known to have been revealed, or indicated, or suggested by the outlines of the earth's surface.

To repeat what has so often been said, if research in oil fields has proved anything, it is that surface indications do not indicate the presence of oil in reservoirs below.

FINE PERFORMANCE OF THE BATTLESHIP "KENTUCKY."

BY LIEUT. R. W. MCNEELY, U. S. N.

The U. S. S. "Kentucky," which has just returned from the Asiatic station, made some remarkable records at recent target practice with some of her guns, these results being largely due to new devices invented by her officers. In these improvements the question of sights for naval guns was the one that received most attention; for it was discovered that, when more care was taken to plot the exact spot of fall of shots, our sights were of too frail and obsolete design; for such close observation and good shooting cannot be accomplished unless one has good sights.

The custom formerly had been for each gun pointer

to make his own allowance for speed, wind, etc., by aiming to the right or left of the target, as the case might require. This inexact method was entirely done away with during the recent four-year cruise of the "Kentucky," and mechanical means have been substituted, whereby the sights can be turned in azimuth, so that exact allowances can be made, while the gun pointer is always looking at the spot to be hit. In the 13-inch and 8-inch turret sights, this is accomplished by mounting the telescope on vertical trunnions, motion being given by a graduated sliding wedge, the telescope being held against the wedge by a heavy flat spring. The changes in elevation are made by a drum and screw, as in the older design of sights. All these parts are massive, and have large excesses of strength. The turrets are trained by one man, the trainer; and each gun is pointed by another man, the pointer, who fires the gun. These men are of necessity not stationed close together, and it is therefore obviously difficult to have all the sights of the turrets moved or "set" together, although that is greatly to be desired. Just here it may be mentioned that one of the disadvantages of the superimposed turret made itself evident when our navy began to take up the question of accurate shooting. It is obvious that the drift which is inherent in all rifled cannon, but different for each caliber, is not the same for the 13-inch as for the 8-inch guns; therefore, when the turret is trained exactly on the target for the 8-inch guns, the 13-inch is slightly off. This inaccuracy is of no importance as long as only one gun of the turret is firing, but when both sets of guns are firing, the error will be introduced.

The chance of premature explosion of a loading charge in the turret guns by burning particles and ignited fumes has long been recognized, and ingenious and effective means were used aboard the "Kentucky" on the Asiatic station, during the recent target practice, to drive these dangerous foes out of the gun on opening the breech. One of these was to make a "closed stokehole" of the turret, by introducing an atmospheric pressure in the turret chamber of about one-half inch. Another was to direct a compressed air jet on the breech during opening. Both these methods drove every particle of cinder, residue, or fume out of the muzzle, and left a clear chamber, so that it made no difference what had been the material of the powder-bag, or whether the fumes ignited or not. Many shots were fired with an interval between shots of 30 seconds; which is many times the speed originally thought possible with some of our 13-inch turret guns.

With the 5-inch battery of the "Kentucky," some novel ideas were introduced for the first time, and it was with these guns that the most remarkable records were made. The original sights of these guns were not arranged so that the correction in azimuth (for speed, wind, etc.) could be given to both sights at once by the sight-setter, but this drawback was removed by introducing a heavy bar, which gave parallel motion to the two sights. Formerly, it had been the custom for the sight-setter to set one sight, then run around to the other side of the gun and set the other sight; but while he was doing this, the range having changed, large errors crept in. With the new sights, the sight-setter stands in a fixed position, and sets both the range and lateral correction at once for both sights. Longer and more powerful telescopes were used, and, in fact, the pointer could see the hole made in the target by his shot—a very pleasing sensation. In the Morris tube drill, as used in these guns, which has been described in the Scientific American, all the members of the crew were drilled except the sight-setter, who happens to be one of the most important men at the gun. A device was mounted on the larger guns which gave range and lateral movement to the Morris tube, while these movements were known to the officer. The Morris tube was set at various ranges, these ranges being given to the sight-setter, as at target practice, and unless he set his sights correspondingly, the Morris tube would miss the bull's eye. It must be remembered that the large gun was loaded with a dummy cartridge at the time of loading the Morris tube, so that every movement of firing was given to the crew except the actual shock and noise of discharge. Strange as it may seem, nothing but percussion primers, which many ordnance experts think obsolete, were used. The lanyard used to fire the gun was pulled by an electro-magnet, and the interval between the time the pointer "willed to fire" and the actual "discharge" was the same as in purely electric primer fire. The contact for the electro-magnetic circuit was led to a platform attached to the revolving part of the gun-carriage, on which the pointer stood. This platform allowed the pointer to stand in a fixed position while the gun was in motion, and also gave him the use of one free leg and foot with which to fire the gun by pressing the contact. The platform also gave the pointer the use of his right hand (which is generally exclusively used for firing) to assist his left hand in working the gun. It is not so remarkable, but rather natural, that the remarkable record of eleven hits in one minute was made under these favoring conditions.

It is the custom nowadays to have a practising device known as the "loading machine" on board each ship. This device is arranged so that the drill cartridges are the same shape, size, and weight as those used for actual firing, and each day the crews were drilled at this machine. This drill gives the crews fine physical exercise as well as team work. Since the renaissance of naval ordnance, about two years ago, improvements, discoveries, and changes are being made in drills as well as in material. Thus, nowadays, the drill officer has become a "coach," and the crew become a "team." It was by these means, coupled with the improved sights, that it became possible to fire twelve rounds in one minute with a 5-inch gun, and to make eleven hits, range 1,600 yards, speed 10 knots; something that nine months ago would have been thought impossible.

The smaller guns of the "Kentucky's" battery consist of 6-pounders, 1-pounder Hotchkiss R. F. guns, and 1-pounder Maxim-Nordenfelt automatics. The day of non-automatic guns below a 3-inch R. F. is past; and as the 6-pounder and 1-pounder R. F. guns did not develop any new ideas, they will not be described.

Happily, the extreme usefulness of the torpedo became evident to our navy before the Russo-Japan war brought that question before the world, and our navy will soon regain the time lost while the experts were fighting it out academically.

The question as to the ultimate age of naval guns, which is so often asked, is a question of the quality of the powder used in the gun. The English prefer a nitroglycerine compound, and as the temperature of combustion is very high—higher than the fusing point of steel—at each discharge a thin layer of the bore of the gun is fused or pitted, until the bore is eroded or worn out. In our navy, a pure nitro-cellulose powder is used, and its temperature of combustion is lower than the fusing point of steel. Therefore, on discharge, the bore is not fused or eroded, and the life of our guns is practically indefinite. The English are now adopting a nitro-cellulose powder.

The "Kentucky" class of ships has often been called "wet" because of their low freeboard forward. This is undoubtedly a disadvantageous feature, which in the newer ships is overcome by raising the freeboard; but it must be understood that the "Kentucky" could have fought all her main battery guns in any weather that she experienced during the last three years.

The electrical department of this ship is unusually complete, and not only are all of her turret motors electric, but the ammunition hoists, deck winches, and boat cranes are electric. Her bunker chutes load directly to her coal bunkers, and this feature, combined with fast electric deck winches, makes a rapid and easy ship to coal. Her crew in one working day put in over 1,100 tons of coal. These points all combine to make her, in spite of her age, a very valuable ship for our fleet.

The steam engineering department, which furnishes the propelling power, is the one which generally suffers the most deterioration in a three or four years' cruise; but this rule apparently does not apply to the "Kentucky." Since she left the United States in November, 1900, she has cruised 65,000 miles, and, if necessary, she could immediately repeat this excellent performance, although the ship has been kept on the go, and therefore away from dockyard repairs for over three years and a half. The following is a brief description of the steam engineering department. Steam is furnished at 180 pounds pressure in five Scotch boilers, three being double-enders and two being single-enders. The two main engines are direct-acting vertical triple-expansion. The propellers are three-bladed. The ship was designed for a forced-draft speed of 16 knots, or about 110 revolutions per minute of the main engines. Last year the Secretary of the Navy ordered the "Kearsarge," a sister ship, to make a natural-draft trip across the Atlantic Ocean. The "Kearsarge" was put in order for this trip, which was to be a record breaker. She did well, having covered 2,800 miles at an average speed of 13.4 knots per hour, or 87.5 revolutions per minute. No special orders were issued to the "Kentucky" on her homeward trip to break records; but nevertheless that was done, as she steamed 2,900 miles under natural draft, crossing the Atlantic at an average speed of 13.82 knots, or 91.1 revolutions per minute. The maximum speed of the engines on the trip was 98.8 turns per minute for four hours, or over 15 knots for the ship per hour. The consumption of coal per diem averaged about 135 tons, and enough coal for over three days' steaming at full speed was in her bunkers on arrival at Tompkinsville on May 21, 1904.

A scheme for an elevated reservoir at Tallah is now exercising the minds of the Calcutta Water Supply Commissioners. The reservoir is proposed to be of steel construction and will hold 5,000,000 gallons. It is to be elevated to a height of 85 feet by means of a series of braced steel pillars.

SCIENCE NOTES.

A very interesting discovery has been made in the Etruscan necropolis of Tarquinia. It consists of a coronet of modern shape, three thousand years old. Two hundred tombs containing helmets, a breastplate of gold, amulets, vases, etc., have been opened, showing that Etruscan civilization was far superior to that of the Romans. The collection will be offered for sale after the Italian government has appropriated one-fourth of it under the law.

In No. 7 of the Physikalische Zeitschrift (April 1, 1904) Prof. Wladimir de Nicolaïève arrives at the conclusion that electrostatics in its present form is a fiction. In order to agree with the experimental facts, this science should be transformed, and its formulæ should be made to include the electric conductivity in addition to the permeability; the formulæ of electrostatics, from which the forces acting on an isotropical dielectric substance are calculated, fail to be of any use when applied to some experiments described by the author.

Sir Norman Lockyer, the British astronomer, has advanced a remarkable new theory concerning the utility of sun spots. Our knowledge of sun spots is distinctly limited, and Sir Norman Lockyer contends that the discovery and understanding of these phenomena will prove one of the most beneficial additions to the world in general. He advances the theory that such knowledge may enable astronomers to convert the sun into an agent to enable us to cope with droughts and famines, and that the spots on the sun may render it possible to predict with practical certainty the coming of famine and the exact part of the world where it will take place.

A discovery of great archeological interest has been made at Cheddar, England. In the course of cutting a trench for drainage purpose through a bed of cave-earth, the skeleton of a man of great antiquity was excavated. Although the skull could only be removed in pieces, it was possible to determine that it was that of a man of a period intermediate between the paleolithic and neolithic ages. The bones of the leg exhibit the characteristic flattening peculiar to those of that period. The frontal bone of the skull is thicker than that of the present day, while over the eyes a decided boss of bone demonstrates that the brows were very prominent. Judging from the size of the skeleton, the height of the man was about 5 feet, 3 inches. In close proximity were found several flint flakes and knives.

In a paper published in No. 8 of the Physikalische Zeitschrift (April 15, 1904) Prof. F. Himstedt arrives at the conclusion that radio-active bodies giving off a gaseous emanation are widely diffused throughout the earth. These emanations are absorbed by water or by petroleum; and after having been conveyed along with the latter to the surface of the earth, will diffuse into the air. Because of the many analogies noted between these emanations and radium emanations, the author thinks it possible that both are identical. In this case the ores of uranium from which radium emanations are derived would either be widely diffused, or else there would be some further matters possessing, though to a lesser degree, the property of giving off emanations. Considering that the absorption coefficient of water as well as of petroleum with respect to this emanation is found to decrease for increasing temperatures, while hot fountains on the other hand show an especially high activity, the hypothesis is suggested that the amount of radio-active material is increasing for augmenting depths, and, according to Curie's observation as to the continual heat evolution from radium, the radio-active components of the earth should possibly have to be allowed for in accounting for the temperature of the earth.

Some interesting demonstrations have been carried out in London with a new photographic art material called "photolinol." This fabric is composed of linen, which is thoroughly permeated with the photograph, producing a high translucency. One very picturesque effect obtained by this means is that the picture, when colored and viewed with a reflected light, bears a very strong resemblance to an oil painting, the lines of the weaving of the linen appearing similar to the canvas in a painting. Photolinol is waterproof and indestructible, while the photograph does not fade in the sun, as it appears to be woven into the material. By its aid much greater enlargements than are now possible can be made with ease. The fabric can be made to any size, some of the enlargements shown being ten feet square. It is applicable to an extensive variety of purposes. As it is transparent, it can be adapted to lamp shades and other ramifications of photographic art for which transparencies are now employed. Novel results can be obtained with it, for the picture appears with equal distinctness on either side by either reflected or transmitted light. The process is a secret one, but its commercial utility and value are already asserted, since it can be employed for curtains, screens, or theatrical scenery. For the latter is is peculiarly adapted, and is both cheaper and more durable than hand-painted scenery.

THE DREDGER "MARQUESS."

The "Marquess," a bucket dredger with a single ladder, has been recently constructed by A. F. Smolders at Rotterdam for the Cardiff Railway Company. The entire hull is of mild steel. The length of the deck is 136 feet, 3 inches; the width, 24 feet, 7½ inches; and the depth, 10 feet. The bucket ladder is 88½ feet in length. It is strengthened by crossbraces, and fitted with cast steel rollers mounted upon steel axles. The buckets have a capacity of 19 cubic feet, and are of Siemens-Martin steel. The upper tumbler of the dredger is quadrangular and is a single steel casting, while the lower one is cast in two halves. The edges of the tumblers are protected against wear by pieces of hard steel. The height of the upper tumbler above the load water line is 28 feet. The discharge chutes, which are of Martin steel, are provided with friction bearings and are set at 30 deg. from the vertical, one on each two sides of the dredger. The buckets can be made to empty into one chute or the other by means of a valve. The stationary chutes are provided in the center with a slide that recedes from or approaches the bucket chain, so as to reduce the waste to a minimum. They have, in addition, two movable extensions that may be raised or lowered by means of windlasses. All these parts are actuated from the deck. The motive power is transmitted by two camel's hair belts running over pulleys keyed to the crank and transmission shafts. The transmission is so arranged that the buckets pass over the upper tumbler at the rate of 16 a minute. The transmission by belt has the advantage that if the buckets meet with an obstacle, such as a rock say, or a tree-trunk, the belt slides. Consequently, a possible breakage of the chain is prevented.

The engine is of the compound type, fitted with a surface condenser and a reverse. The diameter of the high-pressure cylinder is 19 inches, and that of the low-pressure one, 26⅜ inches, while the stroke of each is 19¾ inches.

The boiler is of the type usually employed on sea vessels. It is of Siemens-Martin mild steel with two furnaces. The diameter of the body is 8 feet, 10½ inches; and the length, 10½ feet. The diameter of the furnace is 2 feet, 9½ inches. There are 112 3-inch tubes in the boiler. The heating surface is 860 square feet. The effective pressure is 105 pounds.

The dredge is provided with five steam windlasses. One of these does duty for the ladder, two others for the two lateral chains, a fourth for the bow chain, and the fifth for the three stern chains.

In addition, there are two hand windlasses for manipulating the discharge chutes. The dredger is lighted entirely by electricity. The current is furnished by a continuous-current dynamo and is capable of supplying a total of 1,600 candle-power.

There are cabins for the captain, mate, the engineer, the fireman, and the crew.

The dredger operates to a depth of 45 feet beneath the surface of the water. At the time of the experiments made in the Cardiff channel, it dredged and discharged 4,536 tons of material into lighters in 319 minutes. The average work was therefore 853 tons an hour. The minimum was 732 tons per hour, and the maximum 1,030. The contract called for 650 tons per hour for work in compact clay, gravel, and sand, and for 325 tons for work in marl. The same chain and buckets naturally had to work in both cases. The requirements of the contract were therefore largely exceeded.

THE BERTHIER ACTINO-ELECTRIC TRANSFORMER.

BY EMILE GUARINI.

Although it is as yet remote, a day will come when we shall be obliged to direct our whole attention to the utilization of natural forces, or at least of such as we do not at present consider the utilization practical.

Although it is true that water courses and water falls have received numerous applications—yet far less numerous than they might have received—in the majority of countries there are, on the contrary, other natural forces, such as the wind, which can be made use of everywhere, and the tides, which are very pronounced in certain countries, and the applications of which may be relied upon with confidence. There is one, even, which has as yet been utilized scarcely at all, and that is the sun, at least in countries in which it shines more or less frequently; and perhaps this same sun will, in the years to come, be made to give us nearly all the heat necessary to keep us warm in winter, and a large proportion of the power needed to run the machinery of the world, which is ever increasing in size and quantity. Something, moreover, has already been done in this direction, especially at Los Angeles, where a reflector of about thirty-three feet in diameter has been utilized for concentrating the calorific and luminous rays upon a steam generator that supplies a 15-horse-power motor.

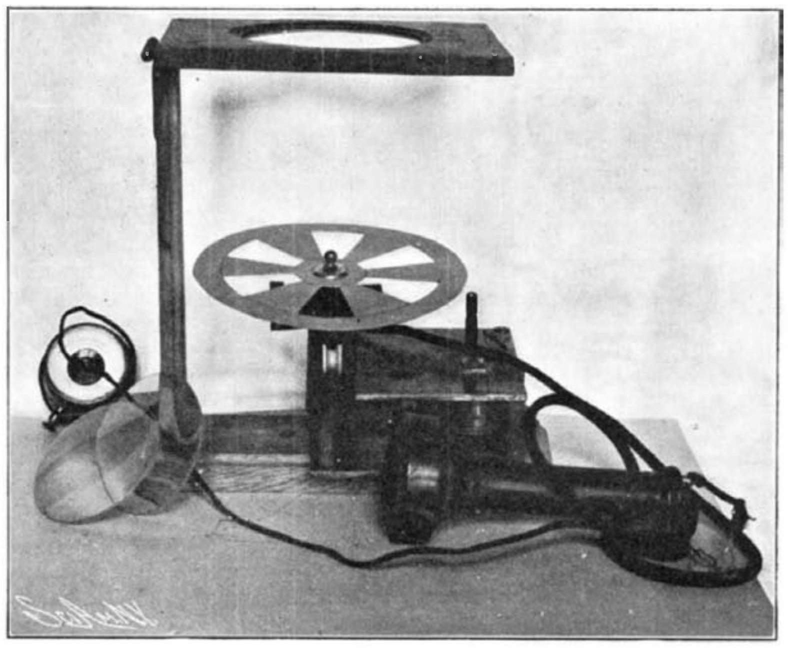


Fig. 1.—Arrangement for Producing an Alternating Current.

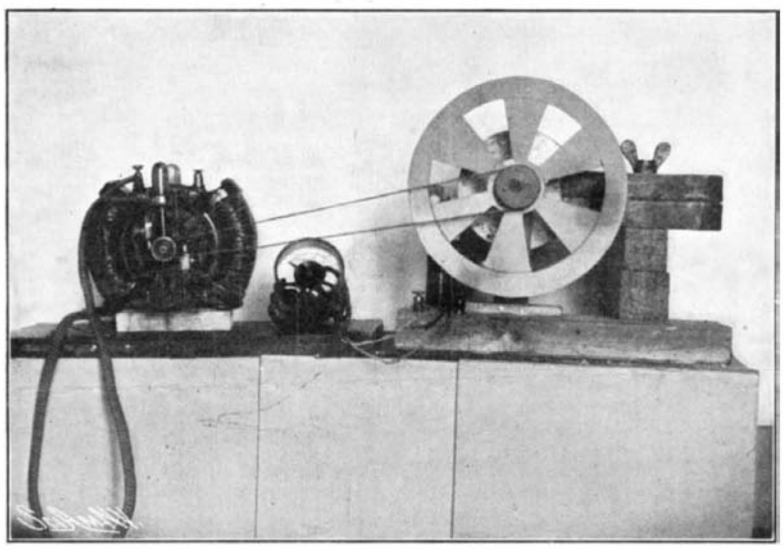


Fig. 2.—Arrangement for Producing a Direct Current.

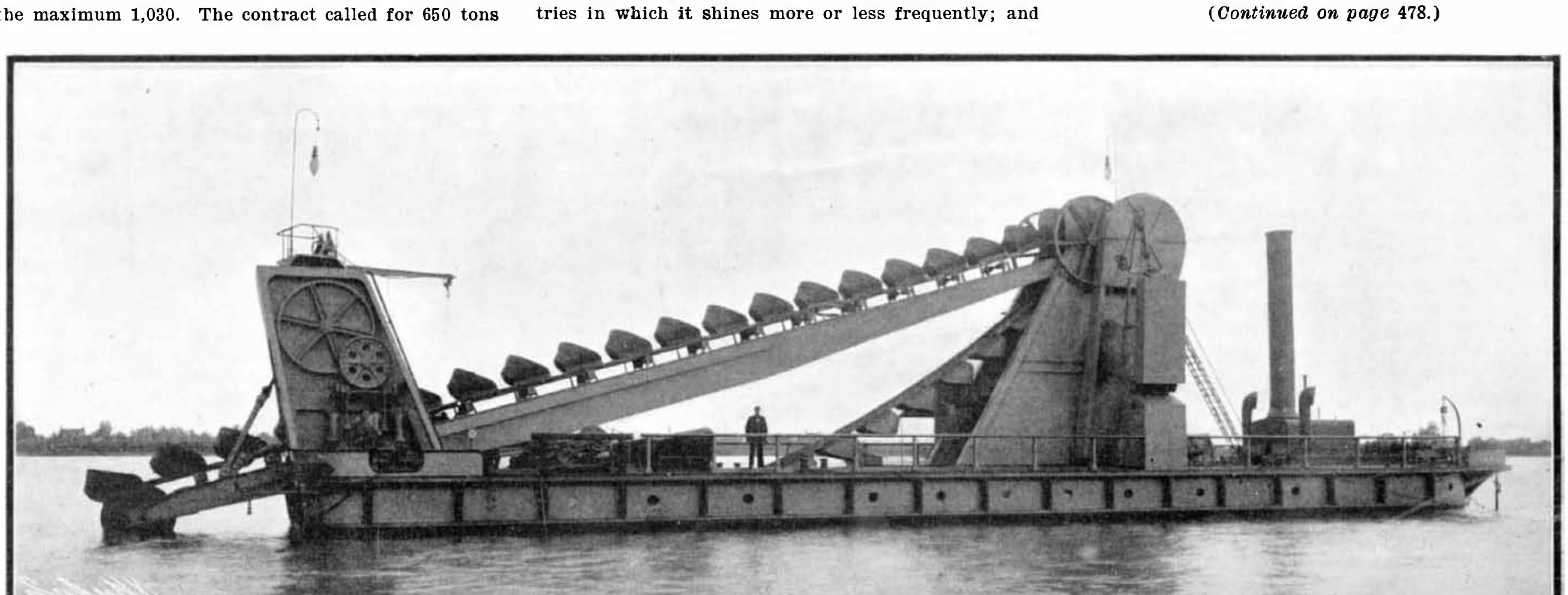
APPARATUS FOR PRODUCING ELECTRICITY FROM LIGHT.

M. Berthier, on the other hand, desirous of demonstrating to us once again the ease with which one of the numerous forms of energy may be changed into another, has entered upon an entirely different path, in aiming at the transformation of light into electric energy; and, with such an idea in view, has devised an actino-electric transformer, an apparatus capable of utilizing the property that selenium possesses of producing an electro-motive force under the influence of light. Such a result may be reached in two different ways: (1) By constructing an apparatus based upon the use of selenium submitted to more or less rapid variations in light, and, consequently, by utilizing the modifications in resistance; and (2) by constructing an apparatus in which the light shall act in a constant manner for the production of a constant electromotive force capable of being utilized. The second of these methods is not new. Prof. W. E. Adams long ago showed that a ray of light, falling upon a bar of selenium, develops therein an electro-motive force that gives rise to a current, and that the bar by this fact becomes temporarily converted into a small battery. I do not know why this property has not, up to the present, received practical applications, since it seems to me that nothing could be more easy than to form industrial actino-electric elements of the nature of thermo-electric batteries. The bars, connected in multiple, might serve for increasing the intensity of the current, and connected in series, for increasing the tension of the current.

The first of the methods mentioned above is new, and M. Berthier has devised a most interesting apparatus for the carrying out of it.

The inventor gives his apparatus two forms. By means of the first, he obtains an alternating current, and, of the second, a continuous one. The first form is represented in Fig. 1. A disk, provided with apertures and revolved by means of a clockwork movement, serves as a shutter and produces in the luminous pencil, concentrated by a convergent lens, a rapid series of interruptions. The pencil of light itself is directed upon a selenium bottom formed of quite a large number of thin strips of this metalloid and submitted to the action of the magnetic field of two powerful magnets or of two electro-magnets. The battery is placed at the point where the field possesses its maximum strength. The selenium battery is put in circuit with two coils secured to the extremity of the magnets. These latter therefore serve as cores. These coils are provided with another winding, which constitutes the induced circuit. It is connected with a telephone or any other apparatus in which, in a normal state, no sound is heard. There is therefore no current in the

(*Continued on page* 478.)



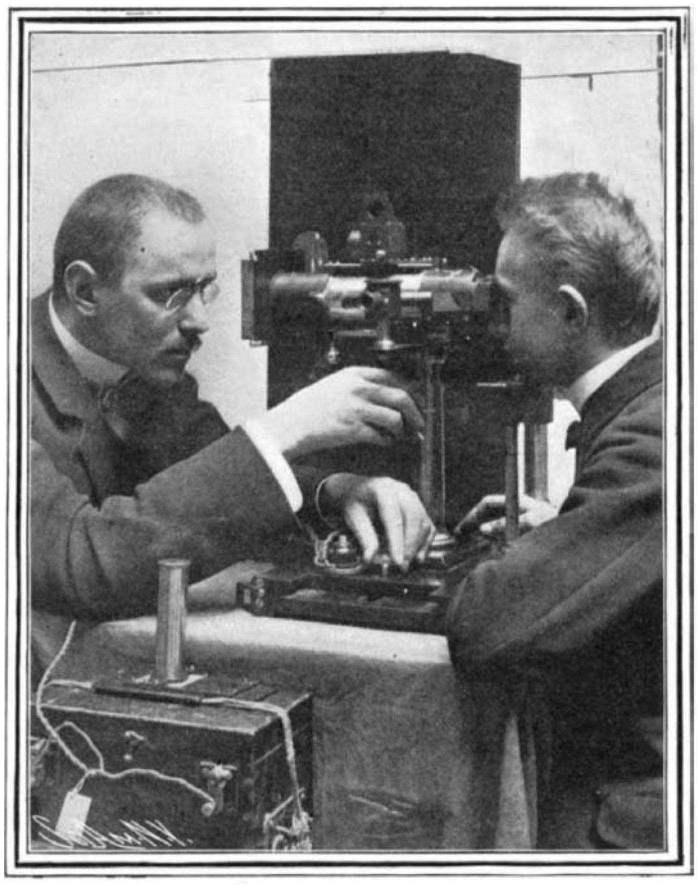
HUGE ENGLISH DREDGER "MARQUESS," CAPABLE OF EXCAVATING 1,030 TONS OF MATERIAL PER HOUR.

NEW APPARATUS FOR PHOTOGRAPHING THE BACKGROUND OF THE EYE.

Dr. Walther Thorner, of the University Eye Clinic at the Royal Chàrité in Berlin, has recently succeeded in solving a problem that has long occupied the minds of oculists, many fruitless attempts having been made heretofore to find a solution. His invention is an important one, and is a big step forward in the treatment of eye diseases. Dr. Thorner has devised an apparatus, by means of which it has become possible to photograph the background of the eye and obtain good pictures of the same. His contrivance constitutes a material improvement of the ophthalmoscope invented by Helmholtz in 1850, which latter device only admits of looking at the background of the eye. Owing to the peculiar construction of the eye, it has been impossible heretofore to photograph the interior or back of the eye. It is a matter of great difficulty to illuminate the interior sufficiently to take a serviceable picture, and even if strong sources of light were used, the exposure would last too long, rendering necessary a fixation of the eye, which in turn would entail serious inconvenience to the patient.

By means of his apparatus, Dr. Thorner first succeeded in obtaining photographs of the eyes of animals, particularly cats.

The interior of the human eye being much darker than that of the cat, it required many improvements to take good photographs of the interior of human eyes with the apparatus.



APPARATUS FOR PHOTOGRAPHING THE BACKGROUND OF THE EYE.

The result was highly successful, the changes proving perfectly satisfactory. We present to our readers a picture of Dr. Thorner's apparatus, constructed by the firm of Schmidt & Haenisch, of Berlin.

With the mild light of a kerosene lamp, the eye is first so focused that its back yields a clear image on the photographic plate, a telescope-like focusing glass forming part of the apparatus being used for this purpose. The focusing having been accurately done, and the plate put in, the camera itself is opened by pressure on a special lever, and a flash-light composition ignited by means of an electric spark generated in a storage battery. Thereby the background of the eye is lighted up sufficiently for a moment to produce a good image on the plate. Still, the pictures thus obtained are somewhat underexposed, and require special care in developing, to obtain the best results.

A large number of such photographs of diseased and healthy eyes have been reproduced by Dr. Thorner in his recent book, equally interesting to the profession as to laymen, entitled "The Theory of the Ophthalmoscope and the Photography of the Back of the Eye," published by August Hirschwald, Berlin.

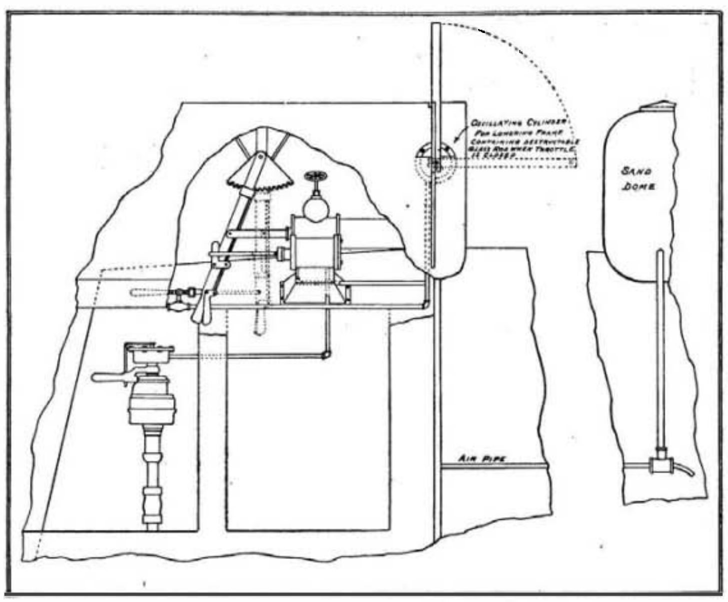
It is possible to distinguish healthy eyes readily from sick ones, the eye of a strongly short-sighted person being, for instance, characterized by a peculiar ring around the sun-like illuminated center. Oculists will now be enabled to watch the progress of eye diseases or disorders step by step. The apparatus also permits of taking a picture of any separate parts of the interior of the eye.

AUTOMATIC CONTROL OF LOCOMOTIVES.

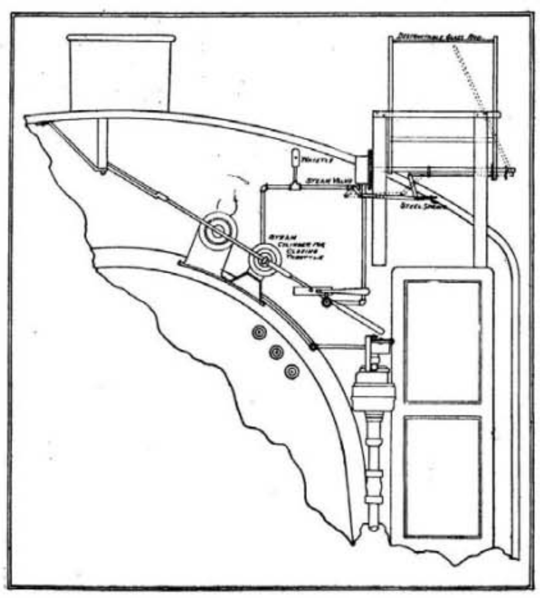
The shocking accidents which have recently occurred in the vicinity of New York city, on railroads fully equipped with block signal systems of the most improved type, and in perfect working order, have shown very forcibly that between these signals and the throttle of the locomotive, which they are supposed to control, is an unreliable human intermediary. The perfect system would, therefore, seem to be one capable of acting directly on the throttle when ignored or wrongly interpreted by the engineer. Many systems have been invented, but as we stated at the time of the Westfield horror, these are all open to the same objection, namely, that they are liable to destroy the watchfulness of the engineer, and then, should the automatic mechanism become disarranged, the chances of accident would be greater than ever. But this objection does not apply to the automatic signal system which we illustrate herewith, for it is so arranged as to increase, rather than diminish, the vigilance of the engineer. Every time a signal is ignored, the locomotive is automatically stopped, but at the same time a record of the fact is automatically made which the engineer must explain at the end of his run.

The mechanism employed in this system is very simple, and is clearly indicated in our detail views. Projecting above the cab of the locomotive are two parallel and vertical arms, the outer one of which is pivoted to swing sidewise toward the other arm, but is normally held parallel therewith by a glass rod interposed between the arms at their upper ends. The signal system along the track consists of the usual block signal semaphores, but in addition to these each signal post is equipped with a lever normally in a vertical position, connected to these semaphores. When the danger signal is set, this lever is swung to horizontal position over the track, so as to strike and shatter the glass rod carried by the locomotive. When the glass is broken, the pivoted arm swings to the dotted position shown in our front view of the apparatus. In so doing, by means of the lever connections shown, a steam valve is thrown which admits steam to the throttle-closing cylinder. As shown better in our side view, the piston rod of this cylinder is so connected to the throttle-lever as to first unlock it and then draw it to closed position. At the same time a valve is turned which throws the sand lever. When the throttle is closed, the piston in the throttle-closing cylinder uncovers a port leading to a valve which acts on the engineer's brake lever and sets the emergency brakes. Thus, the train is automatically brought to a standstill without the assistance of the engineer, and cannot be started again until a new glass rod has been placed between the pair of vertical arms. This, however, occurs only in an emergency, as the engineer is provided with a means for swinging the glass rod out of the path of the danger signal, and is held responsible for any failure to do so; but by means of an interlocking system, the throttle must first be closed before this can be done. The two arms which hold the glass rod are mounted in a swinging frame, so that they can be swung forward and downward, thus clearing the danger signal. The swinging frame is operated by an oscillating steam cylinder controlled by a valve lever near the throttle lever, but is locked by a rod extending from this lever. When the throttle is closed, this locking rod is withdrawn from engagement with the valve mechanism, permitting the latter to be turned to admit steam to the oscillating cylinder, which will then swing the frame to the dotted position shown in our side view. Owing to the interlocking connection of the valve with the throttle, the latter cannot be opened until the valve has been closed, shutting off the supply of steam and permitting the frame to swing upward to its normal vertical position. This precautionary device prevents the careless engineer from running his engine with the automatic mechanism in the inoperative position. Owing to the fact that engineers sometimes suddenly die or lose consciousness at their posts, a whistle has been attached to the steam pipe which leads to the throttle-closing cylinder, so that whenever the automatic operations take place, this whistle will sound a call to the fireman, who can come to the engineer's aid in case of necessity.

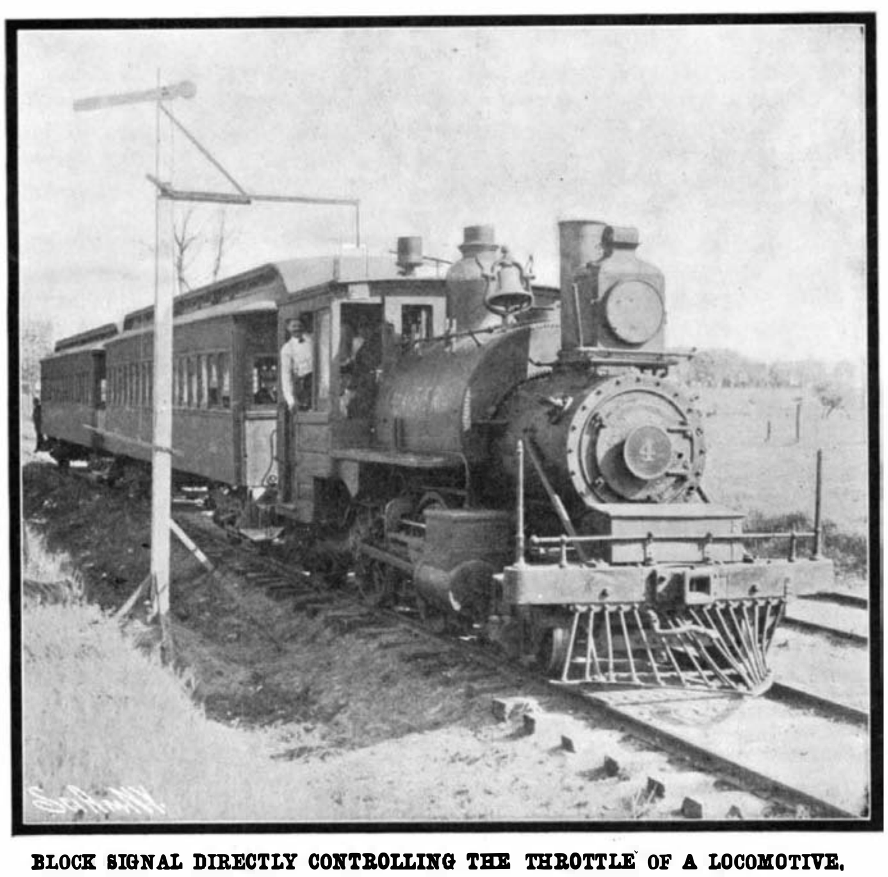
As a check upon the engineer for failure to close the throttle at each danger signal a time-recorder is placed in the cab, and this records each automatic closing of the throttle. Furthermore, each engineer is provided with a limited number of glass rods and must account for them all at the end of his run, giving satisfactory explanation for



Side View, Showing the Details of the Controlling Apparatus.



Front View of the Controlling Apparatus.



BLOCK SIGNAL DIRECTLY CONTROLLING THE THROTTLE OF A LOCOMOTIVE.

any missing ones. We recently witnessed a very interesting test of this system on a branch line of the Long Island Railway, which proved the efficiency of the apparatus beyond a doubt. The accompanying photograph shows the locomotive used in this test approaching one of the danger signals along the line.

Santos Dumont's New Airship.

Santos Dumont's airship No. 7, which is to be used at St. Louis, has been overhauled and considerably modified in the details of the *nacelle*. A visit to the balloon shed near Paris showed that the No. 7 was already inflated with gas, and is only awaiting a favorable moment for making a sail. The aeronaut states that the trials which he has made of the motor and the mechanical parts have been very satisfactory, and he is confident of the success of the new airship. He expects to make a very thorough series of trials in the air in order to become perfectly familiar with the maneuvers, and will not leave for St. Louis before this is carried out. Beside the No. 7 is a new airship of somewhat similar form, but of smaller size, to the No. 11, which has been sold to an American. It has a long *nacelle* and the basket will contain four persons. The motor is of the Clement-Bayard type with a special carbureter, and is rated at 16 horse-power. The balloon has been constructed at the Lachambre establishment. It is already filled out, and will, no doubt, make a trial trip shortly. The No. 9, the smallest airship yet constructed, with which Santos Dumont made a number of interesting performances last year, has been purchased by another American, Mr. Boyce, who expects to try it soon at New York. Mr. Boyce had previously purchased the No. 8, but had an accident with it during his first ascensions.

The Burning of Troy Polytechnic Institute.

The main building of Rensselaer Polytechnic Institute, one of the oldest and most widely known schools of civil engineering in the country, was destroyed by fire on June 9. This is the fourth fire to visit the institution in a year and a half. Two were in the chemical and one in the electrical laboratory.

The Rensselaer Polytechnic Institute was founded by Stephen Van Rensselaer, of Albany, the last, save one, of the Patroons, on November 5, 1824. Until 1850 it was known as the Rensselaer School, and was devoted to theoretical and practical science. It was reorganized in that year as a general polytechnic institute, and assumed its present name. The purpose of the Institute, as declared in its charter, is to maintain a school for instruction in mathematics, civil engineering, chemistry, mineralogy, geology, botany, literature, and, in their application to the arts, agriculture, domestic economy and manufacturing. In carrying out its purposes it was extensively equipped with apparatus and collections, but the work especially carried on is the instruction of engineers.

The Current Supplement.

The current Supplement, No. 1485, opens with a splendidly illustrated account of Creusot ordnance. F. J. Rowan recently read before the Institution of Engineers and Shipbuilders a most exhaustive paper on superheated steam. His treatment of the subject is so valuable that the Editor publishes his paper in full. A novel balanced rotary valve for gas-engines, which controls both functions of induction and exhaust of the gas to and from the motor, and which can be used for two or three cylinders, thus dispensing with two or three sets of valves and gearing, is made the subject of an article that is very elaborately illustrated with diagrams. Charles Fremont's method of testing steel rails is described. Dr. C. A. Herter writes in an appreciative vein on the influence of Pasteur on medical science. Some novel studies of radium will be found among the minor articles.

The Invention of Babbitt Metal.

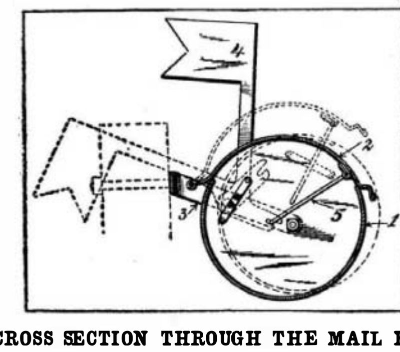
Although Babbitt metal is one of the most common anti-friction metals in use at the present time, but few users of this metal are aware that Isaac Babbitt, whose name it bears, was the inventor and patentee of the method of lining boxes with soft metal rather than of any particular alloy of the metal itself. The Metal Industry recently published a copy of the original patent, No. 1,252, which was granted to Isaac Babbitt, of Boston, Mass., July 17, 1839. In this he claims to have invented a new and improved mode of making boxes in which gudgeons or journals are to run. To quote from that part of his patent relating to the metal used, he says: "I prepare boxes which are to be received into housings or plummer blocks in the ordinary way of forming such boxes; making them of any kind of metal or metallic compound which has sufficient strength and which is capable of being lined. The inner parts of these boxes are to be lined with any of the harder kinds of composition known under the names of britannia metal or pewter, of which block tin is the basis. An excellent compound for this I have prepared by taking 50 parts of tin, 5 of antimony, and 1 of copper. But I do not intend to confine myself to this particular composition."

No claim whatever is made for the composition and, in fact, that specified is somewhat softer than what is now known as "genuine baboitt," which is commonly composed of 96 parts of tin, 8 parts antimony, and 4 parts copper.

Although Babbitt's name is somewhat erroneously applied to the metal, yet, as he was the first to exploit the use of soft metals in the manner in which they are now so commonly employed, it seems but just that his memory should be perpetuated in this way.

MAIL BOX FOR RURAL DELIVERY SERVICE.

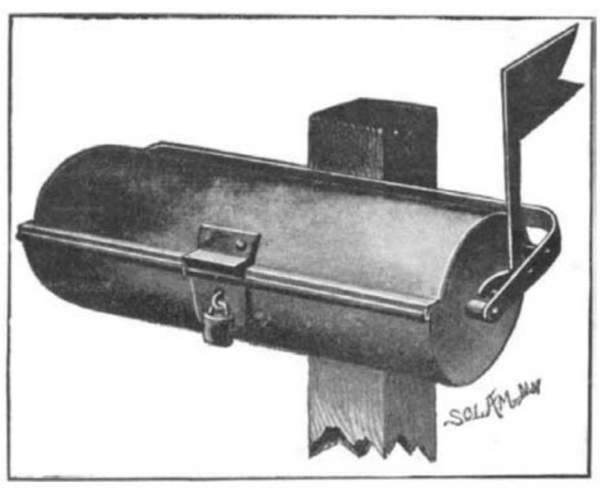
The rural free-delivery system recently introduced by the Post Office has created a demand for a new type of mail box, one which will indicate by a signal whether or not it contains any mail matter. The rural mail box must be situated along the main road, often a considerable distance away from the house it



CROSS SECTION THROUGH THE MAIL BOX.

serves; and it is evident that a signal which would automatically indicate that mail has been deposited in the box, would save the owner many useless trips thereto.

We illustrate herewith a mail box of this type, which was recently invented by Mr. A. M. Hoes, of Palmer, Neb. This box, it will be observed, is of cylindrical shape, the lower half and ends, 1, constituting the main body, and the upper half, 2, constituting the lid. The box is eccentrically mounted in bearings in a yoke piece, 3, which may be secured to a post or other support. The lid is also hinged to this yoke piece at the rear. A bell crank is pivoted to one arm of the yoke, and carries a flag or other signal, 4, at its upper end, while its lower end is slotted to engage the end of a rod, 5, which projects through the end wall of the mail box. This signal serves to notify the owner that mail matter has been deposited in the box; normally, however, the flag is not held upright, but rests against the cross arm of the yoke piece. The rod is secured at its upper end to the lid, as shown in our section view. When the lid is raised, this rod, together with another rod similarly connected at the opposite end of the mail box, serves to swing the body portion, 1, on its eccentric pivots to the position shown in



MAIL BOX FOR RURAL SERVICE.

dotted lines. The projecting end of rod, 5, will, at the same time, tilt back the signal bell crank until the flag falls to normal position. To set the signal, the postman while closing the box, after having deposited mail therein, holds the signal bell crank in such a position that its slotted end will be engaged by the projecting rod, and thereby raised to a vertical position. Owing to the cylindrical form of the box, and to the fact that the lower part rotates eccentrically on opening, the mail matter will slide forward, coming within easy reach, and the entire contents of the box will be brought into view as soon as it is one-third open.

According to the Iron Age two of the largest spiral springs ever made in the United States were shipped recently from Pittsburg. The springs are 27½ inches diameter, and have a height of 34 inches. When closed solid they are 19 inches high. They are made of 1½-inch steel, and the bars were 533 inches in length. The springs are so elastic that they can be moved with the finger, while it requires a pressure of 3,000 pounds to close them down. The rule among spring makers has heretofore been that the inside diameter of a spring must not be over 10 times the thickness of the bars without special appliances to keep the coils in position. These springs, however, are seventeen times the diameter of the bar.

THE BERTHIER ACTINO-ELECTRIC TRANSFORMER.

(*Continued from page 476.*)

induced circuit, since the electro-motive force of the circuit of the selenium battery is constant. When the manipulating disk is revolved, the following phenomena occur: At the moment at which the first pencil of light reaches the selenium, the latter becomes converted into a battery. The current of this latter traverses the primary of the transforming coil, and produces variations in the flux of the magnet and of the electro-magnet. Such variations are made manifest by a current in the induced circuit, that is to say, in the secondary of the transformer or simply of the induction coil. The greater the flux of the magnet is, the greater will be the variations produced therein, and the more intense also will be the induced current—a phenomenon that will be shown by a sound in the telephone. Another induced current is produced at the moment at which the selenium is no longer influenced by the light. We have therefore closings and openings of the circuit, and consequently an alternating current in the secondary circuit of the transformer. The frequency of this current is determined by the rotary velocity of the shutter disk.

The magnet, as I have above stated, may be replaced by an electro-magnet excited by a battery of accumulators, which, according to M. Berthier, may be recharged by the induced circuit if care be taken to put in series with the arrangement, a Nodon electrolytic valve formed of a plate of aluminium and one of lead immersed in a saline solution of phosphate of soda.

Although, up to the present, M. Berthier has desired to produce merely a demonstration apparatus and not an industrial one, his arrangement nevertheless presents a great interest from the viewpoint of the conservation of energy. It would evidently be very interesting to know the exact theory and the efficiency of it.

The second form, which is shown in Fig. 2, is designed for the production of a continuous current. The apparatus resembles the Foucault or the Faraday disk. Nevertheless, while in the Foucault experiment, the disk placed between the branches of an iron horseshoe magnet is movable, it is here stationary. What, on the contrary, is movable is the light-obscuring shutter. The arrangement is plainly shown in Fig. 2. The actinometric disk is this time formed of a sheet of mica covered with sensitive selenium. A disk of porcelain has likewise been tried. The disk is heated to the desired temperature and is then coated with selenium by moving a stick of this material over the surface of the mica, which is afterward kept at a temperature of 210 deg. C. Experiments have been made also with disks of aluminium, copper, etc. It is interesting to observe the current that thus passes over the edges of a stationary disk as the shutter is revolved before it. The edge of the disk is naturally provided with a rim formed of a strip of thin metal. A metallic plate likewise is placed in the center for collecting the current. The current produced should be perfectly continuous. Instead of magnets, it might be possible to employ electro-magnets supplied with current from the battery that runs the motor, although in such a case it is to be apprehended that effects of induction might be produced. M. Berthier purposes to make a series of experiments with slightly different arrangements, especially when employing a liquid conductor. It would be a question then of preventing electrolysis.

The form of shutter need not be exactly that shown in the picture. The apertures, for example, may have the shape of half-crescents. It is possible also to construct the shutter of a disk of mica or glass to which is glued a sector of black paper. The apparatus is inclosed in a tight box having a single window with the shutter in front. Some experiments have been made also with wires of pure nickel coated with selenium and wound into a flat ring and then submitted to luminous variations. The apparatus thus constructed presents, according to M. Berthier, some analogies with the Gramme dynamo with the armature fixed between foliated inductors.

The state of M. Berthier's health has, up to the present, prevented him from pursuing his researches actively. But he has recently secured the assistance of M. Albert Nodon, the well-known inventor of the electrolytic valve that bears his name, and it is probable that under such circumstances the experiments will be actively prosecuted, and that at a period less remote than might be expected, we shall have a definite solution of the very interesting and very important problem of which I have sketched the main features in the above notes.

Correspondence.

Railway Fatalities.

To the Editor of the Scientific American:

I beg to call your attention to a serious mistake in the editorial appearing in your issue of Saturday, May 28, entitled "Increasing Railroad Fatalities." In this editorial you locate an accident in which there were 65 fatalities, caused by the train striking some heavy timber which had broken loose from a lumber car on the adjoining track, on the Pennsylvania Railroad. It it well known to the readers of the current news of the day that this accident occurred on the Baltimore & Ohio Railroad, and I think it is due to the Pennsylvania Railroad Company that a statement correcting this inaccuracy should be made. From the well-known reputation of the Scientific American for accuracy in all things, this misstatement is peculiarly regretful. George W. Boyd,

General Passenger Agent, Pennsylvania Railroad.

Philadelphia, June 9, 1904.

[The Editor takes pleasure in giving publicity to the literal facts as stated in the above letter. In crediting the disaster to the Pennsylvania system he was governed, no doubt, by the impression common to the "readers of the current news of the day," that the Baltimore & Ohio road is an affiliated road of the Pennsylvania system.—Ed.]

The Application of the Water-Plane Principle to High-Speed Water Craft.

To the Editor of the Scientific American:

The idea of applying the water-plane principle in constructing a practical craft, which would make a radical increase in speed over the heretofore best models, has for many years been in my mind, and I see no logical argument which would negative the conclusion which I have come to, namely, that an arrangement constructed on this principle, and having sufficient power (not necessarily prohibitive), would free itself from its greatest resisting factor—the water—by riding *on* it instead of plowing *through* it. A flat stone when shied across a pond, on the surface of the water, remains *on* the surface, for it cannot sink, owing to the reaction on its under side, caused by its forward movement. The ordinary boat or water craft sinks a certain amount, and this fact is the cause of its having, consequently, to plow *through*, instead of glide *over*, the water. Is not this argument manifestly logical?

A practical water-plane craft, in my mind, would have great beam in proportion to its length; tapering bow, having a small angle with the horizontal; and be perfectly flat-bottomed, with the exception of necessary fin keels to prevent leeway and facilitate steering. The exact form of such a craft would be, of course, determined by experiment; also the nature and mode of propulsion could be a matter of trial; but I see no reason why a craft constructed with this idea in mind should not surpass any formerly devised marine contrivance in speed.

If such an arrangement, with dimensions of, say, 50 feet length and 30 feet beam, was supplied with power sufficient to drive a boat of equal displacement (whatever that might be) at, say, 25 or 30 knots per hour, I claim that it would run out on top of the surface of the water, and make, to say the least, a decidedly increased speed over and above any heretofore constructed apparatus designed for high speed on water.

The initial power and speed might have to be great; but I can see no reason why such an arrangement should not prove entirely practicable. Once out of the water, the craft would be free from its greatest hindrance to high speed and would be capable of being driven at a hitherto undreamed-of rate—*over the surface of, not through, the water.*

Any one can see the advantages of such a craft, assuming my claims are true, without my enumerating them. I wonder at the fact that this principle has not been given attention in applying it as I have suggested.

Arthur E. Hagarty.

[Some experiments along this line have recently been made in France, in which a 19½-foot long by 9¾-foot broad flat-bottomed boat, fitted on its bottom with adjustable transverse hydroplanes, attained a speed of 17½ miles an hour when driven by a 14-horse-power de Dion motor. An ordinary launch of this size and power will only go 8 or 9 miles an hour. We hope in the near future to illustrate this new type of boat and give further details.—Ed.]

Submarine Boat "Protector" Sent to Japan.

Confirmation of the report that the Norwegian steamship "Fortuna," carrying the submarine boat "Protector," of Bridgeport, Ct., was on her way to Japan was brought to New York by Capt. Dannemann, of the North German Lloyd steamer "Prinzess Irene." His vessel, which came from Mediterranean ports, passed the "Fortuna," on whose deck was the "Protector." Capt. Dannemann recognized the "Protector" from descriptions of her which he had read recently and cuts which he had seen in the Scientific American.

"The 'Fortuna' is apparently bound for the Suez Canal," said Capt. Dannemann. "We came from Gibraltar, and the 'Fortuna' was going in an opposite direction. She was so close to us that we could read her name without the aid of a glass, and the submarine on her deck was plainly visible."

High-Speed Steam-Locomotive Tests in Germany.

In the several reports during the past two years describing the conditions and results of the elaborate experiments in high-speed electrical traction which have been conducted on a section of carefully prepared track between Marienfelde and Zossen, near Berlin, repeated reference has been made to the fact that an equally thorough and interesting series of tests would in due course be made with several specially constructed steam locomotives, in order to secure a basis for conclusive comparisons between the two forms of power for high-speed traffic over long distances. The question to be decided by these deliberate and carefully prepared trials was whether, with the existing conditions of climate, distances between large cities, grades, curves, and the present standard of track and bridge construction in Germany, the speed of express passenger trains could be safely and economically increased to 70 or 80 miles per hour, and, if so, whether steam or electricity would prove preferable as a motive power. Would the German "Blitzzug" of the future be hauled by an electric motor or a steam engine so enlarged and improved as to meet the highest requirements of modern railway practice?

The electric motor trials were completed, as will be remembered, during the autumn of last year, with the net result that the two motor cars obtained speeds of 117.32 miles per hour—or nearly 2 miles per minute—without injury to the car or motor, without undue strain upon the track or discomfort to passengers. This upon a straight, nearly level track 14.5 miles long, and of the heaviest and most solid and careful construction, with inside guard rails to minimize the effect of lateral motion at high velocities. But as the railways of Germany involve all the usual variations of grade and frequent curves of a radius as low as 520 yards, any such pace as 117 miles an hour was and must long remain outside the limits of actual practice. It remained for the new locomotives to demonstrate the efficiency of steam up to 80 or 85 miles an hour, the apparent limit of speed development under existing conditions.

The track having been carefully examined and the deteriorating effects of the electric-motor-car trials noted and repaired, the experiments with steam locomotives began about the end of February and were continued until a few days ago. The tests included engines of four different types, each built by a different German firm, or company. In order to make the conditions as nearly as possible those of actual service, the load consisted of six vestibule cars, weighing about 30 tons each, one of which had been equipped with instruments to measure and record speed, oscillation, and the pull exerted by the engine at each part of the run. Each engine was first tested with the full train, then half of it was detached, and another series of trials made with three cars only. This latter series was in compliance with a scheme by which it was proposed to divide the fast long-distance passenger-train service into units of three cars each, capable of carrying 100 passengers with all facilities for their comfort by day or night.

The first trials were those of a locomotive built by the Egestorf Machinery Company, at Hanover. It is of the same general model as the "Atlantic" type in the United States—that is, carried on ten wheels, viz., the four-wheeled forward truck, then the two pairs of coupled drivers, and a pair of trail wheels under the cab to sustain the after portion of the boiler, which is of extraordinary size and large heating surface. This machine, with a train of six cars, attained an average speed of 111 kilometers (68.97 miles) per hour throughout the run, and with three cars a pace of 79.41 miles an hour.

The second machine of Grafenstadt construction is a compound locomotive, likewise of the Atlantic type, in which the cylinders are placed far back and the piston head geared by a short connecting rod to the crank pin of the rear driving wheel. This engine made with the full train a run of 118 kilometers (73.32 miles) and with three cars 76.42 miles an hour, and showed good results as to fuel and steam consumption.

The third contesting machine was an eight-wheeled compound engine equipped with Schmidt's device for superheating steam. It was designed by Baurath Garbe and built by A. Borsig. This engine was not built specially for these trials, but is one of a number of the same type which have been constructed and supplied for service to the royal Prussian railway administration. The driving wheels are 78 inches in diameter; heating surface, 963 square feet; surface of superheater, 288 square feet; normal working pressure, 12 atmospheres (176.4 pounds) to the inch; and weight, when ready for service, 120,051 pounds avoirdupois. This engine attained with the full train 128 kilometers (79.53 miles) and with three cars a speed of 84.5 miles an hour, the energy developed being about 2,000 horse-power.

The fourth competitor was an engine of a wholly original type, designed by Chief Engineer Wittfeld, of the Prussian railway administration, and built by Messrs. Henschel & Sons, of Cassel. The engine has been described in these columns. Before being brought to Berlin it was tested on one of the State lines near Göttingen, and since the trials were finished it has been dismantled and shipped for exhibition at the World's Fair in St. Louis. Its most striking peculiarities are that it is so built that the engineer stands in front within a glazed cab like the motorman of an electric car, and both engine and tender are covered with a sheathing of sheet iron with glazed windows and so arranged as to provide a covered passage from front to rear. The engine is carried on twelve wheels, viz., a four-wheel bogie in front and rear and between them the two pairs of drivers, coupled in the usual manner. This arrangement is for the purpose of securing steadiness of motion despite curves or irregularities of track surface. The engine is of the compound type, the high-pressure cylinder being located midway between the side frames, where its piston connects with an inside crank on the forward driving shaft. The low-pressure cylinders, of which there are two of equal diameter, are external and drive two outside cranks set parallel to each other and on the same side of the axle 90 deg. from the inside crank that connects with the high-pressure cylinder. This secures an even balance between the reciprocating parts, from which important results have been expected. The boiler is, from the European standpoint, enormous, having 2,766 square feet of heating surface, and it is calculated that, with a coal consumption of 2.5 pounds per horse-power, it will develop about 1,775 horse-power. It weighs 76.8 tons and cost $23,800. The tender weighs 47 tons and carries 7 tons of coal and 4,400 gallons of water, which it is equipped to take up at speed, as is done on some lines in the United States. At the recent tests this engine slightly surpassed all its competitors, attaining a speed of 128 kilometers (79.53 miles) per hour with six cars and 85.12 miles with half that number. While, therefore, its speed with the full train was the same as that of the Borsig superheater, the Cassel machine did 1 kilometer (0.62 mile) better with the light load, a difference so slight that it might easily have been influenced by varying conditions of wind.

This in substance is what is now publicly known concerning the results of these most interesting trials. The comparative advantages of all the contesting engines—their relative consumptions of fuel and steam, their general efficiency at high velocities, and their smoothness of movement on curves of different radius—will be known only to the government experts until the whole mass of notes and records made during the experiments and subsequently on other portions of the line shall have been formulated and published.

Among the incidental demonstrations made by the tests was the fact that with the pneumatic brakes now in use on German vestibule cars it required a full minute and a distance of 1,093 yards to stop a train of six cars running at 85 miles an hour. German first-class trains are equipped for a maximum speed of 85 kilometers (52.8 miles) an hour, and their brakes are capable of stopping a train running at that speed on level track within a distance of about 433 yards. If, therefore, any approach to the higher speeds which will be made possible by these new types of locomotives should be adopted, the change will involve important modifications in brakes and signal systems, which are based on present limitations of speed and braking power.

Pending the preparation and issue of the official report on which the ultimate conclusions will be based, a Berlin engineer, Dr. Reichel, has given some interesting comparisons of cost between steam and electric traction from the standpoint of German practice and illustrated by the recent experiments with both motive forces. A steam train of five cars and a standard locomotive weighs 330 tons, seats 168 passengers, and uses at full speed 1,400 horse-power. The electric train of one motor car and four trail cars weighs 260 tons, seats 180 passengers, and utilizes 1,000 horse-power. Each train and engine costs for initial construction about $100,000. The operating cost of the steam train is fixed by Dr. Reichel at 12½ cents per 100 seat kilometers, and 11½ cents, or 1 cent cheaper, for the electric train. Frank H. Mason.

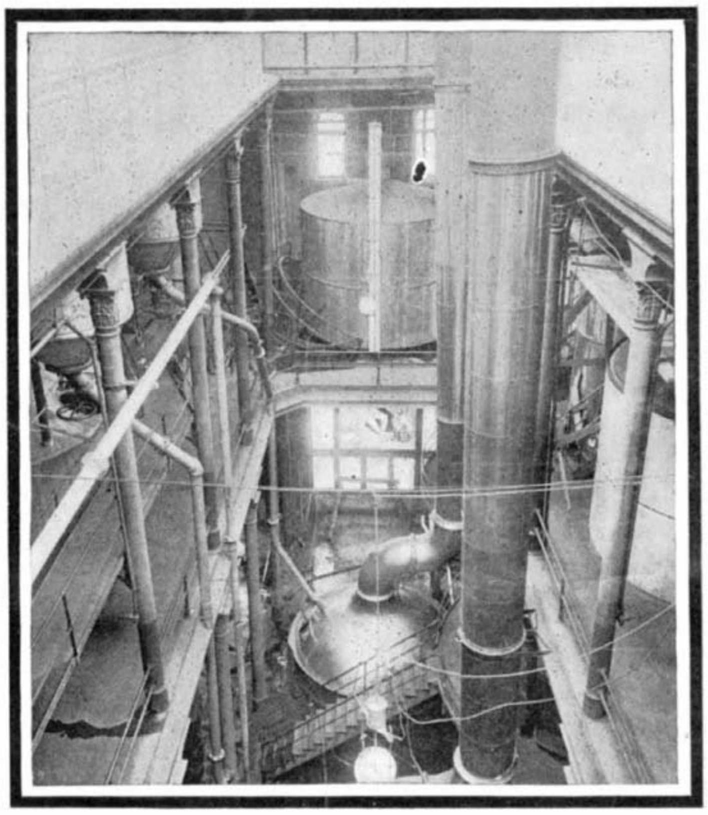
It is reported that a test well on the island of Tcheleken has encountered oil at a depth of 1,067 feet, showing the existence of a new oil-bearing stratum below that now exploited. When first struck the oil spouted to a height of 200 feet, and contained no water.

MALTING AND BREWING CONDUCTED ON SCIENTIFIC PRINCIPLES.—II. BREWING.

In a recent issue we described malting as carried on at the Pabst Brewing Company's establishment at Milwaukee, Wis. We will now describe their process of brewing. We left the finished malt in the moisture-proof storage bins.

When wanted the malt is again scoured, and is ground or rather crushed in specially-constructed malt mills, which press the grains so that the hulls remain intact while the interior starch body is finely powdered. It is now termed "malt-grist," and it is stored in grist hoppers, where it is kept in readiness for the mash-tub underneath. All the previous operations have been carried on with a view to the chemical reactions which now occur, assisted by mechanical means.

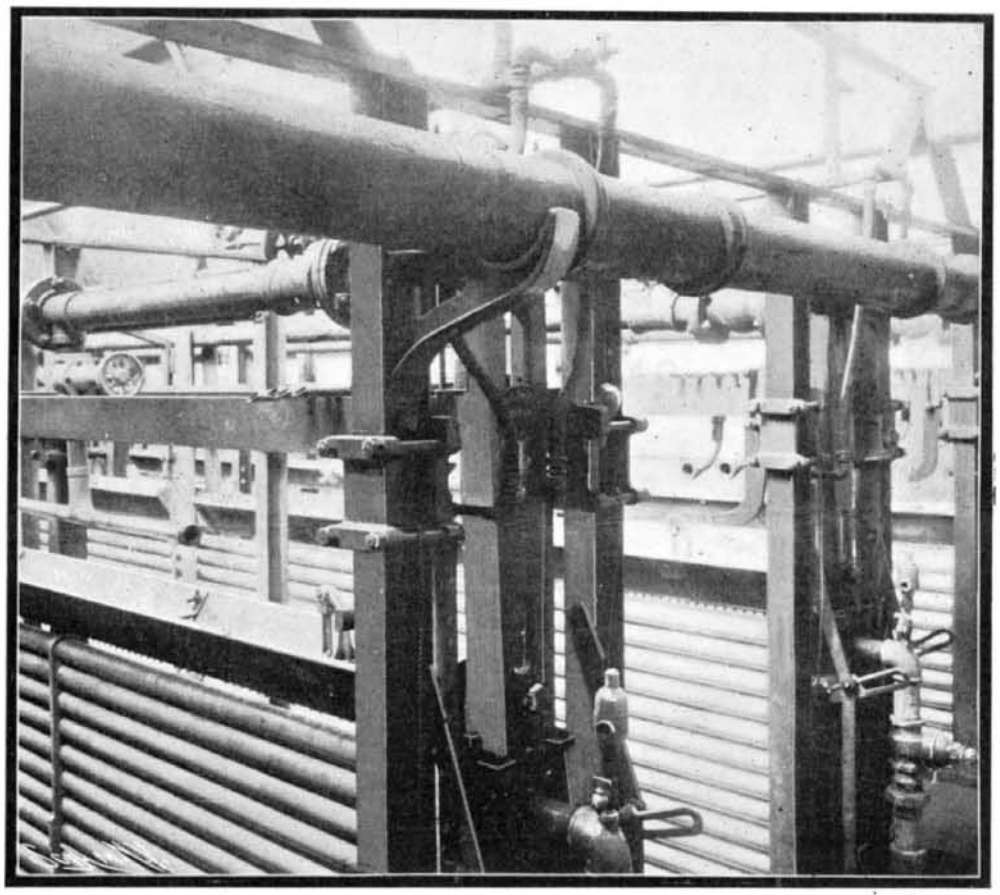
In the huge mash-tubs the malt-grist is brought into contact with water of a certain temperature, varying according to the brew. About 16,000 pounds of malt constitute one brew, and the mashing operation requires one and one-half hours, during which time the mash is agitated by raking machinery, which is revolved by power. Automatic recording thermometers indicate the temperature at all times. After the mashing process is finished, the mash is pumped by means of centrifugal pumps to the filtering tubs, which are provided with a false bottom of bronze plates, having 9,500 holes per square foot. This filtration occupies from four to five hours. The malt extract thus obtained is called "wort," and runs directly to the copper brew kettles, of enormous size and perfect cleanliness, holding 350 barrels each. The wort in these steam-jacketed kettles is boiled for several hours together with hops, which are introduced into the brew at this stage.



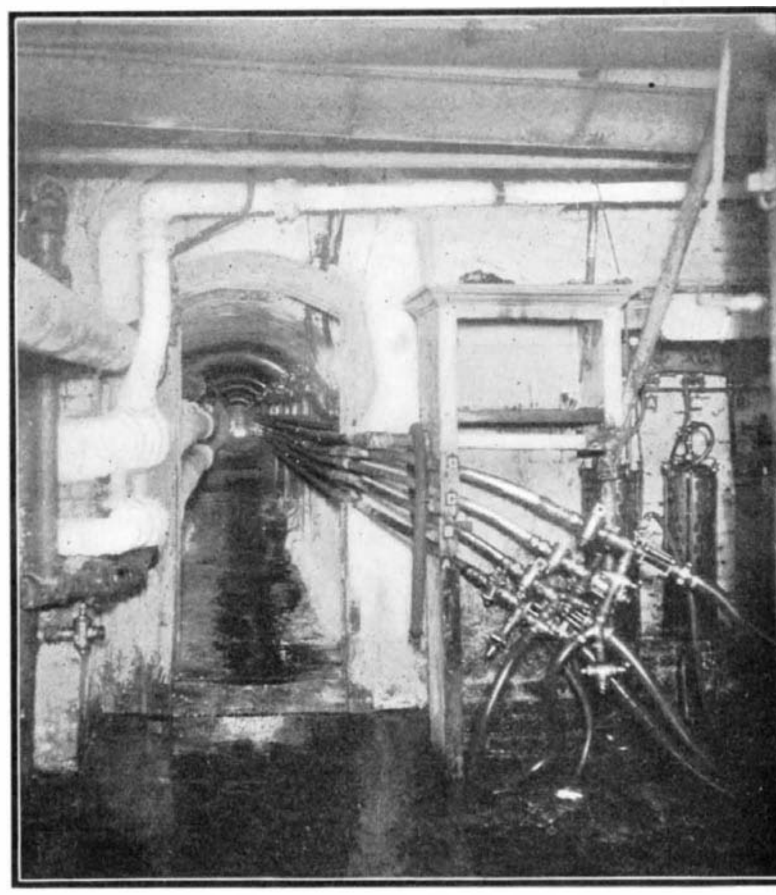
Looking Down in the Brew House.

The hops give a slightly bitter and agreeably stimulating taste to the beer, and in addition they contain constituents which promote the keeping qualities of the product. The hops contain aromatic resins, which assist in the preservation of the beer.

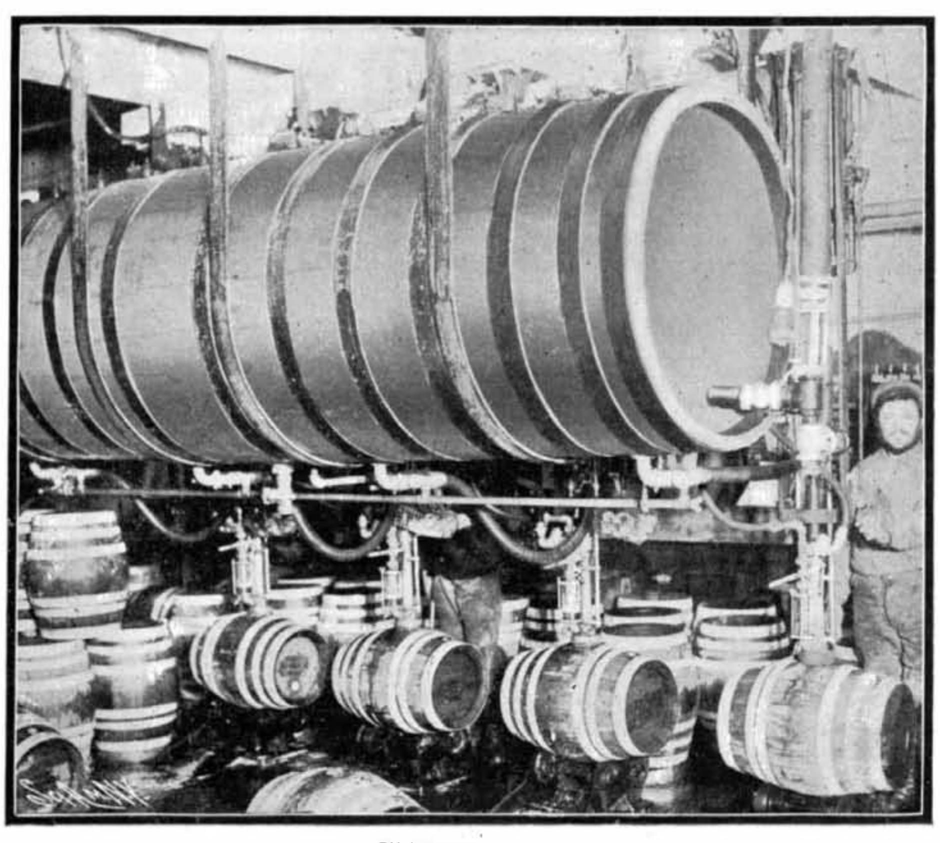
When it is stated that there are six brew kettles, each having a capacity of 350 barrels per brew and four brews each a day, some idea can be obtained of the enormous capacity of the Pabst brew house. From the brew kettle the hopped wort is run into the "hop-jack," or filtering tub, which separates the spent hops from the wort. From there the wort is conveyed by pumps to hot wort reservoirs, from which the wort runs through the hermetically-closed aerating coolers, which are several in number. Each cooler consists of 54 pipes arranged horizontally in a vertical bank. The upper ones are of copper, the lower ones of steel. Cold water flows through the copper pipes, and liquid ammonia is expanded in the steel pipes. The hot wort is distributed over



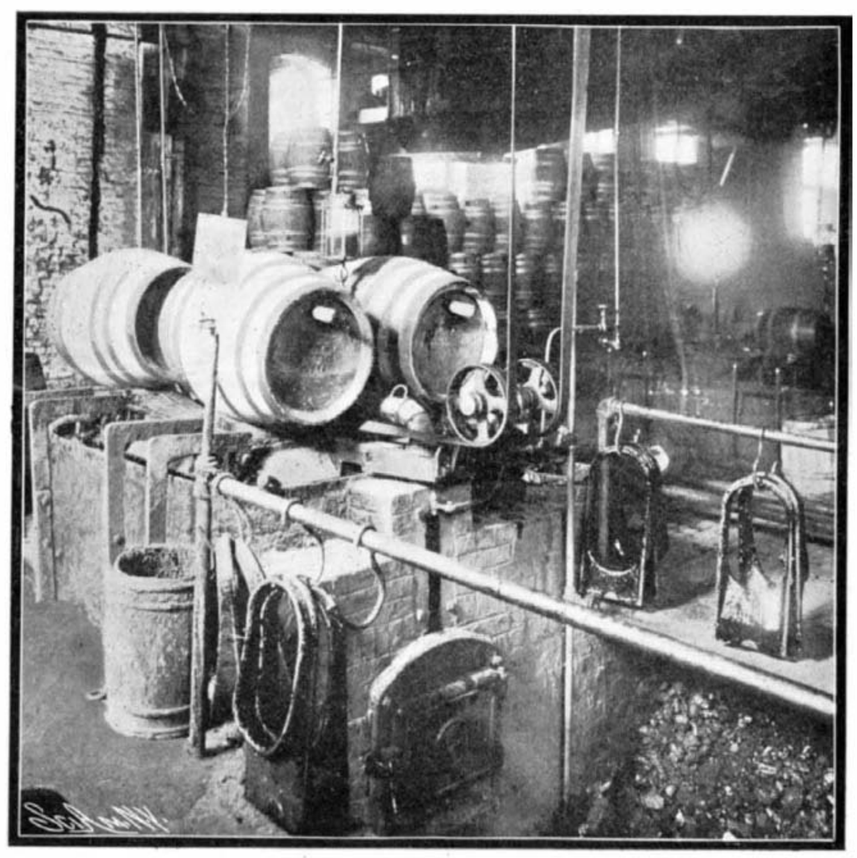
Cooling the Fresh Wort.



The Refrigerated Pipe-Line Tunnel.



Filling the Kegs.



Pitching the Kegs.

MALTING AND BREWING CONDUCTED ON SCIENTIFIC PRINCIPLES.

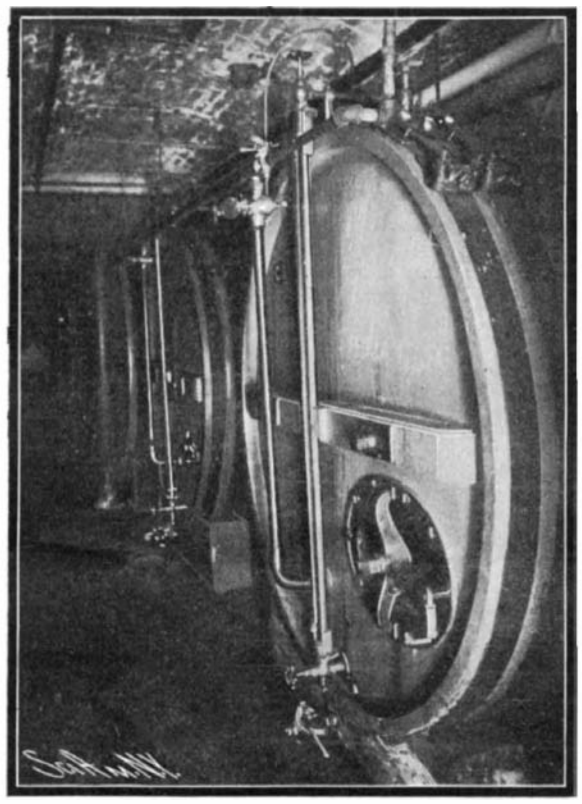
the whole length of the pipes by a self-regulating feeding trough. The sides of the cooler are adjacent to the pipes, and are composed of copper.

Sterilized air is blown against the wort, so that it absorbs the proper amount of oxygen at all stages of temperature from the boiling point to 40 deg. F., which is the temperature at which the wort runs off from the cooler through the copper pipe line leading to the cool wort vats in the fermenting cellar.

Fermentation is caused by a microscopically-small plant called yeast (*Saccharomyces cerevisæ*). There are thousands of different varieties of the yeast plant to be found in nature. In order to obtain an absolutely uniform fermentation and final product of a desired character, a special variety most suitable for the purpose is selected, and cultivated on a large scale from a single cell in a special department called the "pure yeast plant." The yeast thus obtained is used to start the fermentation of the cooled wort in the large fermenting cellar. In the Pabst brewery the fermenting vats are hermetically sealed for a double purpose; first to prevent infection from germs in the atmosphere, and second to collect the gas of fermentation. This gas is almost chemically pure carbonic acid gas, and is led off under a slight pressure to a gasometer, and eventually liquefied after purification, and used for carbonating and elevating beer from the cellars. Five million pounds of this by-product were produced and utilized at this brewery last year, effecting a great economy. The main fermentation takes from ten to twelve days in the fermenting vats. Considerable heat is developed, which is taken away by cold brine circulating through copper cooling pipes. The product can now be called "beer," but it is necessary to mature and ripen the beverage by cold storage in large vats for a period of from three to four months at a temperature a little above the freezing point. During the storage period most of the yeast cells settle to the bottom of the tanks, thus effecting a clarification of the beer. The liquid is then drawn off, and either conveyed to the shipping barrels or the bottling department. On its way from the storage vats to the filling machines, the beer is saturated with the pure carbonic acid gas obtained from the main fermentation, and it is then filtered through sterilized pulp filters, which render the beer absolutely brilliant before it enters the barrels or bottles. In all cases the filling is done under carbonic-acid-gas pressure.

For bottling purposes the beer is conveyed through sterilized copper pipes, which extend from the storage houses to the basement of the bottling department. The pipe lines are conducted through a long underground tunnel, which is refrigerated throughout its entire length, keeping the beer at a temperature a little above the freezing point. This tunnel is large enough to walk through.

The beer enters the so-called measuring tanks, which few breweries possess. A special act of Congress was necessary to legalize the system, as the old law required that there be no connection between the brewery and the bottling house, so that brewers were required to first place the beer in a small barrel, cover the bung with an internal revenue stamp, and cancel it. By this new system, the beer is kept in its original condition and purity. The revenue is now collected in another way. The measuring tanks are gaged by the government, and while the tank is being filled, the outlet cock is locked by an Internal Revenue officer, who visits the brewery daily. Seventy-three barrels of beer are run into each of the twenty measuring tanks. The officer reads the quantity of beer as shown by the glass gage; he then releases the outlet cock after he has been paid the tax of a dollar a barrel, and locks up the inlet cock, so that only the seventy-three barrels can be used for bottling.



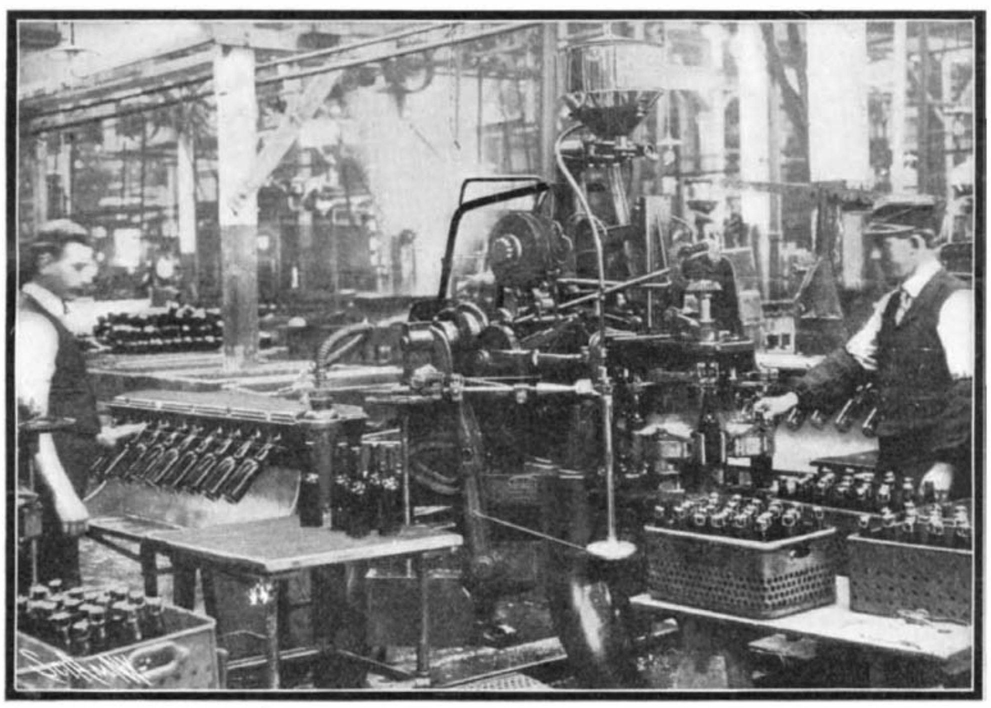
The Measuring Tanks Where the Government Collects Its Revenue.

Pure carbonic-acid gas is used to force the beer up to the bottling machines on the main floor. The bottles are received in train loads, and are first soaked in a diluted caustic-soda solution, and then dropped out automatically into fresh-water tanks, and from there they are put on washing spindles rotating 3,000 times a minute, thereby removing any trace of impurity. The bottles are then rinsed with filtered water and are filled with beer; immediately after filling the bottles are corked or covered with aluminium stoppers.

The corking and wiring machines are most ingenious. The filled bottles are fed into the machine at the rate of eighteen a minute, the cork is forced into the neck of the bottle, a tin disk covers it, and the wires are placed around the neck fourfold, cut, and finally twisted into a knot by the machine. The bottles are then placed in small cases holding twenty-four bottles each. The cases then go upon a traveling table, which takes them to the pasteurizing machines. The temperature is carefully regulated by an automatic heater, which insures a proper pasteurization of the beer. The highest temperature applied for this purpose is 150 deg., to which the bottles with their contents are exposed for about thirty minutes. The bottle enters in a cold condition, and it leaves the apparatus at the same temperature. The bottles are then labeled by machines and are ready for packing, the date of bottling being branded on the cork, and the same date perforated upon the label. The capacity of the bottle house is over 500,000 bottles a day, and last year over 90,000,000 bottles were filled.

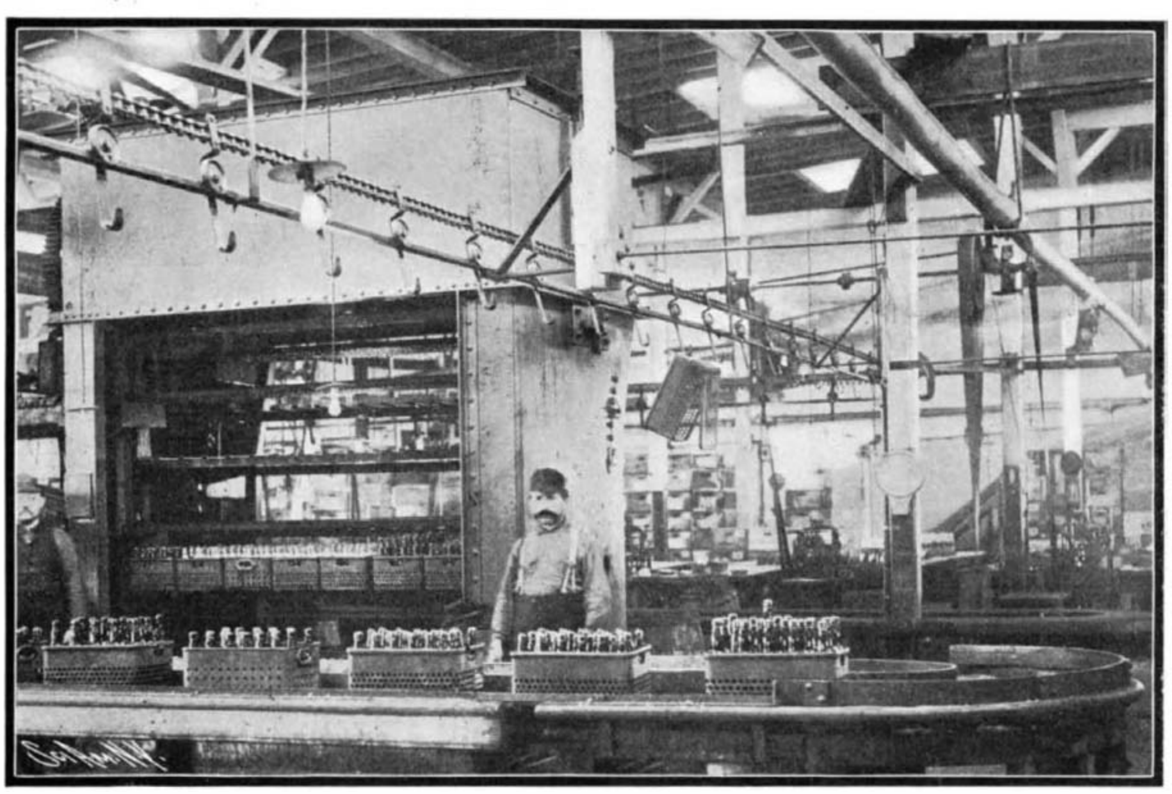
The advantage of brewery bottling is apparent. The beer never for a moment loses its life by the loss of gas and comes to the consumer in prime condition, the sterilization also providing for the proper keeping of the beer under all conditions.

The process described in this and the previous article, the result of years of study and experience, show that the brewing industry is placed upon the highest scientific level.

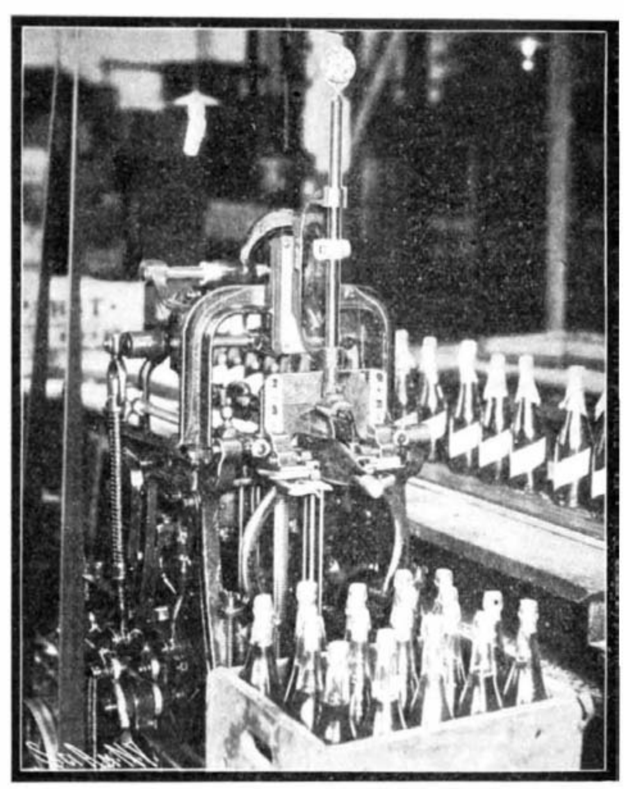


Filling and Corking Bottles.

The railway line from Hanoi to Vietry, in French Indo-China, has been open to traffic for some months; the section to Thanba, half-way to Yenbay, was finished a short time ago, and the continuation to the last-mentioned place is far advanced.



Pasteurizing Bottled Beer.



Labeling Beer Bottles by Machine.

MALTING AND BREWING CONDUCTED ON SCIENTIFIC PRINCIPLES.

RELICS OF THE SPANISH ARMADA.

After keeping them securely hidden from human eyes for over three hundred and fifteen years, the waters of Tobermory Bay, off the coast of the island of Mull, England, have at last given up some of their treasures, in the form of a motley collection of battered and worn relics of no value except to historians and antiquarians, but to them of priceless worth, as they tell the story of the tragic end of the famous Spanish Armada, better and more graphically than could pages of histories.

Capt. Burns, the principal wreck officer of the Glasgow Salvage Association, who was in charge of the operations, was untiring in his efforts in bringing these woful remnants of the once splendid "Invincible Armada" to light again. They were recently placed on exhibition at the Glasgow East End Industrial Exhibition, where they attracted the greatest attention.

As tangible trophies of deep romantic interest, these exhibits clearly prove that tradition did not lie when it said that on the spot where the relics were found by Capt. Burns, there was blown up in August, 1588, one of the richest of the ill-fated ships.

It was with the permission of the Duke of Argyll that Capt. Burns pursued his investigations; for, since the wreck of this particular vessel was given into the possession of a Marquis of Argyll by royal grant scarcely half a century after the Spanish squadron met its fate off the coast of England and Scotland, the title of that noble family to the ownership of whatever the waters of Tobermory Bay held of the vessel of the Don has been undisputed.

The tradition of this particular bit of the stormy history of England has scarcely changed in a single point, in spite of having been handed down from father to son for three centuries, and the recent discovery of the relics has only added to its authenticity. The name of the vessel which was blown up has been spoken of as the "Florida" in old records, but it was really the "Florencia," a Florentine galleon which came from the Levant, one of the Italian possessions of the King of Spain, and was commanded by one Pereija.

By far the fullest account in Scottish history of the loss of this ill-fated ship is to be found in the records of Clan MacLean, whom it most closely concerned. In the year 1588 the chief of the House of Duard was Sir Lauchlane MacLean, who had at that period seriously embroiled himself with his neighbors of the Clanranald and the Clan Ian in numerous bloody feuds, and as a result of these had been "denounced rebel" by King James.

Soon after this the "Florencia," commanded by Capt. Don Pereija, was forced by stress of weather and want of provisions into Tobermory Bay. The captain sent peremptory orders to Sir Lauchlane MacLean to supply his ship with such provisions as he might require or as the island could afford. No reply having been made, he threatened to use the means within his power to enforce his request. The haughty chief of MacLean replied to the effect that "the wants of the distressed stranger should be attended to after he had been taught a lesson of more courteous behavior; and in order that he might have such a lesson as speedily as his wants seemed pressing, he was invited to land and supply his wants by the forcible means threatened; for it was not the custom with the chief of MacLean to pay ready attention to the wants of a threatening beggar." The Spaniard discreetly decided to decline the invitation, and now promised payment for whatever necessaries in the way of food and clothing might be supplied him. Finally a sort of friendship sprang up between the Don and his Highland host, and in return for the provisions supplied him, he offered Sir Lauchlane the assistance of a hundred of his marines, and with this help the Scot proceeded to make war on his neighbors. He first ravaged the islands of Rum and Eig, then held by the Clanranald, and the islands of Canna and Muck, the property of the Clan Ian. After devastating these, he made a descent upon the mainland of Ardnamurchan, and, still with his Spanish contingent, laid siege to MacIan's castle of Mingarry.

In a word, he swept through the neighborhood with fire and sword, working havoc wherever he went.

While he was engaged in this way he received a message from Capt. Pereija requesting that the Spanish soldiers be sent back at once, as he was preparing for sea. At the same time he heard that the provisions supplied to the Spaniard had not been paid for. Sir Lauchlane remonstrated with the Don for his injustice, and full satisfaction was promised. On the strength of this the men were sent back, but MacLean, not relying entirely on the captain's promise, retained three of the soldiers as hostages till the debt should be paid. At the same time he sent one of his own men, Donald Glas MacLean, on board the "Florencia" to receive an adjustment of the demands of his people. The emissary was at once disarmed and made prisoner, and no communication was allowed between himself and his friends. But Donald Glas conceived a plan, which, though it meant certain death to himself, promised a speedy and terrible retribution to his captors.

Finding that the cabin in which he was confined was close to the magazine, he found an opportunity to force his way into it, and laying a train from it to the outside, he fired it, and the ship was blown to pieces, killing the three or four hundred on board.

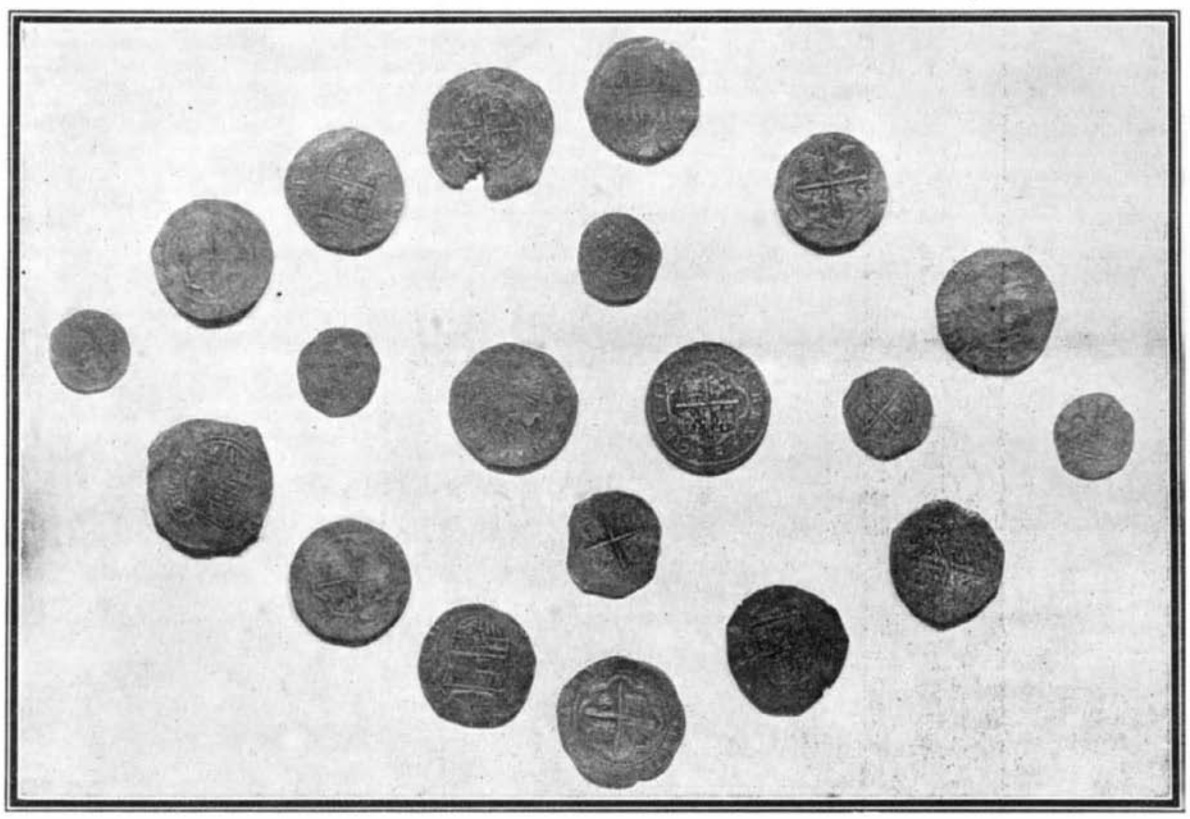
The wreck of this vessel and the enormous treasure which she was reported to contain created a great deal of interest in the spot where she had sunk. They early excited the interest of the Argyll family, and in 1611 the Marquis of Argyll obtained as a gift from Charles I. the vessel, provided he paid to the Duke of Lennox and Richmond the one-hundredth part of the ship, after the deduction of expenses. In 1665 the Earl of Argyll entered into a contract with one James Mauld, wherein the latter agrees to give the former one-fifth part of all that shall be recovered from the ship of the Armada, lost beside Tobermory. These contracts have gone on and on, but no great store of gold and silver has been found, nothing more in coin than a few pieces now and then, though some fine brass cannon have been found.

Among the articles recovered, apart from old timber, warped ironwork, stone and iron cannon balls, human bones and skulls, and silver coins, there is also a bronze breech-loading gun 4½ feet in length, one of the fifty-six carried by the "Florencia."

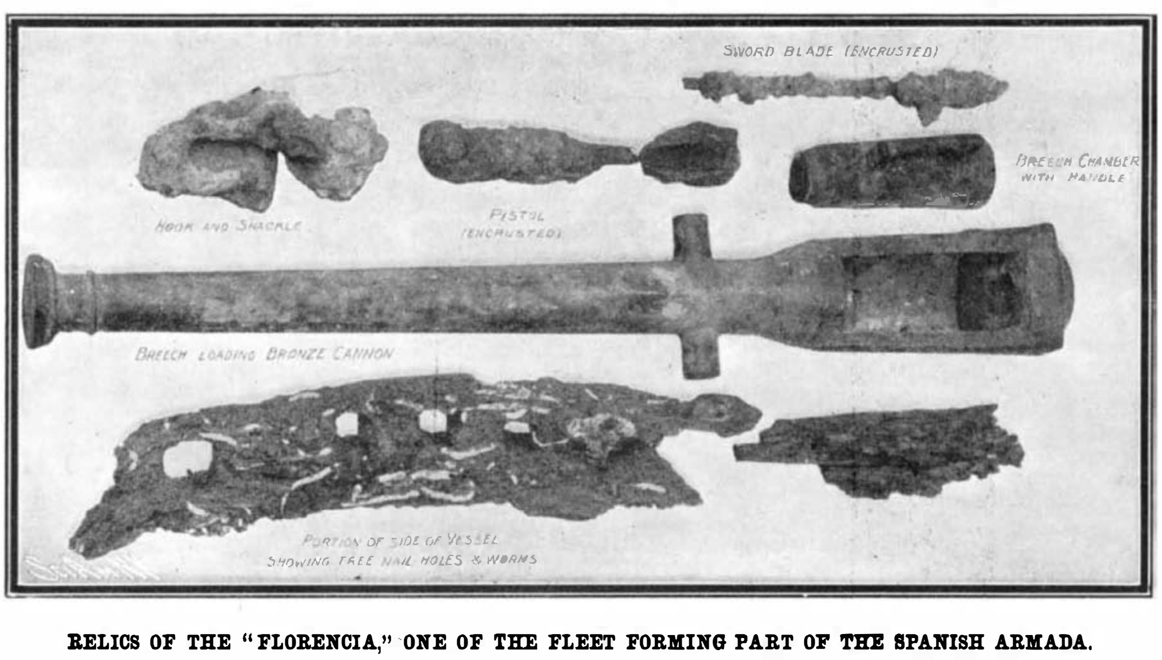
The gun is still in such a condition that, although it lay in twelve fathoms of water for more than three centuries, the monogram of the maker, supposed to have been Benvenuto Cellini, and the date, 1563, are still visible. The ball with which the gun was loaded still remained in it. The breech action is lifted out of the gun by a handle similar to a laundry smoothing iron.

A projection fits into the bore, and the wedge-shaped hole at the side of the gun has apparently been used to fasten the breech-block, and prevent it from being forced back by the firing of the charge. When the breech-block was removed, it was found not to be solid,

China Vase, Strainer, Mortar, Scabbard, Coins, Ring and Compasses Found in the Wreck of the "Florencia."



Silver Coins Recovered from the Wreck of the "Florencia," Sunk in Tobermory Bay.



RELICS OF THE "FLORENCIA," ONE OF THE FLEET FORMING PART OF THE SPANISH ARMADA.

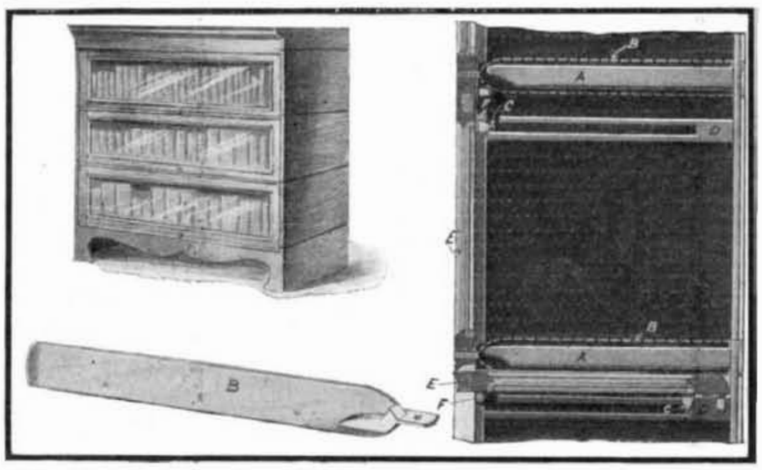
but to have been used as the powder chamber. The iron bullet was found in direct contact with the powder, and in front of it were the remains of a wad of rough fiber, apparently manila oakum. The bore of the gun is one and five-eighths inches. A round hole at the end was for ramming and cleaning out the gun between the shots. This gun, therefore, takes its place among the earliest known breech-loading guns. The bronze of which it has been made was not affected by the water.

The broken blade of a sword, a pistol, and a hook and tackle, thickly incrusted with limestone, are also on view, as well as a piece of the woodwork of the ship in a fossilized condition.

The tradition is that the "Florencia" had fifty-six guns on board, and thirty millions of money. The latter has never been recovered, where it still reposes beneath the sand of the bay, making its recovery very difficult.

A SECTIONAL BOOKCASE.

An improved form of sectional bookcase has been invented by Mr. O. O. Buice, of 400 Dexter Street, Montgomery, Ala., which offers the particular advantages of secure interlocking of the units and convenient manipulation of the door, the latter when in open position being completely out of the way of the user of the case. The case is made up in the ordinary way of a base unit and a top unit, between which are held any desired number of case units. The case units comprise the usual sides, bottom shelf, and door. The bottom shelf is indicated at *A* in our sectional view, and is provided at each end with a transverse rail, *B*. The bottom shelves are fastened to the side walls of the case by screws threaded in the walls and passing through a horizontal rib on each rail. The lower vertical flange of the rail is adapted to fit in a groove in the base unit, or in the case unit just below, as the case may be. The door of the case is provided with rollers, *C*, at its upper end, which are adapted to travel in guideways, *D*, within the case at each side. When the door is closed, these rollers serve as hangers to support the weight of the door. To open the door, it is swung on these rollers as pivots to horizontal position, and then pushed back into the case with its lower face resting on rollers, *F*. Friction rollers, *K*, are also set in the side edges of the door to prevent it from jamming.



IMPROVED SECTIONAL BOOK-CASE.

To Turn Glass in the Lathe.

BY JOHN M. BLAKE.

The most practical way to turn glass appears to be with steel tools. A diamond scrapes, and works more slowly. The steel tool can be forced, and it will support a more acute angle, say 50 deg. or 60 deg. at the edge. The lubricant that is the most convenient and effective is water applied continuously with a sponge held against the work. An essential point is to have slow speed—say sixty turns or less per minute for a disk one inch in diameter. No extreme pressure is to be used; only the firm, steady hand which turners acquire by practice.

A convenient tool can be made from one-quarter inch square steel, ground off obliquely from corner to corner. This is a form of tool often used on other work, and such a one will answer for a trial. It is well to have six or more tools of this kind, having the center drilled out, and the steel left hard as dipped in water. Grinding tools is quite an item, as would be expected.

These tools, when sharpened, will accomplish more or less, according to the way they are handled. Truing may dull more steel for the proportion of glass removed, than would be the case at a later stage after the surface has been made true, and more pressure could be applied. At this first stage, keenness of edge is not so essential, and the same tools will bear more continuous use without regrinding. When finishing, or scraping, keen tools are best. At this stage of the process, the glass acts more like a grindstone to dull the edge, therefore we must take a fresh-ground tool as required.

A large portion of the turning has to be done by careful scraping upon critical parts of the work. A good tool for that operation is made of flat steel, thin at the end, and ground to a square edge. The outline of the edge may be either straight or curved. These tools have the advantage that they may be ground quickly.

Most plate glass is hard lime glass, and does not cut so readily as many varieties of optical glass. Nearly all varieties, however, the writer has made to yield to the turning tool. This turning has been applied to shaping lenses to convex and concave lenses. They were mostly an inch or less in diameter. In a few instances, a diameter of three inches was turned to shape.

The field for this kind of work lies more in experimental optics. As a manufacturing process, the method would hardly replace that in which a stream of sand and water is made to fall constantly upon the roughing tool. The rapidity of turning glass by this method does not compare favorably with that of any ordinary material; but the saving of time over the slower way of emery grinding is great.

The purpose of this article is to draw attention to the fact that it is possible to turn glass with steel tools. The quantity of material that can be safely and rapidly removed, when conditions of body of material and an adequate support for the same favor a forcing of the tool, would come as a surprise.

A wagon gearing with two fifth-wheels is the invention of Theodore Sandstrom, of Connorsville, Ind., the object being to permit very short turns of the vehicle, and to prevent it from being overturned in case of a runaway or accident. One of these is in the usual place on the front axle, and the other is on the rear axle with a cog connection, so that when the front wheels are turned, the rear ones will be inclined in the opposite direction.

RECENTLY PATENTED INVENTIONS.

Electrical Devices.

TROLLEY.—J. H. WALKER, Lexington, Ky. In the practical use of this invention the thrust-plates and carrier-blocks may be made of copper, brass, or other material of high conductivity, and the current will be carried by practically a copper conductor from the wheel to the motor. The inventor arranges for avoiding frictional wear upon a bolt which extends from side to side of the trolley. This bolt or shaft has a head at one end and a suitable nut at the other, said bolt and nut being housed in the sockets of their respective carrier-blocks and covered by the cap-nuts. Mr. Walker has invented another improvement in trolley mechanism which seeks to provide a novel construction whereby to secure a practically continuous copper conductor from the trolley-wheel to the motor and to provide improvements in the connections between the harp, the branches of the conductor wire, and the trolley-wheel. Mr. Walker has secured a patent on still another trolley, which has for an object, among others, to provide a contact supplemental to the wheel in order to provide for taking off more current than can be ordinarily effected by the use of the wheel alone.

TROLLEY MECHANISM.—J. H. WALKER, Lexington, Ky. In this patent the invention is an improvement in trolley mechanism, and particularly in the means for securing a practically perfect conductor connection between the conductor-wire carried by the trolley and the cable leading from the trolley-base to the motor.

ELECTRIC FIRE AND BURGLAR ALARM.—W. C. BARGER, Mammoth, W. Va. In this case the invention is in the nature of an improved electric fire and burglar alarm. It belongs to that class of alarms in which a cord maintained under tension holds an alarm-bell mechanism in an inoperative condition: but when the cord burns or is slackened the alarm mechanism operates and rings a bell.

TROLLEY-PROTECTOR.—J. H. BEST, JR., Sandusky, Ohio. Novel means in this instance serve to prevent jumping action of the trolley from the conductor-wire, which means has the further advantage in being constructed adapted for allowing free passage of the trolley along the conductor-wire without liability to damage from engagement with projections thereon—such as switches, hangers, and other devices—likely to engage with trolley protectors as they have been heretofore constructed.

SWITCH FOR ELECTRIC LAMPS.—C. WAGNER, New York, N. Y. Mr. Wagner's invention relates to means for turning the current on and off at will, and more particularly to such means as can be used with electric lamps. His special object is to provide an improved switch for service with incandescent lamps and to insure good electrical contact, while at the same time giving the lamp a comparatively neat appearance.

Heating and Lighting.

VENTILATING, HEATING, AND COOLING APPARATUS.—C. CLUTHE, New York, N. Y. Mr. Cluthe's object in this invention is to provide an improved system and apparatus for the convenient and economical heating or cooling and ventilating of rooms in a building. A step-by-step arrangement of internal coils or radiators placed in an inclined position in the case of the apparatus facilitates the circulation of the air in the case where the device is employed as a heater, since hot air rises, and when used for cooling purposes the arrangement affords means for forming a cooling-chamber or refrigerator beneath the case by inclosing the space below the same.

Machines and Mechanical Devices.

BUTTON-MAKING MACHINE.—E. ROSENWALD, 5 Rue du Ponceau, Paris, France. The new method of manufacture secured by this invention consists in subjecting the pieces or blanks of corozo or other material to the successive action of various tools coacting to form the button in such manner that at every step made by the table of the machine the various operations required for the manufacture of the button will be simultaneously performed, the result being that at each step made by the table a finished button will be delivered from the machine, while there will be always a number of buttons simultaneously in course of manufacture corresponding to the number of stages in the operation.

Of General Interest.

MIRROR.—M. T. GOLDSMITH, New York, N. Y. In this patent the invention has reference to hand-mirrors; and Mr. Goldsmith's object is the provision of a new and improved mirror arranged to require no special fastening devices for the bezel employed, to hold the silvered glass in place, and to give the mirror a very fine appearance.

COMBINED BUCKLE AND COCKEYE.—F. W. HAWES, Henryetta, Indian Ter. The object in view in this case is to provide means for the connection of the cockeye of a trace to a buckle adapted to be adjustably connected with the rear end of the trace, so as to permit lengthening or shortening of the trace at its rear end and dispensing with the ordinary buckled connection of the trace with a collar or breast-band of the harness.

CLOSET CONNECTION.—D. KEOHANE, New York, N. Y. The aim of this invention is the provision of a connection between the soil-pipe and the lower part of the bowl, said connection affording a strong and tight coupling between the parts which overcomes escape or leakage of water or sewer-gas and the possibility of the bowl becoming displaced on the floor or a marble slab.

ENVELOP.—C. A. MEADOWS, Yonkers, N. Y. In this case the object of the invention is to provide an envelop for sending letters and other communications through the mails and arranged to form an advertising booklet or like advertising medium when the envelop is opened by the receiver for the removal of the contents.

COMB.—A. F. MOTT, New York, N. Y. In this patent the invention has reference to improvements in combs designed particularly for drying a person's hair after washing or shampooing, an object being to provide a comb by means of which the hair may be quickly dried without danger of burning or singeing. Heat from a heated bar and its teeth, the same inserted into the comb, heats sufficiently to dry the hair as the comb passes through the same.

MEASURING INSTRUMENT. — P. H. WALSH, Bayonne, N. J. The object of the invention is to provide a measuring instrument arranged to permit the mechanic to readily obtain the lengths and cuts of rafters of all kinds, the joints and sides of polygonal figures, miter cuts, etc., in a very simple and easy manner without requiring further calculations or measurements.

CHEESE-BOX.—C. T. SMITH and F. P. SMITH, Canon City, Col. The invention has reference to cheese-boxes for the use of retailers which are designed to so inclose the cheese as to protect it from insects and from drying out and are provided with doors to permit the insertion and removal of the cheese and to give access to the cheese in cutting the same. Such boxes usually have a turn-table upon which the cheese is mounted and turned as its segments are successively cut off. Side walls, doors, and floor bearing the table give more convenient manipulation and freer access to the cheese and occupy less space on a counter.

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.

Marine Iron Works. Chicago. Catalogue free.

Inquiry No. 5617.—Wanted, refined kerosene in cases and barrels of 62 gallons, for export.

AUTOS.—Duryea Power Co., Reading, Pa.

Inquiry No. 5618.—For manufacturers of mechanical toys.

"U. S." Metal Polish. Indianapolis. Samples free.

Inquiry No. 5619.—For firms desiring pattern work, in quantities, at cost. Derby's Pattern and Model Works, Perth Amboy, New Jersey.

Handle & Spoke Mchy. Ober Mfg. Co., 10 Bell St., Chagrin Falls, O.

Inquiry No. 5620.—For parties to manufacture several dental devices, including forceps.

If it is a paper tube we can supply it. Textile Tube Company, Fall River, Mass.

Inquiry No. 5621.—For manufacturers of lawn-clippers or mowers other than rotary or Beal mowers.

Sawmill machinery and outfits manufactured by the Lane Mfg. Co., Box 13, Montpelier, Vt.

Inquiry No. 5622.—For the manufacturers of the "Crown Corking Machines."

We manufacture anything in metal. Patented articles, metal stamping, dies, screw mach. work, etc., Metal Novelty Works, 43 Canal Street, Chicago.

Inquiry No. 5623.—For the manufacturers of the Lyman Boat, which is a round tub shape, made of rubber, with heavy rubber legs and feet, designed for sportsmen's use, and so constructed that one can sit in it and paddle around by means of his feet.

The largest manufacturer in the world of merry-go-rounds, shooting galleries and hand organs. For prices and terms write to C. W. Parker, Abilene, Kan.

Inquiry No. 5624.—For manufacturers of wool-scouring machinery.

The celebrated "Hornsby-Akroyd" Patent Safety Oil Engine is built by the De La Vergne Machine Company. Foot of East 138th Street, New York.

Inquiry No. 5625.—For manufacturers of a stamp and envelope moistener, made of sheet iron or tin.

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

Inquiry No. 5626.—For manufacturers of patented fodder forks on contract, made of cast steel.

Superintendent wanted for manufacturing plant. Must be competent to take charge of machine shop—wood-working and foundry. A hustler and good organizer. References wanted. Superintendent, Box 773, New York.

Inquiry No. 5627.—For a machine that will rivet both ends of a bar at once, one inch apart.

We are well equipped for the construction of special machines and make a specialty of such work. Established for 20 years. Unequaled facilities for prompt and satisfactory service. Send samples or drawings for estimates. The Case Mfg. Co., Columbus Ohio. Manufactures Cranes, Power Transmission Appliances, and Automobiles, Axles and parts.

Notes and Queries.

HINTS TO CORRESPONDENTS.

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

(9408) M. H. M. says: 1. Please explain how the current of a magneto generator rings the bells on the telephone. A. When the armature of a magneto generator of a telephone is rotated the current of electricity is produced in exactly the same manner as in any other dynamo. This current passes over the line, through the bell attached to the box within which the magneto is placed, through the bell also at the station which is to be called up, and also through all other bells upon the same line. The bells at present used are of the kind known as polarized bells. That is, the cores of the electro-magnets of these bells are themselves permanent magnets, and the effect of an electrical current passing through the coils wound upon these magnets is to vary their magnetism slightly, making it greater and less, alternately. The armature of the bell therefore moves very quickly to one side and the other, striking the bell upon each side as it moves to and fro. 2. When the diaphragm of the transmitter of a telephone moves inward does the diaphragm of the receiver move outward? A. When the diaphragm of the telephone transmitter moves inward it produces an intensification of the electrical current which is passing at that time through the coils of the magnet in the transmitter, if a magnetic transmitter is employed. This increase of the current on reaching the receiver to which it is directed, would in turn produce an increase of magnetism in the receiver, which would cause the diaphragm of the receiver to be very strongly attracted, and thus cause it to move inward in the same direction as the diaphragm of the transmitter is moving. The diaphragm would thus move in the same direction from the same impulse, and not in opposite directions. If a carbon transmitter is used, a somewhat different action takes place, but the result is substantially the same.

(9409) F. B. C. says: Please send me some information in regard to taking the temperature of conductors, for accurate resistance tests; I have volumes of electrical engineering, but there seems to be nothing definite about it in them. The books I have recommend a thermometer and do not state how it shall be applied. A. The apparatus for determining the temperature coefficient of a wire as ordinarily constructed for measurement, consists of an outer copper vessel containing water. Within this is another copper vessel which contains a frame of insulating material over which the wire to be tested is wound. The ends of the wire are connected to binding posts upon the outside. A thermometer passes through the center of the inner vessel for the purpose of measuring the temperature. This inner vessel is usually filled with oil, in which the coil of wire is immersed. Of course a volatile oil should not be employed for this purpose. Any other oil may be used. The whole apparatus may be supported in any manner so that the heat can be applied to the outer dish. The water in the outer dish being hot, heats the inner dish with its contents. The temperature is quite easily controlled.

(9410) H. L. asks: Could atmospheric electricity (lightning) and the electricity in the ground be classed as opposite currents, that is, if a storage cell could be made large and strong enough and one pole of said cell were connected with the earth and the other pole connected to a rod on the top of a tower, would a discharge of lightning coming in contact with the rod in the air, charge the battery or would the current run right through the battery into the ground? A. The electricity in the atmosphere and that in the earth below at any moment are of opposite sign; that is, if one is plus the other is minus. The air between is an insulator, keeping these charges separate. When the charge in the atmosphere rises very high, as in a thunderstorm, the air breaks down and the two electricities rush together, making a flash of lightning. There is an enormous potential, but nothing which could charge a storage cell, even if one were built strong enough to stand the strain. You see there are charges and not currents here and no cell could be made strong enough to withstand a charge which had pierced so great a distance through the air.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Issued for the Week Ending June 7,1904.

AND EACH BEARING THAT DATE

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

Ironing machine, H. A. Hecker......761,833, 761,834
Jar closure, H. S. McConnell.......... 762,080
Jar, cover, J. Brenzinger.............. 761,652
Jewelry, construction of, A. Artopoens.... 761,867
Journal bearing, car, M. Poirier......... 761,903
Journal dust guard, railway, G. W. Dennis 762,154
Knitting machine, circular, H. Clarke...... 762,142
Knitting machine fabric cutting device, J. J. Harcher.......................... 762,166
Knitting needle, W. Hart................ 761,831
Lace, garment, H. L. Hiller.............. 761,963
Lacing stud, Barna & Hoffman............. 761,813
Lamp, electric arc, Baker & Wilbur, 762,115, 762,116
Lamp, extension, V. A. Menuez............ 761,845
Lamp globe, arc, S. E. Doane............. 762,029
Lamp holder, miner's, J. Danner.......... 761,764
Lamp, incandescent, S. E. Doane.......... 762,030
Lamp, oil, A. Hyde....................... 761,678
Lantern, J. A. Mosher.................... 762,244
Lasting machine, L. B. Stamm............. 762,209
Latch, gate, D. Wilson................... 761,740
Latch, gate, A. Murray................... 761,983
Lathe speed changing mechanism, engine, J. Judd.............................. 762,062
Leather beading machine, McCarter & Rockwood.............................. 761,696
Leg, artificial, W. Engels............... 762,031
Lens box, J. Menchen..................... 761,977
Letter tray, basket, or drawer, Cary & Rix 761,655
Leveling instrument, P. Lord............. 762,072
Licorice root, extracting juice from dried, F. Evers.............................. 762,032
Lifting jack, G. Riggs................... 761,914
Lime slaking apparatus, J. P. Rich....... 761,913
Link, mending, J. D. Austin.............. 761,812
Liquid fuel burner, S. Trood............. 762,262
Loading or unloading apparatus, H. J. Killian............................. 761,770
Lock, B. Borghese........................ 761,753
Lock, J. Lyon............................ 761,843
Lock, H. Hartman......................... 762,051
Locomotives, automatic safety apparatus for, C. F. Peel, Jr...................... 761,990
Loom, automatic filling replenishing, M. L. Stone.............................. 761,724
Loom filling end holder, automatic, L. H. Brown.............................. 762,023
Loom heddles, separating means for metallic, C. S. Howard................... 761,677
Loom shuttle checking means, W. F. Roper 761,999
Loom shuttle lock, J. Northrop........... 761,986
Loom shuttle, self threading, J. H. Northrop 762,247
Loom smash protector, J. H. Hadfield..... 762,236
Macaroni die plate, L. Bourquin.......... 762,128
Mail and saddle bag, combined, L. N. Prudhomme.............................. 761,907
Mail box, rural free delivery, E. Bevan.... 761,938
Mail or parcel carrier, N. T. Starr...... 761,722
Mail receiving and delivering mechanism for railways, F. H. Burr............... 761,874
Manhole, H. C. Baker, Jr..........761,749, 761,750
Mantles, apparatus for manufacturing illuminating, J. T. Robin.................. 761,715
Match box, F. B. Pringle................. 761,906
Match box, cigar cutter, and corkscrew, combined, B. Brooks.................. 762,130
Match box machine, J. C. Donnelly........ 761,765
Match splints into perforated blocks, etc., and removing same, machine for inserting, A. Lagerman..................... 761,773
Measure, adjustable horse collar, W. Cosbie 762,146
Measurer, grain, J. M. Welbourn.......... 762,217
Meat tenderer, J. H. Tolen............... 761,728
Miter box, adjustable, S. C. Burris...... 761,817
Mop wringer, E. Prescott................. 762,252
Mortising device, C. W. Wagner........... 761,861
Motion, machine for imparting rotary, S. C. Bond.............................. 762,126
Motor. See Current motor.
Mower, lawn, W. H. H. Heydrick........... 762,168
Musical instrument, electric, E. A. Petching 762,083
Musical instrument, stringed, C. A. Moore 761,693
Nail or spike, A. Smith.................. 761,925
Nail set and holder, L. S. Starrett...... 762,258
Neckties, etc., holder for, J. G. Gill.... 761,766
Numbering machine, C. Spielmann.......... 762,101
Numbering or registering machine transfer mechanism, L. F. Brewster............ 761,942
Nut lock, E. M. White.................... 761,738
Nut lock, A. M. Wilson................... 762,107
Nut lock, E. C. Blackburn................ 762,226
Nut lock, W. L. Morrow................... 762,243
Office device, C. F. West................ 761,864
Oil burner, O. Hauck..................... 762,167
Oil extracting apparatus, M. Kirshner.... 761,686
Oils, making watery solutions of mineral and rosin, F. Boleg................. 761,939
Ore treating furnace, A. M. Beam......... 761,646
Overseaming machine cord guide, A. Spielmann............................... 762,100
Packing machine, W. Rose................. 762,255
Packing, metallic, V. Schwabe............ 762,202
Pad holder, M. G. Whitney................ 762,012
Paper corrugating apparatus, J. T. Ferres.. 762,033
Paper pulp, manufacturing, O. Carr....... 762,139
Passenger traffic handling apparatus, W. Wellman.............................. 761,736
Pencil sharpener, F. H. Chase............ 761,944
Pencil sharpener, F. C. Melchior......... 762,077
Phonograph, etc., Tourtel & Hogan........ 761,729
Phonograph operating mechanism, F. Pearce 761,705
Phonographic record holding box, S. Waldeck.............................. 762,214
Photographic printing frame, N. K. Cherrill............................... 761,945
Photographic printing frame, W. E. Burnett 762,228
Photographic shutter, T. Brueck.761,754 to 761,756
Photographic shutter, R. Klein....761,771, 761,772
Photographically producing plates, J. Jacobson............................... 761,887
Photographs, making line composite stereoscopic, F. E. Ives.................... 761,679
Pianos, pneumatic self-playing attachment for, J. Wieser....................... 762,013
Pin tongue, A. C. Stone.................. 761,858
Pipe coupling, train, G. L. Bonham....... 762,127
Pitchfork blanks, forming, Jansen & Eisbrenner............................... 761,681
Planter, J. L. Durham.................... 761,665
Plow adjusting mechanism, W. F. Genet.... 761,883
Plow attachment, T. T. Wells............. 761,802
Plow, cultivator, and harrow, convertible, J. R. Jones........................ 761,840
Pneumatic elevator, G. F. Steedman....... 761,790
Pole, vehicle, J. E. Beebe............... 761,119
Portable elevator, M. Bradfield.......... 761,941
Post protector, W. B. Stanley............ 761,721
Powder drying apparatus, H. Crozier...... 761,763
Printing machine, cloth, A. Hainey....... 762,165
Printing or embossing press, H. L. Phelps.. 761,991
Printing press, plate, G. F. Read......... 761,909
Pulley, split, L. Nevers.................. 761,899
Pulp vessels, machine for making fibrous, G. H. Millen et al.................... 762,181
Pump and motor, combined, Westinghouse & Herr............................... 761,735
Pump and water connection, Z. R. Tucker.. 761,730
Pump, multiple oil, T. L. & T. J. Sturtevant 762,103
Purses, sacks, etc., mouthpiece for, J. R. Hill.............................. 761,962
Radiators, combined shelf or hanger and footrest attachment for, F. H. Maxam 762,179
Rail joint, J. Colin..................... 761,660
Rail joint, H. D. Aupke.................. 762,113
Railway bed construction, R. E. Smith 762,207, 762,208
Railway guard rail clamp, F. C. Anderson 762,224
Railway, pleasure, J. H. Brown........... 762,022
Railway signal, electric, R. J. Sheeby.... 761,853
Railway signaling device, J. O. Garrett.... 761,825
Railway switch, J. A. Faulkner........... 762,158
Railway system, electric, C. H. Murphy.... 761,694
Railway tie, W. Bryson................... 762,132
Railway tie, composite metallic and concrete, C. Bubrer..................... 761,872
Railway tie, concrete, L. & M. J. Beezer.. 761,647
Railway track current controller, A. Oesterreicher.............................. 761,987
Record preserving mount, A. P. Hoard..... 761,964
Refrigerating apparatus, C. C. Palmer.... 761,701
Regulator. See Feed water regulator.
Retort, H. Hirsh......................... 762,058
Reversing mechanism, E. Johnson.......... 761,839
Rivers, raising subterranean, L. P. Friestedt............................... 762,042
Roasting furnace, muffle, F. Meyer....... 761,691
Rod coupling, L. M. McGehee.............. 762,245
Roller die, Such & Heath................. 761,792
Roofing, metallic, J. Williams........... 762,220
Rope clamp, A. M. Marsh.................. 762,075
Rotary engine, E. C. Warren.............. 761,799

Rotary engine, W. Wyand 762,016
Rotary switch, R. T. Johnston 761,769
Rubber articles, making hollow, I. F. Kepler 762,063
Rubber bag bodies, making, I. F. Kepler .. 761,890
Rubber bulbs or other articles having necks or projections, making hollow, I. F. Kepler 762,064
Rubber soles to leather boot or shoe bottoms, machine for applying, G. F. Butterfield 762,024
Sad iron, J. H. James 761,838
Sad iron handle, C. Winter 761,741
Saddle bag, L. N. Prudhomme 761,782, 761,783
Sash, revolving, J. F. Blanchard 762,123
Sawmill log carrier, mounted, A. S. McDonald 761,697
Sawmill set works, E. W. Hopper 762,170
Saw set, J. Sperber 761,720
Saw swaging machine, W. C. Renie 762,195
Sawing machine, band, C. Seymour 762,095
Scale, computing, A. B. Camper 762,136
Scale removing and wire polishing machine, F. Michou 762,180
Scale, weighing, C. W. McKee 762,187
Scale, weighing, W. H. Sargent 762,200
Scraping machine, D. C. Maytag 761,896
Screw guard, set, C. E. Pierce 761,708
Scrub hook, J. McLean 761,850
Seal, bottle, B. L. Wood 761,932
Sealing machine, envelop, C. J. Fancher 761,824
Search light, W. O. Webber 762,215
Shade holder, E. Cooper 761,947
Shade holding device, C. L. Hopkins 761,837
Shaft support, Cook & Miller 762,027
Shaft support, vehicle, D. H. Loveless 761,688
Shafting coupling, H. Holzwarth 761,966
Sharpening device, S. W. Baldwin 761,936
Shaving apparatus, W. R. Allen 761,808
Sheet delivery mechanism, A. B. Graham .. 761,669
Shirt neckband, D. B. Coon 762,145
Shoe holder, O. G. Cates 761,819
Shoes, etc., ironing device for, A. S. Hayden 762,052
Sifter, ash, R. W. O'Donnell 762,190
Sign receptacle, C. D. Platt 762,192
Signal, W. A. Richardson 761,787
Signaling mechanism, electric semaphore, B. O. Wagner 762,105
Signaling system, automatic block, H. B. Taylor 762,009
Skirt spreader, G. H. Wickelberg 761,803
Slates or other coverings, composition of matter for manufacturing, F. M. Ruschhaupt 761,788
Sleigh, H. Bryda 761,653
Sleigh, bob, F. A. Schloemer 762,091
Snap hook, S. Smith 762,097
Snap hook, F. U. Keene 762,171
Snap, locking, F. E. Sweet 761,859
Soap in liquid or paste form, means for distributing, J. M. Campbell 761,759
Soap receptacle, liquid or powdered, G. S. von Wedelstaedt 761,801
Sound reproducing machine tablet, O. Messter 761,846
Spanner wrench, V. H. Ernst 761,881
Speculum, rimless trivalve vaginal, Clark & Harper 761,821
Speed indicator and recorder, C. Schenck, Jr. 762,201
Speed transmission and regulator or brake, variable, C., W., & S. Hibbard 762,055
Speed varying mechanism disk, M. O. Reeves 761,910
Spinning frame clearer, ring, W. H. Gordon 762,163
Spinning machine doffing apparatus, J. F. Muhelm 761,980
Splice bar, A. C. Shand 762,003
Spraying apparatus, plant, L. Wittbold 762,014
Spring brace, C. Smith 761,857
Square, adjustable, J. J. Peyman 761,707
Square, try, C. L. Weld 761,929
Stays, machine for forming wire garment, G. G. Annable 761,640
Steam boiler, H. Carmont 762,137
Steam generator, E. Side 761,719
Steam generator, combined flue and water tube, Nielsen & Praest 761,700
Steam generator, water tube, G. Restucci 761,713
Steam, superheating, E. F. Osborne 762,248
Steam trap, G. L. Belding 761,937
Stock rack, M. F. Holbrook 761,676
Stoker, mechanical, J. W. Kincaid 761,685
Strainer, L. Zabel 762,222
Street sweeping machine, Layman & Parpart 762,241
Stud or button, W. Appleton 761,935
Stump puller, T. E. Ewer 762,233
Sulky, E. S. Frazier 762,038
Swimming glove, C. G. Ammon 762,017
Switch. See Carriage electric switch.
Switch contact, G. Wright 761,744
Target, H. M. Quackenbush 761,784
Telegraph transmitter, W. J. Roussel 761,917
Telephone circuit protective device, Rorty & Thompson 761,916
Telephone selecting device, W. M. James 761,888
Telephone switchboard apparatus, J. L. McQuarrie 761,698
Telephone switch board apparatus, C. E. Scribner 761,852
Telpher, H. M. Harding 761,884
Temperature alarm, electrical, J. P. Bolton 762,125
Thread guide support, W. O. Aldrich 761,934
Thresher and cleaner, bean, J. Trethewey 762,212
Ticket case, E. D. Fritch 762,162
Ticket counting and inspecting machine, R. E. Kimball 761,970
Tire, J. Millar 761,847
Tire bolt wrench, F. C. Gibson 762,049
Tire, pneumatic, C. W. Maxon 761,777
Tool, rotary, J. Konar 761,841
Torpedo placing device, railway, E. M. Jones 762,238
Track drilling machine, W. E. Ludlow 761,975
Train order signal, E. S. Piper 761,902
Tramways or railways having movable rails, means for changing the tracks of, O. Pacini 762,191
Transmitter arm, H. J. Guttman 761,671
Trip sling, W. M. Cain 762,135
Trolley guard, L. B. Aikens 761,637
Trolley signal, C. H. Morse 761,848
Trousers hanger, W. S. Lee 761,893
Trousers pressing device, S. M. Friede 762,041
Truck frame, railway car, S. A. Bemis 761,648
Truck, railway car, G. H. Poor 761,994
Truck side frame, T. M. Gallagher 762,043
Truck transom bolster, railway car, S. A. Bemis 761,650
Trucks, wear take up device for railway car, S. A. Bemis 761,649
Trunk, combination, C. P. Well 762,216
Tuberculosis, mixture for treating, R. Schneider 762,256
Tunnel apparatus, J. W. Reno 761,786
Tunnels, constructing, A. B. Clark 761,658
Turbine, explosion, H. T. Lees 762,175
Turbine governing mechanism, J. Wilkinson 761,865
Turbine, high torque reversing, J. Wilkinson 761,866
Turbine, steam, F. M. F. Cazin 762,263
Twine holder, W. Steger 761,723
Typewriter, N. L. Anderson 761,811
Typewriter, J. H. Kidwell 762,065
Typewriter carriage construction, J. Alexander 761,639, 762,223
Typewriter ribbon movement, J. Alexander 761,638
Typewriter ribbon operating mechanism, J. Alexander 761,807
Typewriting, finger exerciser for students of, Brattin & Ressland 762,020
Unloader and conveyer, J. M. Pierce 761,709
Upright boiler, N. L. Warren 762,106
Vacuum wringer, M. E. Cooley 761,878
Valve, J. G. Westbrook 762,218
Valve, air brake system controlling, E. Cheshire 762,025
Valve and support therefor, puppet, B. Morgan 762,078
Valve, globe, W. A. McGowan 761,849
Valve, quick action triple, R. A. Parke .. 761,703
Valve, steam boiler safety, A. R. Ploppert .. 762,085
Vapor burner, J. G. Branch 762,129
Vaporizer, retort, R. Dempster 761,949
Vehicle body, A. G. Brunsman 761,816
Vehicle, motor, W. Christie 761,657
Vehicle, road motor, W. E. Carmont 762,138
Vehicle sand shield, H. Richardson 761,714
Vehicle steering apparatus, motor, L. R. Rogers 762,197
Vehicle wheel, E. D. Wilderspin 761,804
Vehicle wheel, A. S. F. Robinson 762,196
Vending machine, coin controlled, Garland & Lombard 762,044

Ventilator, S. H. Jacobson 761,680
Vibrator, bed, Wallman & Saliger 761,862
Vise, C. C. Longard 762,070
Votes, apparatus for detecting fraudulent or improper, J. McTammany 761,781
Wagon body lifter, N. Blumhoefer 761,815
Wagon, dumping, W. O. Shadbolt 761,921
Wall construction, ventilating, J. W. Redfern 761,711
Wardrobe, etc., ceiling hook, W. A. Williamson 761,739
Washing machine, M. Jensen 762,061
Washing machine, A. A. & D. D. Rullman 762,199
Washing machine gearing, H. J. Duve 761,951
Water closet, pump, L. M. Hooper 762,059
Water closet tank mechanism, J. M. Burr 761,758
Water elevator, D. D. Dennis 762,153
Water heater, M. Schaack 761,718
Water heater, A. W. Dickerson 762,155
Water tube boiler, M. J. Woodward 761,742
Well drilling machine, F. C. Haar 761,958
Wheel. See Automobile steering wheel.
Wheel balancing device, C. J. A. Heise 762,053
Wheels, device for attachment to, R. E. Browne 762,131
Windmill, Fillman & Davis 762,159
Winding machine, ball, P. Ryan 762,090
Window frame and sash, G. Wahlstrom 761,733
Window lock, A. Zwiebel, Sr. 761,747
Window screen, Stout & Turner 761,791
Wire cloth, loom for weaving, McGee & Donald 761,984
Wire tightener, J. D. Braun 761,871
Wire weaving device, Wood & Henbest 761,805
Wood bending machine, Schmidt & McDonald 762,092
Wrench, A. Baughman 761,645
Wrench, F. W. Vogel 761,797
Wrench, N. E. Atkinson 761,868
Wrench, J. G. Bowles 761,940
Wrench, T. W. Highfill 761,961
Wrench, V. Quenon 761,996
Wrench, A. Dennis 762,028
Wrench, J. D. Hill 762,056
Wrench, C. C. Longard 762,069
Wrench or the like, F. E. Walden 761,798

DESIGNS.

Badge, J. L. Mallery 36,943
Badge, S. Rorex 36,944
Candle, F. L. Perkins 36,953
Candle holder favor, F. L. Perkins 36,954
Casket trimming, E. R. Sargent 36,959
Casket trimming, W. E. Stevens 36,960
Cream whipper bowl and cover, W. Helmer 36,957
Glass vessel, D. C. Ripley 36,956
Mirrors, brushes, or like toilet articles, handle for, S. A. Keller 36,950
Mirrors, brushes, or similar articles, back for, H. A. Weihman 36,951, 36,952
Pins or similar articles, heads for belt, S. Kronburger 36,945
Rug, J. A. Carroll 36,961
Shade for illuminating devices, F. L. Perkins 36,955
Spoons, forks, or similar articles, handle for, P. Farnham .... 36.946 to 36,948
Spoons, forks, or similar articles, handle for, G. W. Shiebler 36,949
Steering wheel, A. W. & H. C. Holmes 36,958

TRADE MARKS.

Baking powder, M. C. Young 42,761
Boots and shoes, leather, N. C. Bohr & Sons 42,758
Boots and shoes, leather, J. Rosenheim & Sons 42,759
Building blocks, machines for making artificial stone, Harmon S. Palmer Hollow Concrete Building Block Co. ... 42,790 to 42,793
Castings, metal, E. H. Benners 42,787
Cigars, C. Donat 42,775
Cleaning compound, certain named, C. L. Barnhart 42,764
Clothing, certain named, C. Austern 42,752
Corsets, J. Siegel & Co. 42,753
Currants, G. Coit 42,760
Drilling machines, W. F. & John Barnes Co. 42,789
Ear rings, Nesler & Co. 42,746
Embroideries, E. A. Fitch 42,750
Lamp chimneys and globes, M. Kirchberger 42,777
Leather dressing and softening compounds, A. J. Reach Co. 42,778
Medicinal salves, J. W. Thomas 42,770
Mineral water, certain named, Red Oak Spring Co. 42,773
Newspapers, daily and weekly, Boston Herald Co. 42,749
Oil, antiseptic healing, Paris Medicine Co. 42,771
Packing, metallic, Holmes Metallic Packing Co. 42,786
Paint in dry powdered form, cold water weatherproof, Muralo Company 42,780
Paper, sheathing, Wolf River Paper & Fiber Co. 42,785
Pencils, certain named, Bleistiftfabrik vorm. Johann Faber A. G. 42,747
Periodicals, Judge Co. 42,748
Photographic apparatus, L. Gaumont & Co. 42,784
Polish for wood and furniture, W. L. King 42,779
Razors and razor blades, Kampfe Bros. 42,782, 42,783
Remedies for certain named diseases, W. E. Hurd 42,766
Remedy for certain named diseases, A. M. Mathews 42,767
Salve for the cure of injuries or diseases of the skin, K. Zimmermann 42,769
Shirts, Marks, Rothenberg & Co. ... 42,754, 42,755
Shoes, fine kid, Green-Wheeler Shoe Co. ... 42,757
Shovels, spades, scoops, and spading forks, Supplee Hardware Co. 42,788
Silk dress goods, Rogers & Thompson 42,751
Soap, shaving, P. M. Megaro 42,763
Socks and stockings, Milford Hosiery Co. .. 42,756
Specific for the cure of boils, E. F. Bacon .. 42,768
Surgeon's lamp, B. S. and F. Co. 42,770
Tonic for certain named diseases, D. Bain .. 42,772
Varnish and paint remover, F. A. Crandall 42,781
Whisky, E. J. Cantin 42,774
Yeast, H. Zink & Co. 42,762

LABELS.

"Alpha," for hosiery, Pittsburgh Dry Goods Co. 11,122
"Blue-Nap," for soap, Henry Roever Co. 11,123
"Cantella," for toilet preparation, Cantella Co. 11,125
"Cigarros," for cigars, Otis Lithograph Co. .. 11,131
"Hair-E-Face," for hair remover, Alexander Co. 11,126
"Hall's Benzine Soap," for soap, R. L. Hall Soap Co. 11,124
"La Marlew," for cigars, H. J. Lewis 11,130
"Old Kentucky Bitters," for bitters, W. D. Rea 11,128
"Rood's Good Enough," for popcorn, Colorado Confectionery Co. 11,129
"The International Hygienic Mattress," for mattresses, A. Soehner 11,132
"The President's Inauguration Cup," for cups, F. N. Osborne 11,121
"Vin-Crest Brut," for champagne, Brotherhood Wine Co. 11,127

PRINTS.

"Gloves," for gloves, Hurd & Page 1,008
"Noteless Piano Chart," for charts, A. L. Brinckle 1,009
"Spiltoir's Buttermilk Talcum," for talcum powder, G. E. Spiltoir 1,007
"Stick Candy The Stick That Never Sticks," for stick candy, George Blome & Son Co. 1,006

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

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

Ventilator, S. H. Jacobson 761,680
Vibrator, bed, Wallman & Saliger 761,862
Vise, C. C. Longard 762,070
Votes, apparatus for detecting fraudulent or improper, J. McTammany 761,781
Wagon body lifter, N. Blumhoefer 761,815
Wagon, dumping, W. O. Shadbolt 761,921
Wall construction, ventilating, J. W. Redfern 761,711
Wardrobe, etc., ceiling hook, W. A. Williamson 761,739
Washing machine, M. Jensen 762,061
Washing machine, A. A. & D. D. Rullman 762,199
Washing machine gearing, H. J. Duve 761,951
Water closet, pump, L. M. Hooper 762,059
Water closet tank mechanism, J. M. Burr 761,758
Water elevator, D. D. Dennis 762,153
Water heater, M. Schaack 761,718
Water heater, A. W. Dickerson 762,155
Water tube boiler, M. J. Woodward 761,742
Well drilling machine, F. C. Haar 761,958
Wheel. See Automobile steering wheel.
Wheel balancing device, C. J. A. Heise 762,053
Wheels, device for attachment to, R. E. Browne 762,131
Windmill, Fillman & Davis 762,159
Winding machine, ball, P. Ryan 762,090
Window frame and sash, G. Wahlstrom 761,733
Window lock, A. Zwiebel, Sr 761,747
Window screen, Stout & Turner 761,791
Wire cloth, loom for weaving, McGee & Donald 761,984
Wire tightener, J. D. Braun 761,871
Wire weaving device, Wood & Henbest 761,805
Wood bending machine, Schmidt & McDonald 762,092
Wrench, A. Baughman 761,645
Wrench, F. W. Vogel 761,797
Wrench, N. E. Atkinson 761,868
Wrench, J. G. Bowles 761,940
Wrench, T. W. Highfill 761,961
Wrench, V. Quenon 761,996
Wrench, A. Dennis 762,028
Wrench, J. D. Hill 762,056
Wrench, C. C. Longard 762,069
Wrench or the like, F. E. Walden 761,798

DESIGNS.

Badge, J. L. Mallery 36,943
Badge, S. Rorex 36,944
Candle, F. L. Perkins 36,953
Candle holder favor, F. L. Perkins 36,954
Casket trimming, E. R. Sargent 36,959
Casket trimming, W. E. Stevens 36,960
Cream whipper bowl and cover, W. Helmer 36,957
Glass vessel, D. C. Ripley 36,956
Mirrors, brushes, or like toilet articles, handle for, S. A. Keller 36,950
Mirrors, brushes, or similar articles, back for, H. A. Weihman 36,951, 36,952
Pins or similar articles, heads for belt, S. Kronburger 36,945
Rug, J. A. Carroll 36,961
Shade for illuminating devices, F. L. Perkins 36,955
Spoons, forks, or similar articles, handle for, P. Farnham .... 36,946 to 36,948
Spoons, forks, or similar articles, handle for, G. W. Shiebler 36,949
Steering wheel, A. W. & H. C. Holmes 36,958

TRADE MARKS.

Baking powder, M. C. Young 42,761
Boots and shoes, leather, N. C. Bohr & Sons 42,758
Boots and shoes, leather, J. Rosenheim & Sons 42,759
Building blocks, machines for making artificial stone, Harmon S. Palmer Hollow Concrete Building Block Co. ...42,790 to 42,793
Castings, metal, E. H. Benners 42,787
Cigars, C. Donat 42,775
Cleaning compound, certain named, C. L. Barnhart 42,764
Clothing, certain named, C. Austern 42,752
Corsets, J. Siegel & Co 42,753
Currants, G. Coit 42,760
Drilling machines, W. F. & John Barnes Co. 42,789
Ear rings, Nesler & Co 42,746
Embroideries, E. A. Fitch 42,750
Lamp chimneys and globes, M. Kirchberger 42,777
Leather dressing and softening compounds, A. J. Reach Co 42,778
Medicinal salves, J. W. Thomas 42,770
Mineral water, certain named, Red Oak Spring Co 42,773
Newspapers, daily and weekly, Boston Herald Co. 42,749
Oil, antiseptic healing, Paris Medicine Co. 42,771
Packing, metallic, Holmes Metallic Packing Co. 42,786
Paint in dry powdered form, cold water weatherproof, Muralo Company 42,780
Paper, sheathing, Wolf River Paper & Fiber Co. 42,785
Pencils, certain named, Bleistiftfabrik vorm. Johann Faber A. G 42,747
Periodicals, Judge Co 42,748
Photographic apparatus, L. Gaumont & Co.. 42,784
Polish for wood and furniture, W. L. King 42,779
Razors and razor blades, Kampfe Bros. 42,782, 42,783
Remedies for certain named diseases, W. E. Hurd 42,766
Remedy for certain named diseases, A. M. Mathews 42,767
Salve for the cure of injuries or diseases of the skin, K. Zimmermann 42,769
Shirts, Marks, Rothenberg & Co 42,754, 42,755
Shoes, fine kid, Green-Wheeler Shoe Co 42,757
Shovels, spades, scoops, and spading forks, Supplee Hardware Co 42,788
Silk dress goods, Rogers & Thompson 42,751
Soap, shaving, P. M. Megaro 42,763
Socks and stockings, Milford Hosiery Co.. 42,756
Specific for the cure of boils, E. F. Bacon.. 42,768
Surgeon's lamp, B. S. and F. Co 42,776
Tonic for certain named diseases, D. Bain.. 42,772
Varnish and paint remover, F. A. Crandall 42,781
Whisky, E. J. Cantin 42,774
Yeast, H. Zink & Co 42,762

LABELS.

"Alpha," for hosiery, Pittsburgh Dry Goods Co. 11,122
"Blue-Nap," for soap, Henry Roever Co 11,123
"Cantella," for toilet preparation, Cantella Co. 11,125
"Cigarros," for cigars, Otis Lithograph Co.. 11,131
"Hair-E-Face," for hair remover, Alexander Co. 11,126
"Hall's Benzine Soap," for soap, R. L. Hall Soap Co 11,124
"La Marlew," for cigars, H. J. Lewis 11,130
"Old Kentucky Bitters," for bitters, W. D. Rea 11,128
"Rood's Good Enough," for popcorn, Colorado Confectionery Co 11,129
"The International Hygienic Mattress," for mattresses, A. Soehner 11,132
"The President's Inauguration Cup," for cups, F. N. Osborne 11,121
"Vin-Crest Brut," for champagne, Brotherhood Wine Co 11,127

PRINTS.

"Gloves," for gloves, Hurd & Page 1,008
"Noteless Piano Chart," for charts, A. L. Brinckle 1,009
"Spiltoir's Buttermilk Talcum," for talcum powder, G. E. Spiltoir 1,007
"Stick Candy The Stick That Never Sticks," for stick candy, George Blome & Son Co. 1,006

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

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