# 20~ 2 <br> CIENTITI 



Showing Down-Stream Face of Partially Completed Dam.


View from Below Dam, Power House in Foreground.


View Showing the Nain Dam, the 12 -Fuot Penstocks, the Floor and Tallrace of the Power House. THE 60,000 HORSEPOWER POWER HOUSE AT PPIER FALLb.-[See page 180.]

# SCIENTIFIC AMERICAN 

ESTABLISHED 1845

MUNN \& CO.,
Editors and Proprietors

## Publishod Woekly at

No. 361 Broadway. New York
terms to subscribers
 the scientific american publications.

oney order. or by bank draft or check.
MUNN \& CO., 361 Broadway, New
NEW YORK, SATURDAY, SEPTEMBER 12, 1903.
The editor is always glad to receive for examination illustrated articles on subjects or timely in erest. If the photographs are
sharp, the artucles shrt, and the facts authentic, the coutributions
will receive special attention. will receive special att
at reyular space rates.

## ANOTHER GREAT HYDRAULIC-ELECTRIC POWER

 PLANT.No stronger evidence could be afforded of the great development which has taken place in the last few years of hydro-electric installations than the fact that a great 50,000 -horse-power plant, such as is illustrated on the front page of this issue, should have been planned and built with such little ostentation that it has only recently, as it neared completion, attracted the attention which its size and importance demands. It seems but a few years ago that the world was filled with wonderment at the announcement that sufficient water was to be diverted from the Niagara River, to operate a series of large turbines, whose aggregate power should reach the then enormous figure of 50,000 horse power. The project was regarded with much curiosity, and there was no little foretelling of disastrous failure, while the day of its opening was regarded as one of the most momentous in the history of the industrial world. This event occurred less than a decade ago; yet, so great was the success of the venture, that its capacity has already been doubled, and another one of far greater size is under construction on the opposite shores of the river. So many similar installations of large aggregate horse power are either planned or under actual construction that the building of a 50,000 -horse-power power house, like this one in the upper valley of the Hudson, seems to call for little more than a passing remark. The indications are that within a few generations there will not be a natural waterfall or rapids, except in the unsettled portions of the country, that will not resound with the hum of the turbine and the generator.

## THE LAST OF A FAMOUS LINER

Every one that is interested in the history of the transatlantic service (and who is not?) will learn with a measure of regret that the famous White Star liner "Britannic" is now engaged upon her last voyage, preparatory to being sent to the bone-yard to be broken up. This historic vessel will long be remembered as having ushered in the era of the high-speed, luxuriously furnished transatlantic liner with which we are familiar to-day; for the very latest vessels are merely a development in size, speed, and comfort of certain features which were first embodied in this ship. She is further remarkable because of the unusual endurance of her engines and boilers, which present an instance of continuous service that, as far as we know, is without a parallel in the history of the mercantile marine. It is not generally known that the engines and boilers with which she is now making the engines and boilers with which she is now making
her last voyage across the Atlantic are the same that her last voyage across the Atlantic are the same that
were put into the boat by the Harland \& Wolf firm when she was launched in 1874, or nearly thirty years ago.
To the "Britannic" belongs the credit of being the first boat to reduce the time between Queeenstown and Sandy Hook to less than eight days, her record for the easterly passage being seven days and sixteen hours. The "Germanic," a sister ship to "Britannic," which was launched shortly after her, is still in the Atlantic service; but she has been re-engined and re-boilered, and thoroughly brought up to date. The older boat, however, has been steadily breasting the storm and stress of the transatlantic passage for twenty-nine years with her original engines and boilers, and she has the remarkable record of never having missed a day in all that time through accident or breakdown. She has remained continually at work except for two or three weeks in each year, when she was taken off the route and overhauled for the season's work. In the twenty-five years from 1874 to 1899 she made 260 round trips between New York and Liverpool, crossing the Atlantic more than 500 times and traveling
over $1,800,000$ miles, or sufficient to make the circuit of the earth over seventy times. During her long period of service she has carried without accident over 200,000 passengers.

## Is YACHT DESIGNING AN EXACT SCIENCE?

The present series of international races has been full of surprises and to no one more than to the two eminent designers of the competing yachts. For it is certain that saving and except for the fact that "Reliance" has done what she was designed to do in successfully defending the cup, each of the great 90 -foot sloops has shown, in actual sailing, qualities that were never intended nor expected, and has conspicuously failed to develop other qualities that were specially aimed at in their design. "Reliance," as we announced several months ago when that boat was undergoing her early trials, was designed to secure exceptional speed when reaching, and, indeed, on any point of sailing with started sheets. This quality was expected to make her perfectly sure of winning the triangular race; and in view of the fact that the leeward leg of the windward and leeward races off Sandy Hook is almost invariably turned by a shift of the wind into a reach, it was calculated that being fast under spinnaker and exceptionally fast on a reach, she would be certain to gain on the leeward leg everything that she might lose by her less speedy performance when beating out to the weather mark. It was estimated that, with her great overhang and full waterlines, the most unfavorable conditions for "Reliance" would occur when sheets were hard aboard. and she was heading into a short and broken sea. As a matter of fact this estimate of the boat turned out to be entirely at fault; for she was unable to beat "Constitution" on a reach, while in windward work she proved to be a most consistent and remarkable performer. Even in the much-dreaded combination of light winds and lumpy seas, she has proved to be a simply phenomenal craft, being, indeed, so swift under these conditions as to stand in a class absolutely by herself. Thus has theory proved itself to be once more entirely at sea, and on no point so much as on the failure of "Reliance" to develop any remarkable speed when reaching in a whole-sail breeze. Anyone looking at her lines would expect that the easy diagonals, the great length of her water line, and the small displacement in proportion to the enormous rig, would enable her to reel off a speed of at least $131 / 2$ to 14 knots an hour. Yet, as a matter of fact her highest recorded speed in reaching on a measured 10 -mile leg is only 12.6 knots per hour. How this discrepancy is to be explained, nobody, not even Mr . Herreshoff himself, can tell.
Turning now to the challenger, it was evident to every one who is acquainted with the elementary principles of yacht designing that her best work should be done in light winds, when the relatively small area of wetted surface which always goes with a full model of large displacement, such as she shows, would tell in her favor. The boat was evidently built for the Sandy Hook courses where light and moderate winds prevail at the time of the year when the races take place. It was natural to expect that in the stronger winds, when the speed passed the point at which the fuller body and relatively larger displacewhich the fuller body and relatively larger displace-
ment of the English boat would tend to set up wavement of the English boat would tend to set up wave-
making, the chances of "Shamrock" holding "Reliance" would diminish, and that the stronger the wind, the less would be her liklihood of taking the race. Here again theory has been totally upset, for in the contests that have been held the "Shamrock" has shown to the best advantage when the winds were strongest, and as the strength of the wind diminished, so the margin by which she has been beaten has steadily increased. In the triangular race sailed. in a good breeze of 10 to 15 knots strength, when, theoretically, "Reliance" should have dropped her steadily with every mile that was sailed. particularly on the 20 miles of reaching, she proved so far the equal of our boat that, on corrected time, if we omit the 19 seconds handicap at the start, she was only beaten by one minute. On the other hand, in an attempted race in which there was that very roll of the sea and light wind which was supposed to embody the ideal conditions for "Shamrock," she was beaten by the same boat 20 minutes in a 15 -mile leg to windward.

It is because of these strange anomalies that the yachting world is drawing on its thinking cap, in the endeavor to find just exactly where it stands; for there is no denying that these two boats. in which are embodied the wisdom and skill of the two leading naval architects of the day, have persistently done the things that nautically they ought not to have done, and have left undone the things that nautically they should have done!

The moral of all this is that in spite of our boasted advancement in the art of yacht design we have as yet by no means reached the ideal boat; and we shall not have done so until some one discovers how to combine with the remarkable beating and running qualities of "Reliance," the ability to reel off 13 to 14 knots an hour when reaching in a whole-sail breeze.

## LIMITS OF ELECTRIC TRACTION WITH DIRECT

 CURRENT.Systems of electric traction differ widely as to the power that may be delivered to a car, the distance from a generating station at which a car may be operated, and the rate of acceleration that a car may attaln. With continuous-current dynamos supplying car motors at pressures of about 500 volts, a limit to the power that may be delivered through a single trolley contact is soon reached.
A car with a motor equipment of 200 horse power, such as is not uncommon for interurban service, draws 350 amperes from the trolley wire when loaded to full rated capacity, if the motors have an efficiency of about 85 per cent and their voltage is 500 . At start ing and on heavy grades the amperes taken by such a car may go up to 1,000 without serious heating at the trolley, but it is doubtful whether this current could be collected constantly without trouble. Coming to be collected constantly without trouble. Coming to
a large electric locomotive or heavy train requiring 2,000 horse power at normal rating, the regular cur rent with voltage and motor efficiency as before, would be 3,500 amperes, which might rise to 10,000 or 15,000 amperes for short periods. Such currents are entirely beyond the capacity of any single trolley or contact shoe. A number of trolleys might be employed with a heavy train or locomotive, but such complication would soon reach a limit. The limitations as to radius of operation of the 500 -volt continuous-current traction system may be well illustrated by an example. If a car requiring 200 brake horse power on the wheels, or a delivery of 350 amperes and 500 volts at its motors, is operated ten miles from the station with a drop of 50 volts in its feeder wire, this wire must have an area of 400,000 circular mils. Ten miles of such wire with weatherproof insulation weigh 80,000 pounds, and at 15 cents per pound have a value of $\$ 12,000$. This sum represents an investment of $\$ 60$ per horse power capacity of the feeder wire, or about three times the cost of dynamos per like unit of capacity. Assuming that only 50 volts drop will occur in the rails as a re turn circuit when the drop in the trolley feeder is 50 volts, the total loss of pressure between dynamo and car motors is 100 volts, so that the dynamo must de liver current at 600 volts in the assumed case. This drop of 100 volts on the line and rails corresponds to a loss of 16.66 per cent. For exceptional loads, as when the car is climbing a steep grade, the percentage of loss in feeder wire and rails will increase directly with the amperes fiowing to the car. Thus, when the car motors take 1,050 amperes, the fall of pressure in the rails and feeder together will be 300 volts, and one half of the energy delivered at 600 volts by the dyna mo will be lost in the transmission. If more than one car is supplied by this feeder, the percentage of loss in it will increase directly with the number of the cars. The torque exerted by the car motors increases approximately with the amperes they receive, but their speed drops with the terminal voltage; hence, though the motors carry a heavy overload, the cars cannot maintain normal speed because of the loss of pressure in line and rails.
When under normal full load, the car in question receives 350 amperes at 500 volts, or 175 kilowatts. When an overload causes the current to rise to 1,050 amperes, the pressure at the motors drops to 300 volts and they receive 315 kilowatts, or 1.8 times the power delivered to them at normal full load. As the generat ing station was assumed to operate continuously at 600 volts, it appears that when the output from this station is multiplied by three, the rate of energy delivery to motors increases only 80 per cent. In other words, the proportion of the entire energy output absorbed by the line and track rises with the ampere flow, and an absolute limit is thus put on the power that may be delivered to the car motors. As one-hal of the energy sent out by the power station is lost in the line and rails with a current of 1,050 amperes, any further increase of current will actually decrease the power dellivered to the car motors, though it will increase their torque. Thus if the station delivers 1,400 amperes at 600 volts to the particular feeder and track under consideration, the motors on the car will receive this current at 200 volts, representing only 280 kilowatts.
In the matter of motor torque, the continuous-current system of electric traction presents its strongest point. The unequalled capacity for increase of torque pos sessed by the series-wound continuous-current motors has carried street cars up all sorts of grades with all sorts of loads and placed electric traction in the se cure position which it occupies to-day. Furthermore, this capacity for increase of torque makes it possible with the continuous-current motor to obtain rates of car acceleration that can be equaled with no other mat chine of the same normal rating.
The torque of a continuous-current motor depengst on the strength of the magnetic field in its air gaps and on the amperes flowing through its armature coils. If the magnetic field remains constant, the armature torque increases directly with its current, and if the field strength goes up also, the torque increases faster
than the current. But the armature current distorts the magnetic field in the air gap and tends to cause destructive sparking at the commutator, this tendency being greater the larger the current in the armature coils. Where great increase of torque over the normal rating must be had, the continuous-current series motor offers this unique property, that the increase of current which gives the armature greater torque further strengthens this torque by adding to magnetic density in the air gap, and this addition reduces cross magnetization and the tendency to destructive sparking at the brushes.
A. D. A.

## THE AGREEMENT BETWEEN THE BRITISH GOVERNMENT AND THE CUNARD AND MORGAN

 COMBINE MERCANTILE FLEETS.by our london correspondent.

The British government has published the terms of its agreements arranged respectively with the Cunard Steamship Company and the Morgan Combine concerning the British vessels which were incorporated in the trust. The government comprises the three branches-the Admiralty, the Board of Trade, and the Postal Department. With regard to the Cunard Company, the government assumes practical control. The financial assistance comprises a loan of $\$ 13,000,000$ or less under certain circumstances, at a yearly interest of $2 \% / 4$ per cent, an annual payment of $\$ 450,000$, and the increase of the postal subsidy from $\$ 310,000$ to $\$ 340,000$ a year. The Cunard Company, on the other hand, in answer to this assistance, will build two new vessels of from 24 to 26 knots hourly speed, suitabie for use as armed cruisers, and will place the entire Cunard flect at the disposal of the government whenever required; will improve the mail service, and will guarantee that the company remain purely Brit ish both concerning its control and the shareholders. That is to say, no one but a British subject may be an official or have any share interest in the concern The agreement is to remain in vogue for twenty years from the time the second new vessel departs on her maiden voyage.
Many important clauses are inserted in the agreement, to enable the government to control both the company and its vessels. The most important of these are broadly as follows:
The plans and specifications of the new vessels to be approved by the British Admiralty, who may make reasonable modifications in the designs to suit their especial requirements
The ships are to be held at the disposal of the government for either purchase or hire. The purchase price is to be the market value of the vessel plus a 10 per cent bonus as compensation for loss or compulsory sale. Depreciation is to be set down at 6 per cent per annum upon the actual cost price of the steamship.
The payment for the hire of a vessel is to vary with its speed. In war time the Admiralty will provide the crew, but when the vessels are requisitioned for naval purposes during peace time the government is to have the option of the crews and will pay them for their services. The rate of payment will vary from $\$ 6.25$ without crew and $\$ 7.50$ with crew, for vessels of above 22 knots speed to $\$ 4.37$ without crew and $\$ 5$ with crew for vessels of between 14 and 17 knots speed, these rates being per ton per month. The company, on their part, are not to increase unduly freight or other charges and must not give undue preference against British subjects.
The company must not sell or dispose of any vessel of over 17 knots speed, without the sanciion of the government. All the ships' officers, eexcept the engineers, are to belong to either the navai reserve or the naval fleet reserve, and not less than one-half of the crew must belong to eit'er of these two branches of the service. In the ever.t of the new vessels failing to attain the minimum gcaranteed sea speed of $241 / 2$ knots in moderate weather, but not falling below the minimum of $231 / 2$ knots, then the amount of the annual subsidy is to be decided by arbitration.
With regard to the mail service, the subsidy for which has been augmented to $\$ 340,000$ per annum, the service is to be accelerated and improved, and the new vessels are to be included. This payment is also to cover the transit of parcel mails up to a limit of 100 tons' measurement in either direction per week. Any failure in the mail service will result in the infliction of fines and penalties.
The government's control also comprises two nominees, who have the power to give votes equivalent to one-quarter of the number of votes possessed by the company's shareholders. In more explicit words the government holds one-quarter of the concern. Any person other than a British subject who acquires a share is to be forced to dispose of it within three days, failing which the share will be compulsorily sold at the market value to a British subject.
The amount of the subsidy to be paid every year has been deduced by careful investigation. The committee appointed by the Parliament for this inquiry reported that a sum of $\$ 552,500$ would be necessary to
indemnify a company for the financial loss they would sustain by running a 24 -knot vessel in time of peace, which sum would have to be increased to $\$ 745,000$ for a 25 -knot boat. On this basis the increase between
these two figures would amount to $\$ 1,297,500$ for two vessels each of $241 / 2$ knots. This payment, however, vessels each of $241 / 2$ knots. This payment, however,
has been compromised by reducing the rate of interest upon the loan of $\$ 13,000,000$ from the normal outside market rate of 5 per cent to $23 / \pm$ per cent.
In the case of the Morgan combine, the agreement is also extended over a period of twenty years, but the government stipulates that in any postal, military, or naval services wherein it may require the utility of the vessels of any of the British steamship companies merged into the combine, they are to be treated precisely the same as other British shipping concerns. One exception, however, is made, and that is the construction of ships of "uncommercial speed" which the government may specially require to be constructed and which are principally intended for war purposes.
The combine undertakes that a majority of the directors of the British companies shall be British subjects; no vessel is to be transferred to a foreign registry without the consent of the British Board of Trade; the ships are to carry the same quota of officers and crew of British subjects as the government stipulates upon other British vessels engaged in the same trade; the government is to have the option of purchasing or hiring any vessel on arranged terms; and one-half of the tonnage at least added to the combine in successive triennial periods from September, 1902, when the agreement was signed, is to be British. With respect to the last clause, reservation is made concerning the ships of "uncommercial speed" and vessels purchased from other than British or American sources which have been running for not less than two years. In the case of any dispute arising between the two parties, the matter is to be referred to the British Lord Chancellor, who is to be the arbitrator, and whose decision either concerning law or fact is to be regarded as final.

From these two agreements it will be recognized that the British government has concluded a fairly powerful bargain, and while it practically acquires the Cunard Company, no antagonism is displayed to the mercantile combine.

## MORE INFORMATION ABOUT THE PRIZE FOR A DUST-

 ARRESTING RESPIRATOR.The council of the Society of Arts are prepared to award, under the terms of the Benjamin Shaw Trust, a prize of a gold medal, or twenty pounds, for the best dust-arresting respirator for use in dusty processes, and in dangerous trades.
The council are well aware that for many years past the necessity for such an apparatus has been recognized. As far back as 1822 the society awarded its gold medal to Mr. J. H. Abraham, of Sheffield, for a magnetic guard to protect persons employed in dry grinding. The apparatus described in the society's "Transactions" (vol. xl., 1822, p. 135) includes a respirator to cover the mouth and nose. This respirator was fitted with magnets, for the purpose of arresting the fine particles of steel thrown off in the process of pointing needles, and in other processes of dry grinding. Although the invention was greatly appreciated at the time, it appears never to have come into practical use, the main objection to it having been, it is believed, raised by the workpeople themselves, who feared that the lessened risk attached to their employment would lower their wages. Similar considerations have, it appears, stood in the way of the introduction of various appliances intended to limit the risks associated with all trades in which the workpeople breathe a dusty atmosphere. The council, however, think that such considerations are likely to have less weight at the present time, and they hope that the offer of a prize may draw the attention of inventors to the matter, so that it may result in the production of some suitable piece of apparatus, despite the difficulties with which the solution of the problem is surrounded.
The apparatus will be required to fulfill the following conditions:
(1) It must be light and simple in construction.
(2) It should be inexpensive, so as to admit of frequent renewal of the filtering medium or of the respirator as a whole; or alternatively it should be of such construction that it can be readily cleaned.
(3) It should allow no air to enter by the nostrils or mouth except through the filtering medium.
(4) It should not permit expired air to be rebreathed.
(5) The filtering medium, though it should be effective in arresting dust particles, should not offer such resistance as to impede respiration when worn for some hours under the actual conditions of work.
(6) It is desirable that it should be as little unsightly as possible.
It should be noted that the prize is offered for a respirator intended merely to arrest dust, and not for a
chemical respirator designed to arrest poisonous fumes. The applications of such chemical respirators are more limited, and there are special requirements connected with them. The council have, therefore, preferred to limit the range of their present offer to the simpler and more important cases of dust, either dust of all kinds or of some special character, e. g., iron or steel. Inventors intending to compete should send in specimens of their inventions not later than December 31, 1903 , to the secretary of the Society of Arts. John Street, Adelphia, London, W.C. Such specimens must be accompanied by full descriptions, and in cases in which the apparatus has been put into actual use, the experience of such use should be given.
Competitors intending to patent their inventions should be careful to obtain protection, as the council of the society cannot undertake any responsibility as regards the secrecy of the whole, or of any part, of an invention submitted to them.
The prize will be awarded on the report of judges appointed by the council.
The competition is not limited to British subjects.
The council reserve to themselves the right of withholding the prize, of extending the time for sending in, or of awarding a smaller prize or smaller prizes.

## SCIENCE NOTES.

Science is nothing but trained and organized common sense, differing from the latter only as a veteran may differ from a raw recruit; and its methods differ from those of common sense only so far as the guards man's cut and thrust differ from the manner in which a savage wields his club.-Engineering Record.
Calcite, when perfectly transparent and free from flaws, has great value for optical purposes. The lo cality which has yielded the largest quantity of fine calcite crystals is near Eskifjördhr, Iceland, and for this reason crystals of good quality are commonly termed Iceland spar.-Engineering and Mining Journal.
The latest addition to the German language is the word "knusperchen," meaning a little thing that can be nibbled. This is the word that has just taken the prize offered by some German educational society for the best translation of the noun "cake."
Phosphorus dissolves slowly in most of its solvents. Sometimes frequent agitation for weeks is required before saturation is effected. C. Stich (Pharm. Zeit.) has determined its solubility in the following liquids, the weights given being the weights of phorphorus in 100 grammes of saturated solution: Almond oil, 1.25 ; oleic acid, 1.06; liquid paraffin, 1.45; water, 1.0003 ; acetic acid, 96 per cent, 0.105 .
The general public, we fear, is not acquainted with the dangers arising from arsenic coloring matter in wall paper. A recent death in Palmer, Mass., is directly attributed, by the medical authorities, to this cause. The trouble which resulted so disastrously made its appearance a year and a half ago in what seemed to be nervous dyspepsia. Two months of travel abroad seemed to greatly improve the patient, but on returning home he soon grew worse again. Ón account of certain conflicting symptoms which could not be readily accounted for, a specialist was called in and gave it as his opinion that there was arsenic poisoning in the system. An investigation was then made which resulted in the discovery of arsenic colors in the wall paper of the sitting room. This room had been papered shortly previous to the appearance of the first symptoms. The wall paper was at once remọved, but. the disease had by this time progressed sc far that it was impossible to save the life of the unfortunate victim.
Andrews (Chicago Medical Recorder) mentions the usefulness of the tuning-fork in the diagnosis of frac tures, especially of the long bones. The test is made by placing the bell of a stethoscope over the bone near the supposed fracture, where the soft tissues are as thin as possible, and the handle of a tuning fork as close to the bone as possible beyond the supposed seat of fracture. The sound will be transmitted through the shaft of the bone to the stethoscope and through the stethoscope to the ears of the examiner When the bone is intact, if the test is properly made, the sound of the fork will be heard with great distinct ness; but if there is a lack of continuity, the sound will either not be heard at all or will be heard very faintly. By comparing the intensity of the sound on the suspected side with the sound heard under similar conditions on the normal side, the question of continuity of bone can be determined. The test for fractures is based upon the fact that bone is an excellent conductor of sound waves, while the soft tissue of the body conducts sound waves very poorly. The bell of the stethoscope should fit tightly to the skin and when comparing the sound and injured sides the instruments should be placed in the same relative positions. The sound waves will be transmitted through a fracture if the two ends are crowded together; also through a joint, especially if the articular surfaces are forced together.

ELECTRO-TELETHERMOMETER OF JUAN VILA FORNS.
The International Congress for the consideration of all devices intended to prevent as well as to fight fires, which has just closed its sittings at London, has examined and adjudged as especially meritorious an instrument which, for want of a better name, may be called the "telethermometer," invented by Mr. Juan Vila Forns, of Gerona, in Spain.

The avowed object of this instrument is to reveal automatically at any distance from the scene of activity any abnormal elevation of the temperature which may occur in its vicinity.

The apparatus is composed essentially of a mercury thermometer connected electrically with a bell or other form of alarm, and an indicating device
In order to establish the desired communication, it is necessary to insert into the tube of a thermometer a number of platinum wires and to arrange them five degrees apart, their uncovered ends being so disposed that, whenever the mercury rises to the figures opposite


ELECTRO-TELETHERMOMETER OF JUAN VILA FORNS.
to which they are located, the ends will form a con tact with the mercury and close an electric circuit. All these insulated wires unite in a single cable after leaving the tube and are carried to and connected with an annunciator set up at any convenient place for observation. Each separate wire is connected with a metallic drop or button showing a number corresponding with the degree on the thermometer at which that individual wire is located. At the center of the annunciator, which closely resembles the half of a clock dial, is found a movable hand or switch point, which may be placed upon any one of the drops or buttons, being at the same time connected, through its fixed end, with an electric bell, also fastened upon the board, by means of a wire, one end of which is inserted into the mercury contained in the bulb of the thermometer. It is scarcely necessary to say that a battery of some kind must be included in the circuit. Now it is evident that the bell will sound the alarm every time the mercury in the thermometer tube reaches or passes the degree controlled by the wire and noted on the button under the switch point. For example, if the switch point rest upon button 115 then, just at the instant that the increase in the temperature in the room in which the thermometer is situated causes the mercury to indicate that number of degrees, contact with the wire will be established, the
electric circuit closed, and the alarm given at the ob serving station.-E. G.

## New Iron-Hardening Procese.

Phosphorus, as is well known, has the. property of imparting a certain degree of surface hardening to iron, but not without producing brittleness. The iron is made to assume a coarse structure, in which the crystals are comparatively loosely bound together. This effect of phosphorus of loosening the coherence of the molecules of the iron greatly facilitates the absorption of carbon by the iron. The carbon rapidly penetrates the iron to a considerable depth, imparting great toughness to the core and nullifying the comparatively slight defect constituted by the inconsider able brittleness of the surface. Two Prussian inventors apply this principle in their process for hardening iron by heating the same in a tempering powder con sisting of organic nitrogenous substances containing a high percentage of fusible ash and employing phosphorus as the medium for the introduction of carbon into the iron. Without prejudicially affecting the welding properties of the iron, it imparts such a de gree of hardness thereto that it can neither be cut nor chipped by the best steel used. In order to harden the surface of about 200 kilogrammes ( 441 pounds) of iron to a depth of 1 millimeter ( 0.0394 inch) by means of this process, the pieces should be imbedded in a retort, muffle. or the like, in bone dust, to which is added a mixture of 300 grains of yellow prussiate 250 grains of cyanide of potassium, and 400 grains of phosphorus. The receptacle is well closed, luted with clay, etc., and raised to a clear red or white heat, whereupon the material treated is immersed in a glow ing condition in a water or other bath.

ENGLISH ARTILLERY TROPHIES AT MONT ST. MICHEL. In 1427, when the English in Normandy made their last assault on Mont St. Michel under Lord Scales, they attacked it with "several powerful engines and certain machines of war," with which, says an old writer, "they trained a battery so furiously against the walls that they made a breach." Among these formidable weapons were two enormous wrought-iron guns, which they were compelled to leave behind on being obliged to raise the siege. They are still on exhibition with some of their projectiles in a railed inclosure just inside the main entrance to the town. As will be seen from the accompanying photograph taken on a recent visit, the local fish ermen find this inclosure very useful for the stowage of their nets, sails, and other tackle.

The guns are of the kind formerly called "bombards," and are of differ ent sizes. The larger one has a caliber of 19 inches, $301 / 4$ inches greatest external diameter, and 12 feet total length, of which about 3 feet 4 inches belongs to the smaller powder chamber in the rear. It weighs very nearly 6 tons. The other gun weighs about a couple of tons less, is of 15 inches caliber and 11 feet 9 inches long. These weapons are not cast but "built-up" guns, being formed of longitudinal bars about 3 inches wide arranged like the staves of a cask and bound round closely with wroughtiron hoops, just as are the "Dulle Griete" at Ghent and "Mons Meg" at Edinburgh Castle. In fact, all four date from about the same period and the "Michelets," as they are called, as well as the others, are most likely of Flemish workmanship. Their projectiles are made of hewn granite and those for the larger gun have been estimated to weigh 300 pounds apiece. The powder chamber is capable of holding about forty pounds of explosive.

The Iron Age states that extraordinary results have followed the establishment of the new drainage scheme at New Orleans, by means of which the level of the ground water has been lowered 4 feet. It is now possible to construct cellars and erect skyscrapers, which could not be done previously. The drainage canals are kept clear by constant pumping. A drawback is a plague of white ants, which are devouring the woodwork of the houses.

## A NOVEL MEASURING MACHINE.

## y dr. A. aradenwitz

Some time ago, while in London, I paid a visit to the works of the Newall Engineering Company, where $I$ saw an interesting measuring machine just brought out by the firm. The chief novelty of the instrument is the spirit level, serving as a comparator,

plan view of a new measuring machine.

side view of the measoring machine.
that is seen on the tail stock; this attachment permits of magnifying the movement of the anvil to an almost unlimited extent, as the movement of the bubble derends upon the curvature to which the vial is ground, being equal to that of a lever of the same length as the radius of curvature.
A coarse screw is operated for quick movement by means of a knurled nut, whereas for fine movement a lever is clamped to the spindle by an eccentric move-

english artillery trophies at mont bt. michel.
$\qquad$

## tall stocr arrangement.

ment on another set of levers, a thumb screw thrusting against a bar. A vernier bar is graduated into tenths of an inch, this being the pitch of the screw, and a second vernier is carried by the rim of a graduated wheel along the first vernier bar.
This graduated wheel is divided into $1-100$ ths on the right hand and $1-1000$ ths on the left, and the second vernier into $1-10,000$ ths. Readings can thus be taken in decimal rotation, the $1-10$ ths being the highest figure disclosed on the first vernier bar, the $1-100$ ths being the highest figure seen on the right-hand side of the graduated wheel past zero, the 1-1000ths the highest figure on the left side of the wheel past zero, whereas the $1-10,000$ ths are shown by the second vernier.
An anvil fits in a socket, in which is an adjustable spring controlling the amount of pressure put on the piece to be measured. The tail end of the anvil comes in contact with a rocking lever, pivoted in a bracket. When pressure is applied to the anvil, a spirit level is displaced The bubble on the level is first adjusted to remain at the left-hand end by means of the thumb screw. Sufficient pressure should be put on the piece being measured to bring the bubble up to a given graduation. The same course is adopted when adjusting the heads by means of end rods or with rule and microscope.
As the movement of the anvil is magnified by the level 4,000 times, if the anvil is moved one-thousandth inch, the bubble would move 4 inches. The rocking lever is kept in contact with the anvil by a spring. which may be adjusted in the boss of the bracket previously mentioned. When the pressure is removed from the anvil, the rocking lever rests against a stop. The head and tail stocks are clamped to a true flat face on the bed, as shown in the sketch. They were designed to meet the requirements of the average tool room and are very easily handled.

## PHOTOGRAPHY IN COLORS-THE THREE COLOR METHOD.

BY A. bosch.
It was nearly 100 years ago that Thomas Young, with an extraordinary foresight for one of his time, advanced the theory of the three fundamental or elementary colors, based upon scientific research, and expressed the belief that the nerve apparatus of the eye possessed three kinds of fiber, each being sensitive to a fundamental color.

Indeed three primary colors, properly chosen and combined, are sufficient to reproduce the seemingly infinite combinations of nature. According to Young, it was apparent that the colored image, which could not be produced in a single exposure, was to be obtained only by combining the three correspondingly colored images. The main difficulty, however, was the proper production of these three images. These images are now produced by means of three colored filters or screens corresponding to the three primary colors.

For the first explanation of the elementary colors we are indebted to the Scotch physicist, James Clerk-Maxwell. He it was who first experimented with three-color photography. The experiments were, however, unsuccessful, for in 1861 we possessed no color sensitizing means. The three elementary colors are red, green, and blue. If we place a colored object before the objective, then cover the lens with a red glass plate, acting as a ray filter, and expose, only the red light rays will be allowed to pass through the glass-plate filter and lens to affect the sensitive plate, the blue and green rays being absorbed. In this manner the red image is produced. By repeating the exposures and substituting the green and violet filters respectively, the three different negatives are obtained. From these three negatives, three positives are produced by copying upon transparent glass plates; and these transparencies are projected, superimposed, upon a screen so that they exactly register, with three corresponding light filters-colored glass plates or liquids. The result is a colored picture, astonishingly true to nature.
Maxwell's liquid light-filters for the projection of the different positives were comprised as follows: For red, a glass receptacle filled with thiocyanate of iron; for green, a solution of copper chloride; and for blue, a solution of copper in ammonia. After Maxwell came Ives, among others.
All these investigators worked along the same lines and obtained very satisfactory results, the only diffi culty being that the exposure necessary to produce the three different negatives was too long. Moreover, the registering of the three positives upon the projecting screen was very unsatisfactory

During the past year, however, much progress has been made in three-color photography by Prof. Dr. Miethe, superintendent of the photochemical department of the Royal Technical School of Berlin, and his assistant, Dr. Traube.
As is well known, the common photographic plate is sensitive to blue light rays only. If such a plate be exposed to the light by using a red filter, it would be hours and days before a negative would be obtained. The astounding success of Prof. Dr. Miethe was only made possible by his succeeding; in connection with Dr. Traube, in preparing plates which are just as sensitive to red and green light as to blue. In the yist, such plates could be made only in a very unsati fictory form. The time of exposure for red lisht rays was so ong that a rortrait was in
m-st cases imposs:ble.
Wrial the n e w plates, however, this difficulty i s overcome. The time of expos ure necessary is reduced to the fraction of a second.
As a striking example of the possibility of this plate, the fol lowing illustration will serve: During the session of the Fifth In ternational Congress for Applied Chem istry, held in Berlin in 1903,


Fig. 1.-Front View of the Camera.
was much shaking of heads on the part of the members. The professor used but a few seconds in exposing the three-colored negatives. Imagine the surprise of the unbelievers when, upon entering the hall the following morning, they were shown a perfect picture of the convention in natural colors by means of the projection apparatus constructed especially for the occasion.
The method of making plates sensitive to green and red rays was first published by H. W. Vogel. It consists in dipping the plates in highly diluted solutions of different dyes. After they have dried they are ready or use.
The work of Prof. Miethe and Dr. Traube has resulted in the discovery of a certain group of coloring compounds which solve the problem in a very satisfactory manner. This group was discovered in preparing a homologous series of compounds of iodide-methylchinoline and chinaldine derivatives. These dye compounds are colored red or violet and show a common spectrum, the absorption spectra being all remarkably alike. With the exception of amyl-cyanine, all show two absorption lines-one in the green and the other in the yellow part of the spectrum.
Prof. Miethe surprised the members of the photographic section by stating that he desired to take a photograph of the entire convention. It was abou 5:30 P. M., with a rather threatening sky; there


Fig. 5.-The Same Scene Photographed Through a Red, a Green, and a Blue Screen.


The following table gives the positions of the absorption lines of the different compounds:

| Dye. | Main Line. | Secondary Line |
| :---: | :---: | :---: |
| Amyl cyanine. | $597 \mu \mu$ |  |
| Methyl-iso-cyanine | 558 | 519 |
| Ethyl-iso-cyanine. | 558 | 617 |
| Propyl-iso-cynanine | 563 | 52 |
| Hexyl-methyl-iso-c |  | 51 |
| Etayl-methyl-iso-cy | . 558 | 519 |

These compounds are all soluble both in water and alcohol. The solubility in water decreases with increasing molecular weight. Of the above-named substances, methyl-iso-cyanine possesses the most uniform sensitizing curve in the visible spectrum, extending far toward the red. The methyl and ethyl dyes are therefore well adapted to the preparation of panchromatic dry plates, and make it possible to produce plates possessing uniform sensitivity for the entire visible spectrum, the sensitivity extending into red as far as wave length $670 \mu \mu$. and an appreciable in creasing of the sensitivity being noticeable still further into the infra-red.
Ethyl-iso-cyanine is especially adapted to photographic purposes, particularly from the fact that the sensitizing curve does not extend too far into the red, making it possible to work by a tolerably bright red light. Furthermore, it is the most easily cleansed. The preparation is as follows, according to the method given by Spalteholz: The raw product is first cleansed temporarily by recrystallizing in alcohol. These crystals are rubbed and washed with ether and again allowed to crystallize in diluted alcohol. This operation is repeated until the crystals are free from the remaining pitchy substances, which are always formed in the operation. The least traces of these impurities will cause failures and fogging in the bath, or a col oring of the emulsions by the dyes. By virtue of the extraordinary coloring power of the iso-cyanines, a very small amount suffices to bring out the desired effec:
The maximum of panchromatic sensibility is reached by using 0.016 grammes of dye per liter of emulsion, or when the finished silver bromide plate is bathed in a dye solution of $1: 50000$ from one to two minutes.

A further important work which had to be carried out in order


Fig. 4.--Exposing with the Blue Screen. to reach the desired result was the determination of the best colors for he three light filters. Briefly described Prof. Miethe's process is as follows: For the red filter the dyes of the eosine class were found to be the best-of these "Rose Bengale" be ing the most service able for the reason that, in a somewhat concen trated solu tion, a very broad a n d
sharp absorption band is
shown in the green part of the spectrum. In prepar ing a red filter of the proper character with "Rose Bengales," the same must be combined with a filter which absorbs blue and blue-green. The film of "Rose Bengale" is to be so prepared that the filter when dry should allow light waves down to wave length $590 \mu \mu$ to pass through.
As medium amounts for the preparation of a red filter, 1.5 cubic centimeters of a 2 per cent solution of "Rose Bengale" in water to 18 to 20 cubic centimeters gelatine solution are taken, and 9 to 10 cubic centimeters of this mixture are then applied to 80 square centimeters plate surface.
If a plate, prepared in this manner, be combined with a nother tightly-fitting covering plate, which is colored with a yellow dye (best prepared with gelatine and a 4 per cent tartrazine solution) an extraor dinarily quick-acting red filter is obtained, giving in every respect the desired position of absorption for the ethyl red plate. A great deal now depends upon the proper preparation of the green filter. An incorrectly oned filter causes as many poor results in the reproducing of colors as a bad exposure. The preparation of the green filter has consequently been very difficult. The adaptability of the green filter depends mainly upon the amount of violet rays which are allowed to pass through.
Suitable green filters can be prepared by using "brilliant acid green." Most green dyes tend to allow the extreme red rays to pass, which, however, is unimportant. Brilliant acid green, shade VIB, is best adapted for the ethyl red plate. To 6 cubic centimeters gelatine solution (for 80 square centimeters plate sur face) add 1.6 cubic centimeter brilliant acid green ( $1: 100$ ), and to this solution 4 to 8 drops tartrazine solution ( $1: 25$ )
By this means exclusion of the violet and the re quired retardation of blue rays is obtained
The blue filter offers very little difficulty. It is necessary, at least in strong blue-green sensitive plates, to exclude only those rays lying in the green part of the spectrum. Light having at most a wave length of 480 should pass through. On the other hand, it is desirable that, in the reproduction of deep red tones of the original, the blue filter should allow the red of the spectrum to pass unhindered. The re cipe for the violet dye is as follows: For 80 square centimeters plate surface, take 13 cubic centimeters gelatine solution, to which 2 cubic centimeters new victoria blue and 2 cubic centimeters methyl violet solution (1:250) are added.
The bright dye, however, demands too short a time of exposure. It is therefore better to retard the exposure. This is brought about by means of a very thin tartrazine disk, which is first so toned down that the blue filter permits a medium exposure. For the ethyl red plate an extra thin covering disk suffices for the equal exposure of red and blue. The required cov ering disk should contain 5 to 6 drops tartrazine solution ( $1: 25$ ) to about 120 cubic centimeters gelatine. From this short description of the colored filters, it is evident that it is possible to expose nearly the same length of time with the red and blue filters. The green filter, however, requires a much shorter period. A retardation of the green filter to about the same exposure is very difficult to bring about without seriously disturbing the curve of transmission. For the proper preparation of the color filters the following requirements are to be strictly observed:

## 1. A dark room free from dust.

2. Skill and painstaking care in handling.
3. A suitable cement or adhesive substance.
4. Careful observation of cement temperature and cautious warming of the plate after cementing.
Filters prepared in this way will last for a long time if not exposed directly for hours to the sunlight, which, however, is net probable in the usual method of working.
Prof. Miethe has a red filter which he has used just two years, making hundreds of exposures with it, in spite of which it has not changed in the least.
We come now to the description of the apparatus. This is made rather small in order to be easily car ried. The best size for plates is $9 \times 8$ centimeters (Figs. 1, 2, 3).
As has been already mentioned, the exposure should be made as quickly as possible. Hence very fast lenses are required. The three images must also exactly register. A long focal distance is therefore necessary and an apochromatic lens. The choice of the latter, however, is rather limited, as apochromatic corrected lenses, i. e., those possessing a like focal distance for the main light rays, unfortunately do not transmit the light very rapidly. For a $9 \times 8$ centime ter plate a strong portrait anastigmatic lens, such as Prof. Miethe uses, of at least 180 millimeters focus is not adaptable. The camera differs very little from the usual form (Fig. 4), the main difference being that it is provided with a plate-holder (Fig. 4), wherehy the three exposures can be made upon one plate of $9 \times 24$ centimeter dimension (Fig. 5), such plates being uniformly and easily developed. The three
glass filters are brought immediately before the sensitive plate (Fig. 3). A ground glass just behind the color filters serves to focus the object properly.
The filters are firmly attached to, or set into the holder (Fig. 3). The plate-holder is then inserted in place of the ground glass. By means of a pneumatic release, the plate holder and filters are made to drop from top to bottom in the slide apparatus, passing successively before the lens (Figs. 3, 4, 5). The three accompanying photographs were made from a plate exposed in this manner. It is not possible to state the length of time necessary for exposure, this de pending mainly upon the lens, the diaphragm, and the light. It is advisable to stop down as much as possible in order to facilitate registration.

As the ethyl red plate is very sensitive, to red, the time of exposure for red and blue, behind properly chosen filters, can be taken from $1: 1$ to $1: 4$. The exposure for green is much less. Another point to be emphasized is that in preparing ethyl red plates, they should be dried with the utmost dispatch.
Highly sensitive dry plates are to abe carefully dusted and worked in a bath containing: ethyl red, 0.1 gramme; alcohol, 300 cubic centimeters; distilled water, 5,000 cubic centimeters; ammonia, 50 cubic centimeters.

The washing must be done in absolute darkness, the plates rinsed under the water tap for 2 to 3 min utes, and then quickly dried. If the plates are long in drying they do not work well and fog easily. If, however, they be dried within 15 minutes, brilliant results can be obtained.
Prof. Miethe dries his plates in a current of air which passes between water pipes, whereby the escaping moisture from the air is quickly condensed upon the pipes. The air being now dry is slightly heated and then passes off over the plates. The plates dry in about 12 minutes. The developing and further arranging of a $9 \times 24$ centimeter plate with the three negatives (each $9 \times 8$ ) is the same as that of a usual plate.

## THE P PROJECTION APPARATUS.

Colored projections were shown for the first time by Prof. Miethe in the Urania Theater, Berlin, in the winter of 1903. The projecting apparatus used upon this occasion was built by the well-known firm of Ferdinand Ernecke, Berlin, manufacturers of precision instruments, being assisted by the scientific manager of the Urania, Dr. Donath. The apparatus consists of 3 arc lights (hand regulated) and consumes the enormous current of 200 amperes, or 45 horse power, only 10 per cent of this being transformed into light, while the other 90 per cent passes off in the form of heat, thus making it very difficult to protect the light condensers and to keep them from cracking.
These light condensers consist of 3 lenses each, and are insulated against the heat of the carbons by means of a hard glass plate. In front of the condensers are the cooling receptacles, which also act as filters for different light rays, being filled with the three respective solutions, above described for filters.
A voltmeter is provided for each lamp whereby the current and potential in each pair of carbons is carefully regulated. The lantern slides are inserted between the condensers and their projecting lenses.
The $9 \times 24$ centimeter plates (positives) are cut into three parts; the red, green, and blue positive being then glued on to another larger plate at equal distances from each other and corresponding to the distance between lenses.
This method permits quicker handling of the apparatus, making a focusing of the lenses for each picture unnecessary. The lenses were made by the firm of Voigtländer \& Son, Braunwick, being triple-anastigmatic and exactly alike in focus, transmission of light, etc., and, of course, very expensive. Owing to the small number of lenses, very little light is lost through refiection or absorption.
The apparatus is as near perfect as the skill of the mechanic will permit. It can also be used with lamps of less current consumption ( 15 to 20 amperes) by substituting smaller carbons.

## The investigations Paris.

 ference between Greenwich and Paris have now been completed. The work has been of a particularly arduous and protracted nature, necessitating enormous calculations. Altogether the English and French observers have carried out 230 observations, equivalent to eighty nights' work each. Two English and two French observers have been engaged upon the task. The observations were made at Greenwich and Paris simultaneously, and in order to obtain absolutely vsimilar results the instruments were frequently interchanged. The results of these observations have proved both the Greenwich and Paris existent meridians to be erroneous, the calculations finally working out just between the two. The discrepancy, however, is very minute, being only a small fraction of a second.
## gPIER FALLS DAM AND POWER Plant.

by watter h. man
The imposing power plant which is now nearing completion at Spier Falls, which is located about ten miles above Glens Falls, in this State, has scarcely attracted the attention which its magnitude demands; for when the complete plant, as now laid out, has been installed, the ten great turbines will have an aggre gate capacity of 50,000 horse power, which is equal to that of the famous electric plant as originally installed at Niagara Falls. The site of the dam was se lected because of the natural advantage conferred by a fall of the Hudson River, which is well adapted at this spot to the creation of a great reservoir. The river fiows between the Luzerne Mountains on the north, and Mount McGregor on the south, and the t.wo form a valley which at this point is about hal a mile in width. The underlying rock is of good quality, well adapted as a foundation for masonry, and the watershed of the Hudson above the reservoir contains about 25,000 square miles.
The dam, of which we present several illustrations, has a total length of 1,800 feet and contains 181,000 cubic yards of masonry. It is built of a fine quality of granite which was obtained from the Saratoga hills At its deepest point it measures 156 feet from bedrock to crest, and a cross-section at this point shows a total width of base of 115 feet. The structure is virtually composed of three parts. Its northerly sec tion, which abuts on the Warren County shore, is 820 feet in length and rises to an elevation of 80 feet. This is separated by a wing wall 10 feet in thickness from the southerly portion, which extends for 550 feet and is 90 feet in height. South of this is the canal 420 feet in length, by which the water is led from the reservoir to the.fore-bay at the back of the power house. At the fore-bay it is led by ten steel tubes, each 12 feet in diameter, to as many 54inch turbines which will be run under a 90 -foot head. Each turbine will be direct-connected to a generator of 5,000 -horsepower capacity. The ten units will be located in a handsome power house, 400 feet in length, which will be built of brick and steel, and will conform in every respect to the best modern construction and finish for large hydraulic-electric power plants. In order to se cure the greatest possible head of water, the power house is located in what was formerly the bed of the river. The total cost of the plant is about $\$ 2,000,000$. The marketing of the power (a problem which in some of the larger power plants that have been constructed of late years has proved to be more serious than was anticipated) has presented no difficulties, because of the large number of important towns and manufacturing centers that are within easy reach Within a radius of 50 miles are Glens Falls, with its shirt factories and other industries; Saratoga, with its big demand for electric lighting; Troy, which produces more collars, cuffs, and shirts than any other city in the world; Schenectady, with its great electrical and locomotive works; Watervliet, with the United States arsenal and gun factory, and Albany, the capital of the State. Throughout this section there are many hundreds of miles of interurban trolley lines, which find cheaper power in the dammed-up energy of the Hudson River, than in their own coal-fed power plants. So promising is the demand, that thirty years' contracts have been made for practically the entire output of the plant.
The provision for transmitting the power was a large undertaking in itself. A right of way for pole lines was secured, the threephase system was installed, a nd mounted linemen, in relays of fifteen miles patrol every foot of the line each day. All the linemen are kept in communication with the switchboard by a private telephone line, and the loss of power due to defects of transmission is practically nothing. The power is distributed. as alternating current of high voltage to sub-stations in the various cities and towns, where it is transformed and stepped-down to the par ticular voltage required by the consumer.

## Berliner's Airship.

Emile Berliner, well known for his microphonetelephone transmitter, the gramophone, and other in ventions, announces that he has devised an aeroplane. From the newspaper accounts thus far published, it seems that his contrivance is made of aluminium and tin-plate, with ribs of oak and metal tubing. -The whole machine is 10 feet wide by 14 feet long.

The escalator at the 23d Street station of the Sixth Avenue elevated railroad, New York city, which has been shut down recently, has now resumed regular operation. Sometime ago the motor driving the escalator was connected to take current from the third rail. It was found, however, that the voltage fiuctuates over a considerably wider range than had been anticipated and the shut-down was necessary in order that alterations might be made in the motor to secure better speed regulation. During the interval that the electrical changes were in progress, the receipts of the station showed a marked falling off.

Engineering Notes.
There have been launched in the United Kingdom
during the past six months 290 vessels, totaling 565,during the past six months 290 vessels, totaling $565,-$
343 tons gross, as compared with 289 vessels, of 668 . 533 tons gross, in the first half of last year.
It was recently announced that a train from London to Plymouth on the Great Western Railway had made a run of 246 miles in $2339 / 4$ minutes, thus establishing a world's record for a long-distance run. The officials of the Lake Shore \& Michigan Southern have promptly given out figures which disprove this claim. On May 21, 1903, the Twentieth Century Limited left Cleveland at 4.02 A. M., and arrived at Elkhart, Ind., at 7.23 A. M., making 246.12 miles in 221 minutes.
From the returns compiled by Lloyd's Register of Shipping, it appears that, excluding warships, there were 426 vessels of $1,028,099$ tons gross under construction in the United Kingdom at the close of the quarter ended June 30, 1903 . The return shows an increase in the tonnage under construction of about 54,000 tons as compared with the figures for last quarter, but a decrease of about 385,000 tons as compared with the total reached in September, 1901, which is the highest on record.
The new dock which is being built at Boulogne, and which will be called the Bassin Loubet, is to be a deep tidal dock; without gates, and rectangular in form; the north and south quays will each be 350 yards in length, the west side 219 yards, and the east 165 yards. Alongside the north quay there will be a depth of 13 feet at low spring tides; at the south quay there is to be a depth of 25 feet at lowest spring tide to enable ocean liners to he alongside it at low water. The, dock, which. will cover an area of 16 acres, will be entered from the east end. The Bassin Loubet is to occupy the site of the Capecure sands and sand battery. The latter has been entirely removed and set up on a new breakwater.
Writers in the English press appear to have been much exercised over certain statements made by a Woolwich gunsmith in supporic of his claim for compensation against a railway company who seek to acquire his premises for the improvement of their line. The gunsmith, who occupies quite ordinary premises adjoining the railway station, asked the premises adjoining the railway station, asked the
modest sum of $£ 2,684$ for being turned out against his will, and in explanation of his demand said that his profits ranged from 200 to 800 per cent, one specialty of his, described as a wind-gage, which cost 9 s. to make, selling for $£ 214 \mathrm{~s}$. On gunpowder he made an average profit of 200 per cent. These figures are enough to make the mouth water, but they are questionable.
A paper was read before the Association of German Engineers, by Prof. Schmoller, of Berlin University, entitled "The Borderiand between Technical Progress and Practical Economics." He said that "In the year 1750 , when Germany had a population of $18,000,000$, of whom $9,000,000$ were laborers, the proportion of the physical power exerted by the human
factor in economic activity was to the power exerted factor in economic activity was to the power exerted
by machinery in the ratio of one to one. In the year 1895, when Germany had a population of $56,000,000$, of whom $28,000,000$ belonged to the laboring classes, the proportion of manual labor to labor done by machinery was as one to six, or, according to other estimates, as one to ten. Nevertheless, it was recognized that the machine" without the superintendence of the human factor was merely an automaton, and that its productivity could only be immeasurably increased in cases where industrial processes could be resolved into a variety of constantly recurring and identical movements."
The British Admiralty has experienced considerable difflculty in the storage of the steam coal for the war vessels at the coaling bases, since the fuel is injuriously affected by wind and water both in volume and calorific power when stored in bulk. To overcome these disadvantages, which are more serious than may be supposed, an ingenious floating coal depot is being constructed for the Admiralty. In design it resembles an enormous tank capable of holding 12,000 tons. It comprises a waterproof steel framework, very similar in design to the hull of a cubical battleship, and into this is sunk a central shaft, which lets down into an open area corresponding in dimensions with the base of the depot. Pumps are provided to remove any water that may leak into this chamber, while periodically the men descend the shaft to release the coal outside as it settles downward. The vessels containing the coal are moored alongside the tank, and the fuel is removed from their holds by means of four traveling cranes which shoot it through hatchways-one provided to each crane-into the body of the tank. The coal gradually settles downward, and when it is desired to coal a vessel, it is drawn from the bottom of the reservoir through scoops and transferred to the bunkers of the warship. By this means it is anticipated that it will be possible to keep the coal as fresh for months as if it had only been the coal as fresh for months as if
drawn from the minees as required.

Statistics prepared by the United States Census Bureau show that upward of 502 million dollars is invested in the electric light and power undertakings of that country, which number 3,619 , and that the gross yearly earnings of these amounted to upward of 85 million dollars. The total annual expenses amounted to 67.7 million dollars, of which about $201 / 2$, million dollars was paid in salaries and wages, and 22.8 million dollars for supplies and materials. The horse power of the machinery installed totaled $1,758,175$, of which 381,134 were generated by 1,378 turbines, and the remainder by 5.921 steam engines. The total output for the year in kilowatt hours was $2,437,218,732$ units.

The Miller signaling system has been adopted for the Severn tunnel on the Great Western Railway. The tunnel is 4 miles and 600 yards in length. With the new signaling system the tunnel will be divided into sections of 1,200 yards length, thus permitting more than one train on the same line in the tunnel at the same time and with perfect safety. The usual semaphore signals at the sides of the line will be supplemented by "repeat" signals indicated in the cab of each locomotive before the eyes of the driver. This system, which can only be used in connection with electrical track circuit signaling is in successful operation in the Park Avenue tunnel of the New York Central Railway.
It has been decided by the Prussian State Railways Administration to run all the trains on the suburban railway between Berlin and Lichterfelde by electricity. This is said to be an outcome of the long series of trials on the military railway between Berlin and Zossen, which proved the advantage of propelling trains by electric power. An experimental train has been running on the Berlin-Lichterfelde section for the past month with much success. Locomotives by this time are entirely banished from the line. The method of working is by motor cars, each train consisting of two long coaches, one second and one third class, each with separate compartments for smokers. The advent of electrical working on one of Berlin's suburban lines is regarded as the beginning of a new era in railway locomotion in that city, which will soon see steam haulage on all the suburban lines displaced by electric propulsion.
In the investigation of the conductivity of ordinary air, by H. Geitel and C. T. R. Wilson, a certain amount of uncertainty is introduced in the determination of the capacity of the electroscope. In a method proposed by F. Harms, in the Phys. Zeitschr., this uncertainty is avoided. The method consists in determining the rate of discharge from a body suspended in air, and the potential measuring apparatus is only connected with the body at the instant of measuring the potential. The charged body is a brass sphere suspended on a glass thread, it is charged to a certain potential by means of a battery, and after a certain time has elapsed, it is connected to the electrometer and its potential is measured. It is again charged to the original potential, and after a different interval of time its potential is again measured, and so on, each experiment giving one point on the curve of discharge. The experiments give the number of ions used and regenerated per second, and cubic centimeters in air at 19 deg. C. as 28 , while C. T. R. Wilson's experiments gave from 14 to 19 at 15 deg .
D. Negreano, in a communication to the Paris Academy of Science, described a new process for separating metallic powders from inert matters. On an insulated metal plate the pulverized mixture is placed, the plate being connected to the negative terminal of a Wimshurst machine. On bringing up to the plate a metal disk connected to the positive terminal of the machine and projecting the pulverized substance in a vertical direction by means of a special blowing machine, the metallic powder is found to be repelled and partly deposited on the upper parts of the disk. The separation will occur readily when operating with sand and metal grains; experiments with sand grains and very small copper and bronze grains have shown nearly the whole of the metal to be deposited on the disk. This phenomenon is explained as follows: in. the space between the metal plate and disk, the combination of which constitutes an air condenser, the field being uniform, the flux will be perpendicular to the disk; in the neighborhood of the edges of the disk the lines of force will undergo a bending effect, so that the lines parting from the plate beyond of the surface facing the disk will be curved in toward and made to terminate on the latter, this being the path followed by the metallic particles deposited. The above process may serve in some cases to separate a mixture of finely divided metals. When applied to a mixture of brass and copper particles, for example, experiment shows that the brass will be repelled and deposited on the metal disk. The process may, as well, be applied to separating the metallic part of an ore from the gangue.

Motor Cars as Feeders to Trunk Rallroads A service of motor cars, for feeding its trunk railroad, has been established by the Great Western Company of England between the station at Helston, in Cornwall, and the Lizard, some eleven miles distant, and to which there is no railroad communication at present. A short time ago we drew attention to the possibilities of the automobile to act as feeders to trunk railroads, especially in inaccessible places, or where the traffic is not sufficiently extensive to render any other means of communication remunerative The cars which the Great Western railroad have selected for their service are the Milne-Daimler gasoline vehicles developing 16 horse power on the brake There is accommodation for 32 passengers. The jour ney between the Lizard and Helston station, which is over a somewhat hilly road, will occupy approximately $1 \frac{4}{4}$ hours. This service is purely experimental, but ly $1 / 4$ hours. This service is purely experimental, but should it prove successiul, similar services will be where the townships or villages are located some distance from the railroad.
The Great Western Company are also completing arrangements for the introduction of a railroad motor car service upon the section of their track extending from Stonehouse to Chat ford, through the Stroud Valley, a distance of about seven miles. The power in this instance will be steam, the motor being carried in a compartment at one end of the vehicle. The length of the car over all is to be 56 feet by 9 feet, $31 / 4$ inches maximum width. It will be built on the bogey principle, and will weigh $341 / 2$ tons, with accommodation for 42 passengers. The seats will be placed longitudinally on either side of a central gangway. The motor compartment will be inclosed right in and will be scarcely distinguishable from the remainder of the vehicle. The funnel will protrude slightly above the roofing of the car. The power to be generated will be sufficient to supply a tractive energy up to 30 miles per hour. The motor will not be fitted with reverse motion, as it is to be controlled and driven trom either end of the car. The introduction of these steam either end of the car. The introduction of these steam
motor cars is due to the severe competition of the motor cars is due to the severe competition of the
local street surface railroads, which, since converston to electric traction, have conveyed the larger bulk of the passenger traffic formerly carried by the railroad trains. It is thus anticipated that by the employment of the single motor coaches for short distances, the railroad company will be able to regain the whole of its former traffic, especially as the service will be quicker, and thereby constitute a powerful rival to the street surface cars.

## Death of Frederick Law Olmsted.

On August 28, Frederick Law Olmsted, the famous American landscape architect, died at Waverly, Mass. Hardly a city in the Union has not at some period made use of Mr. Olmsted's genius. It was in 1856 that Mr. Olmsted and Mr. Vaux made plans for New York Central Park. From that time on Mr. Olmsted's efforts were given almost entirely to the work sted's efforts were given almost entirely to the work
of landscape gardening. With Mr. Vaux, Mr. Olmsted prepared complete designs for Prospect Park Brooklyn, laid out public parks in Buffalo, the South Parks of Chicago, and the Chicago suburb of Riverside, as well as many other large and small parks of a similar nature in other places. In 1875 he severed his connection with Mr. Vaux and became the salaried landscape architect of New York city. In 1878, he planned Boston's system of parks, for which purpose he moved to Brookline, near Boston. Perhaps his most recent famous undertaking was the laying out of the World's Fair Grounds in Chicago, for the splendid success of which enterprise he received honorary degrees from Harvard and Yale.

## The Current Supplement.

It is the purpose of the editor to publish in the Supplement, in three installments, an article by Emile Guarini on "Mechanical Handling of Coal and Coke in France." The first installment appears in the current Supplement, No. 1445. The system described, although not quite so absolutely mechanical as the American system, is nevertheless interesting. Airships are just now much in the public eye, for which reason an article on the development of the fiying machine should be welcome. William Metcalf discusses "Springs." The Dettmar electric speed indicator for locomotives and other vehicles is described in full. Many illustrations accompany the text. Charles $\mathbf{E}$. Randall presents an account of Utah's "hot-pots." Not the least interesting article in the Supplempnt is Lord Kelvin's striking mathematical analysis of ether and gravitational matter through infinite space, discussing as it does the possible density of the luminiferous medium and the mechanical value of a cubic mile of sunlight. Randolph I. Geare presents some information on "Savage Tattooing," in addition to that to be found on another page.

BLECTRICITY AS AN AID TO AGRICULTURE-A DESCRIPTION OF TWO HODEL ELECTRICAL FARMS. by bmole quarini.
Perhaps the only use to which electricity has been applied in agriculture, with which our readers are familiar, is the electrification of seeds in order to accelerate germination. Still, other applications of electricity to the needs of the farm have been crowned with notable success. Electric plows have been found to do their work better than draft animals harnessed to the old-time share; for the soil is turned up from a greater depth. To protect the soil from insects and worms, electricity has proved itself a valuable aid. In harvesting, too, it has been found that work can be lightened and results improved by the judicious use of electrically-driven apparatus.
necessary. For electric plows, threshing machines, and for movable agricultural implements in general, the Helios Company has designed a special portable transformer, for the purpose of stepping down the high-tension cureent before it is sent to the motors. The same company has recently installed two model electric farms, the one at Quednau and the other at Simmern.
The Quednau farm is superintended by Prof. Backhaus of the Agricultural Institute of the University of Koenigsberg. The farm is situated near Koenigsberg, and covers about 181 hectares ( 447 acres). The enterprise not being very extensive, a dairy is operated in conjunction with it, the output being 10,000 liters ( 2,200 gallons) of milk per day. The central station comprises two divisions-the one a gen-
to drive a carrot-cutting machine. The other two are portable, and can be employed as may be desired for driving milling machinery, a machine for crushing fiaxseed, a pump, a circular saw, a threshing-machine, and other purposes. On the Quednau farm an electric plow is also employed.
The Simmern farm differs from that of Quednau chiefly in the manner of generating the current. Turbinedriven dynamos are employed, the Simmern River furnishing all the water power that can be desired. The turbine used is of the Bêché type, and drives a Helios dynamo of 11 kilowatts, generating a current at a pressure of 110 volts. Since the transmission distances are not great, direct current is gen erated. The dynamos are also employed to charge a Hagen storage battery of 62 elements. In installing


Motor Driving a Cream Separator.


Portable Motor Driving an Overhead Shaft.


Transformer Cart.


Grain Cleaner Driven by Portable Motor (Simmern Farm.)


Portable Motor Driving a Threshing Machine on the Simmern Farm.

## ELECTRICAL APPARATUS FOR FARM WORK.

Threshing-machines, winnowing-machines, saws, and pumps for irrigation have been driven by electric motors with great efficiency and economy. Furthermore, by means of electricity the wine grower can age his wine, the olive grower can purify his oil, and the turf-cutter can carbonize his peat.

In carrying out all these manifold operations it is, of course, necessary to have a source of electrical power. For the purpose of showing how an electrical plant can be installed at a small cost for work in the field. three German companies, the Union, Schuckert \& Co., and the Helios Company, have installed model larms on which most of the farm work is done by means of electricity.

In order to cut down expenses, central stations have been built which distribute the current for many miles at a very reasonable rate. Transformers are, of course,
erating plant, the other an electric lighting plant. The power house is equipped with an engine of 50 horse power, which drives a four-pole dynamo. A current of 90 amperes at 500 volts is generated. A small two-pole dynamo is employed for electric lighting, the current generated having an intensity of 30 amperes and a pressure' of 220 volts, or an intensity of 18 amperes and a pressure of 320 volts when it is used for charging a Pollatk storage battery of 120 volts.
The electric lighting plant is so designed that the lamp capacity can be doubled by the utilization of a secondary dynamo. It will; however, hardly be necessary to use supplementary lamps. For cooking and for heating the living rooms electricity is also used. Three electric motors drive the agricultural machinery. One, having a horse power of $23 / 2$, is used
this farm it was sought to do away with manual labor as much as possible. For that reason it became necessary to design motors which should be small, light, and readily portable. The Simmern farm has two such motors. The first is of 10 horse power and has a voltage of 110 , with a speed of 1,200 revolutions per minute. When mounted on wheels revolutions per minute. When mounted on wheels
it usually drives four small machines, namely, a car-rot-cutting machine having an output of 690 kilogrammes ( 1,518 pounds) an hour; a machine for crushing flaxseed having an output of 500 kilogrammes $(1,100$ pounds) an hour; a straw-cutting machine having a capacity of 190 kilogrammes ( 418 pounds) an hour, and a pump. By means of a fast and loose pulley, the four machines can be set in operation at once or can be worked independently. The same motor also drives a threshing machine, having an output of 900.
kilogrammes ( 1,980 pounds) an hour. The second motor is fastened to a bed-board and is portable. It has a horse power of three-quarters and drives a centrifugal cream separator having a capacity of 450 liters of milk per hour, or a mechanical winnower placed in the wheat bin.

## TATTOONG.

by randolph i. aeare.
The custom of tattooing originated among savage people, and was primarily established, it is believed, as a substitute for writing and as a means of permanently recording facts in their lives. The word "tattoo" is derived from the Polynesian tattaw, and was


The Electric Tattooing Needle.
first anglicized by Captain Cook. The practice has been defined by Berchon as "that strange and very ancient custom which consists in the introduction under the cutaneous epl dermis, at different depths, of coloring matter, in order to produce some design which will be of very iong duration, though it is not absolutely indelible."

The significations of tat tooing in different regions have become so varied that collectively they may be regarded as the visible expressions of certain racial motives and impulses. Love of ornamentation, substi tution for clothing, a de sire to show fortitude un der physical suffering, the wish to perpetuate tribal symbolism, and among women the indication of marriage, are some of them. Others, again, believed that by engraving the image of a deity on their flesh, they furnished proof of their devotion.
In some countries only the men were tattooed, while in others women alone were thus adorned. I n Samoa there is a curious legend that the goddesses of goddesses of tattooing swam here from Fi ji, for the pur pose of introducing the custom, and had been ordered to sing all the way "Tattoo the women but not the men.' Having to repeat $i$ hese words so often, they became confused, and when they arrived at Sa moa, they wer singing just the reverse; and $h e n c e$
arose the practice there of tattooing the men instead of the women.
There are two principal methods of tattooing, i. e.,


Marquesas Warrior.
by making cuts in the flesh so as to leave a cicatrized mark, but generally without the addition of any coloring matter; and by drawing a pattern on
the skin which is afterward pricked in, and to which various coloring matters are applied, so as to produce a permanent picture. Tattooing has its modern votaries among civilized people, and that it may be made a lucrative business seems proven by the fact that some years ago a device was originated by O'Reilly, of New York city, for making tatioo marks. Briefly stated, it consists of a hollow ink reservoir surrounding a suitable set of needles which are reciprocated by electric power. This implement is here shown; and that its inventor had no difficulty in obtaining customers is indicated by the examples illustrated in this connection.

For lack of space only two or three methods of tat-


Head of a Savage in Goettingen Museum, Shuwing Large Amount of Post-Mortem Tattooing.
tooing can be here aescribed. In the current Supplement, however, will be found an account of the tattooing practices of various savage races.

In all Polynesia there is no place where tattooing is so widespread or varied in character as in the Marquesas Islands. Every part of the body is decorated, from the crown of the head to the fingers and toes. This applies principally to the men, the women generally having only a bracelet or two, or other small ornaments, tattooed on their arms. One writer states that women. even princesses, have no right to tattoo any parts but their hands and feet, although at Mukahiva "noble ladies" are permitted to wear more numerous tattoo marks than the women of the lower ranks. Old men have their bald heads covered with tattoo marks.

The figures to be tattooed are chosen carefully and with ap propriate ness to the part to be dec orated. Sometimes animals are depicted while again other objects are employed which $h a v e$ special refer ence to the manners and customs of the people. Rows of punctures are separated by curved. lines, dia. monds and other designs. A man's head is completely covered, his breast is commonly ornamented with 9
shield, while stripes of various kinds adorn the arms and thighs. On the back is generally a large cross, beginning at the neck and ending at the end of the backbone. In the front are often seen figures representing the human face. On each side of the calf of the leg ic an oval figure. The hands are profusely tattooed, and each finger has its own pattern. A peculiarity of the Marquesans is that they allow the finger nails to grow very long and pointed, this being esteemed, as among some of our own people, a mark of rank, since it furnishes evidence that the person thus ornamented is not accustomed to doing hard manual work.
Among the Marquesans this elaborate ornamentation answered the purpose of dress, nor indeed would it pay the poor victim to suffer all he has to endure during the long and painful operation, only to cover all his adornment with clothes. The men wear nothing but a small cloth around their waists, while the women of rank are similarly clad, with the addition perhaps of a large piece, which they can throw over their bodies to keep off the discomfort of the sun's rays. And, curiously enough, it is not the heat they mind, but the danger of spoiling their complexions by getting sunburnt.
A noteworthy feature of the practice on these islands is the tattooing of widows' tongues, as an expression of grief for their lost husbands. In this operation the operator's implement is first dipped into the coloring matter, then placed on the tongue. It is then given a smart stroke with a rod, whereby the skin is punctured and the dye injected. A woman who was undergoing this painful treatment was asked why she allowed it. She replied that while the pain was great, her af feciion was still greater, and that particular mode of expressing it was chosen because it could never be obliterated.
In Samoa tattooing is applied to the whole body from the hips to the knees, covering the skin so com pletely with the pattern that (as on Easter Island or in Tahiti) at a little distance the person looks as though he were wearing ornamented tights. The operation, which as in the Marquesan Islands requires much time and many "sittings," is quite ceremonious. The tattooer, called the Matai, is, as elsewhere, a man of considerable influence, and his services are engaged by a prepayment of several mats, or perhaps a canue. Here again "combs" are used and also a little mallet but the combs are made of tiuman bones, about an inch or less in width, resembling little bone adzes with the edges cut with a number of teeth. These blades are at tached to handles about six inches long. The pigment is made from the ashes of the cocoa-nut.
The person to be tattooed lies on his face, resting his head in the lap of his sister or some other female relative, who with other young women assisting sing loudly to drown his groans, as it would injure his record for courage to be heard giving vent to expressions of pain. Instances have occurred however, when young braves have lost all self-control, being entirely overcome with the agony of the opera tion, and have been despised as cowards for the rest of their lives. The operator, having traced out his pattern, commences to drive the toothed "comb" through the skin with his mallet by sharp and rapid taps. The assistants are ready with strips of white "masi" to clean off the blood as it fiows from the wounds.
In general, the patterns used throughout the Samoan islands do not vary greatly, small variations denoting the particular island on which the man lives, the family of which he is a member, the slaying of human beings, etc., the form of an animal being usually the badge of honor in such cases. It takes ordinarily an hour to cover about three inches square, after which the "patient" gives place to an other. After a week or so, his turn comes round again, and as à rule an operator can only attend to five "cases" a day. When the tattooing is about hal done, the operator demands another payment, and if not satisfied, he refuses to complete the work, which puts the young chief in an embarrassing position, with the alternative of going through life "half dressed" or submitting to the Matai's demands. We may conjecture that he usually "pajs up." While the opera tion is going on, the victim suffers terrific agonies, but when it is consummated, he glories in his admie
sion to manhood, and sains the admiration of the female contingent.
The Burmese are fond of tattooing, and use coarse needles on a long reed with a metal image of some idol on the opposite end.

In Japan tattooing is chiefiy confined to the lower classes, whose shoulders, arms, and thighs are decorated wich such figures as are seen on porcelain. Cinnabar and Indian ink are the pigments used. A thief who has stolen within a apecified amount of property has a circle tattooed on his arm, and on the second offense he is beheaded. They use fine cambric needles, firmly bound to a piece of bamboo about seven inches long.
A remarkable case of tattooing came to light in Prof. Hebra's lecture-room in a hospital in Vienna some thirty years ago. The man was the subject of a lecture, and one of the spectators at first mistook him for a bronze statue. He was tattooed from head to foot, and not a quarter of a square inch of his entire person was intact. The skin presented an appearance resembling the elegant tracery of an exceedingly rich cashmere shawl; only that the coloring was done with indigo principally, with enough red inserted here and there to give it effeet. His name was George Constantine, a Greek by birth, who with a band of robbers entered Chinese Tartary to commit depredations. The gang was captured, and this man, with


A TORPEDO BOAT ENGINE AND A PUMPING ENGINE, BOTH OF THE BAME HOREE POWER
Retarn of the Brooks Periodic Comet.
The Brooks periodic comet has just returned to visibility. This comet was discovered by Dr. William R. Brooks, professor of astronomy at Hobart College, at the Smith Observatory, Geneva, N. Y., on July 7, 1889, in the constellation Cetus. Computations soon indicated that the comet was moving in an elliptical orbit, with a period of revolution around the sun of about seven years.
True to the prediction, it returned in 1896, and now for the third time the comet makes its appearance exactly in its computed place in the heavens.
It is now in Capricornus and moving slowly westward. It is a telescopic comet and is not likely to become visible to the naked eye.
Soon after its discovery in 1889 the comet was found to be attended by four small companion comets, and hence, is sometimes called the Brooks multiple comet.
In this respect it stands unique, and this, in connection with its short periodic character, renders this comet one of the most interesting in astronomical annals.

A striking Comparison.
No more striking example of the immense power of the compact engines used in the modern torpedo boat can be offered than by the accompanying illustration. Our picture represents a large set of engines for the East London Water Company, and the engines of a second-class Yarrow torpedo boat. Both engines are of the same horse power. Unfortunately we have no data giving the steam pressure and revolutions of both installations. No doubt it would have been interesting to give a comparison of the cost of each engine, the space occupied, with the probable loss in each system for maintenance, repairs, and deprecta tion.

Shop Fires from spontaneous Combustion.
Damp lampblack will ignite from the sun's rays. The same can be said of cotton waste moist with lard or other animal oil. Lampblack and a little oil or water will, under certain conditions, ignite spontaneously. Nitric acid and charcoal create spontaneous combustion. New printers' ink on paper, when in contact with a hot steam pipe, will ignite quickly. Boiled linseed oil and turpentine in equal parts on cotton waste will ignite in a few hours under a mild heat, and will in time create enough heat to ignite spontaneously. Bituminous coal should not be stored where it will come in contact with wooden partitions or columns or against warm boiler settings or steam pipes. This coal should' not be very deep if it is to be kept on storage for a long period. If piled in the base ment of a building it should be shallow and free from moisture, and under good ventilation. That liable to absorb moisture should be burned first. If on fire, a small quantity of
others, was ordered by the ruler to be branded in this manner. On the palms of his hands letters were tattcoed, which explained that "he was the greatest rascal and thief in the world." It took three months to tattoo him, the indigo being pricked into the skin. The designs represented elephants, lions, tigers, birds, etc., with letters worked in between. A coup'le of dragons ornamented his forehead. He said that his body swelled up very much at the time and had ever since been sensitive to changes in the weather.

Among criminals secret hieroglyphics often form the tattoo marking, and the following specimen was observed in Portugal by Dr. Peixotto-which he believed to be some magical formula used in early Roman times to drive away fevers. It read

SATOR
AREPO
TENET
OPERA
ROTAS
These letters read the same vertically or horizontally, forward and backward, and the reader will have the opportunity of deciphering its meaning for himself.

It has been decided that the telephone line between Rome and Paris is to be opened very shortly, and at all events in time for Victor Emanuel's visit to France.
water showered on this kind of coal cokes it upon the top and retards any great supply of water reach ing the fire, thus necessitating the overhauling of the pile. Iron chips, filings, or turnings should not be stored in a shop in wooden boxes. The oily waste which is not infrequently thrown among them adds to the danger of fire from this source. The sweepings from the machine shop, if kept on hand, should never be placed over iron shavings. This mass of disintegrated iron is enough to incite heat and combustion. Iron and steel filings and turnings when mixed with oil will ignite spontaneously after becoming damp. A steam pipe against wood will cause the latter to ig nite spontaneously after being carbonized, particularly if superheated steam enters the pipe, thus increasing the heat temperature.-J. H. L. Coon in Cassier's Magazine.

The Russian naval department has decided to in crease the strength of the navy by the construction of twenty-three additional vessels of the lighter typetwenty gunboats and three torpedo-boat destroyers. The former are intended for the reinforcement of the Russian fiotilla on the Amoor, while the latter are for service in the Black Sea. The whole of the gunbo'ats are to be built at the governmènt donk yards will be of light draft, and will all be fitted with turbines.

## ELEPHANT ROCK AND OTHER BOWLDER.

 by cearlig alma byerb,A group of huge granite bowlders, of which Elephant Rock is king, at Graniteville, Iron County, Mo., located in the heart of the Ozark Mountains, has for many years furnished to geologists a subject for much study and has proved an attractive curiosity to thousands of tourists. In some respects this group might be termed freak of nature, for freakish it undoubtedly is, a nd unquestionably is it of nature's designing. It is often referred to as "the granite potato patch of the Ozarks," which name is fitting, as is also the name given the iant one of the group, viz., Elephant Rock.
Elephant Rock is not only so called because of its immense size, but partly so because of its broad resemblance to an elephant. To one standing at a certain point on the north side of the bowlder, the resemblance of a portion of it to an elephant's head a nd trunk is easily discernible, while its color is almost exactly the same. Elephant Rock is about twenty-two feet from loase to top and about thirty-five feet in length, and is of pure red granite, as are also all of the other bowlders of the group. The surface of the slight elevation n which the bowlders lie is also of solid granite, and n most places, is almost as level as a fioor
Whether these bowlders are of glacial origin $h$ as been the theme of considerable discussion by geologists. It is certain that their shape in every way indicates that they have traveled as detritus many miles in a glacial stream; but when one observes their immense size and notes the fact that they are now in the heart of a very large granite deposit, he is inclined to doubt the probability of that theory. From the latter fact it would seem that they are of local origin. And it seems evident that these bowlders could not have been de posited here during the glacial period, when the Lau entian glacier moved outward from the highland north of the St. Lawrence River in every direction, and covered North America with a continental ice sheet, for we have much evidence that this glacier did not extend below the Ohio and Missouri Rivers. North of these rivers have been found the glacial drift caused by the melting of the glacier
Geologists of late years have generally conceded tha the Ozark Mountain range in Missouri and Arkansa is the oldest land in the American continent; and were it not that this group of bowlders is found in the only granite region of the Ozark Mountains, one might be lieve that it had been carried here by a glacier from a more elevated part of the range; that they are the oldest remains of glaciers in the American continent ron Mountain and Pilot Knob are thought to have bee the first elevations to rise above the waters that once covered all America, a nd these mountains are only four and five miles respectively from the group of bowlders, although no granite is to be found on either of them.
In connection with this, it might be of interest to state that Prof Moorhead instructor of archæology of the Phillips Academy of Andover, Mass., in the belief that the Ozarks are the oldest elevations n this continent, is now going over these mountains to investigate the probability that here is to be found evidence of a more primitive man than has yet been found elsewhere on this continent.

## Radium and Cancer.

Dr. Alexander Graham Bell has in a etter to Dr. Sowers, a physician of Washingtion, made a suggestion which may lead to good results. He said in the letter: "I understand from you that the Röntgen X-rays, and the rays emitted by radium, have been found to have a $m$ ark ed curative effect upon external cancers but that the effects upon deep-seated cancers have not thus far proved satis factory. It has occurred to me that ons reason for the unsatisfactory nature of these latter experiments arises from the fact that the rays have been applied ex ternally, thus having to pass through healthy tissues of various depths in or der to reach the cancerous matter. Th Crookes tube from which the Röntgen rays are emitted is, of course, too bulky to be admitted into the middle of a mass of cancer, but there is no reason why a tiny fragment of radium sealed up in a fine glass tube should not be inserted into the very heart of the cancer, thus acting directly upon the diseased mate rial. Would it not be worth while mak ing experiments along this line?'' 'Гo this letter Dr. Sowers replied: "The suggestion which you make in regard to the applieation of the radium rays to the substance of deep-seated cancer I regarc as very valuable. If such experiment should be made I have no doubt they
would prove successful in many cases where we now have fallures.'

\section*{"COAL-PORCELAIN."

## sy

## sy

"Coal-porcelain" is probably known only in the anthracite regions of Pennsylvania. Those who live in other States of the Union, with the exception of a few relic-hunters, certainly know nothing of the beau


A CUP CJT FROM A bloci of coal.
tiful utensils which are made of coal in the mining country. The exquisite natural polish to which coalporcelain is susceptible when turned on a buff lathe, is unexcelled in black brilliancy, and exceeds in bright ness the shining white surface of the finest china. Coal is a pure natural black. China, on the other hand, is rarely a pure white.
The only qualities of coal that are commonly associated with it are its combustible properties. It has, however, many uses. The jet which jewelers use is nothing but coal of a very compact texture. In a Welsh country town there may be seen a foot-bridge made of coal, originally intended to be only a temporary structure, but found of sufficient strength and firmness to warrant its being used as a permanent footway. At Barcelona, Spain, there was constructed in 1888 a lighthouse of compressed coal-blocks. On a portion of the southern English coast, at a small point called Kimeridge, circular shale-disks, with a square hole (very much like Chinese "kash"), have been turned up by the plow. They are used as fuel. Curious geologists who heard of the disks, found that they were nothing but coal money; for it seems that in ancient England, in pre-Roman days, coins or tokens of coalshale were quite common, and were perforated in


ELEPHANT ROCK, GRANITEVILLE, MO.


POTATO ROCX, GRANITEVILLE, KO.
rder to be strung together (like Chinese "kash"), that they might be more conveniently carried.
Not the least curious of these many applications of coal, is coal-porcelain: Just what can be done in the way of shaping a bit of hard coal into a useful vessel is shown by the accompanying illustration, which represents a drinking-cup or miniature bucket. Coal fiower vases, milk-mugs, plates and saucers, book-covers, clock-frames, wash-basins, inkstands, spools for lacework, candlesticks, and scores of other articles are made in like fashion
Since coal is a rather brittle substance, it is impos sible to produce the fine ornamental work of good chinaware. There are many natural minute air-cells which may cause chipping in the making of a vessel. Still, a broken or chipped coal-utensil can be mended with cement just as readily as a bit of broken china.
A model coal-porcelain factory is to be found at Summit Hill, Pa. Here an ex-coal miner and a few associates have for years been turning out exquisite pieces of coal ware. Although the finished coal product s cleanly enough (it can be washed in boiling soapsuds without discoloring the water), still its manufacture is one of the most uncleanly callings imaginable. As might be supposed, objects such as that here pictured are turned on lathes. These lathes are run at a very high rate of speed. The peeling off of coal-particles gives rise to small clouds of fine coal dust which set tle on everything in the lathe-room. The working equipment of the coal-porcelain factory is of the sim plest. Two or three chuck- and buff-lathes, and a few hand-tools of the chisel-cutting and pick order, are al that are needed. The rest is supplied by the good taste and skill of the coal craftsman.
Only the very best blocks of the hardest anthracite can be successfully used in the manufacture of coal ware. Blocks from what is known as the Mammoth vein in the Lehigh region are most prized. It requires long experience and a trained eye to determine how a piece of coal in the rough is likely to behave under the cutting lathe. The high, permanent polish which can be given to coal by the buffing-wheel serves the pur pose of closing many minute pores, and renders the finished vessel impervious to hot or cold liquids.
The price of coal-porcelain averages about 50 cents a pound. The manufacturer buys the raw material for $\$ 2.50$ a ton. Fashioned into utensils, the coal becomes worth about $\$ 1,000$ a ton.

## Ancient Statuary in China.

Under date "Hsiaochang, via Te Chou, Tientsin, North China, April 27, 1903," Dr. Sewell S. McFar lane sends the following communication to the Royal Geographical Society: "In February, during one of my journeys in the scuthwest province of Chili, North China, I came across a number of stone horses, sheep, lions, etc., some in a fair state of preservation. They were in two parallel rows, and beside them were sev eral 'petrified' Buddhist priests, sup posed to be on guard. The people seemed to know nothing about them. a nd cared less. Upon inquiry among the gentry of the adjoining village, one old gentle man informed me that it was the en trance to a very old subterranean tomb of one of China's prime ministers, who lived under the Han dynasty. This would be about the year A. D. 25. Many years ago a tablet stood there, which they unearthed with the above stone figures, giving full particulars, but the disinter ested inhabitants destroyed it 'as it was in the way of their cart track.' How the people came to unearth these huge statues is interesting. During the past generations the severe dust-storms ex perienced in North China have swept over the district and steadily but ef fectually buried out of sight the beau tiful tomb and all its accompaniments The inhabitants frequently dig out their land to make mud bricks for their houses, and in this manner the stone figures came to light. It is said there are a great many more of them ere one reaches the actual tomb. Had this been in Eng land these ancieri curios would have bee excavated and a correct description pub lished centuries ago. But in China th country folk, who simply live from hand to mouth, somewhat take after Gallio, of sacred writ, and 'care for none of these things.' "

It is reported that Mr. Brodrick has sanctioned the expenditure of $\$ 10,000$ on experiments with a dirigible balloon. These experiments will be earried out by the Royal Engineers, under Colonel J. L. $B$. Templer, the superintendent of the balloon factory.

RECENTLY PATENTED INVENTIONS.
Apparatus for Special Purposes. APPARATUS FOR MAKING STEEL, ETC -E. C. Wills, Altoona, Pa. By his inven or base on which the converter may be support ed and to and from which the base of the con verter may be adjusted in connection with means for rocking the table, so the metal in the converter may be caused to flow above or beow the twyer-entrance in order that the air of the metal.

Electrical Devices.
ELECTRIC FIRE-ALARM.-G. B. Martin Zanesville, Ohio. In the present patent the and more particularly to electric fire-alarms heap and efficient form of. fire-alarm suitable or use in houses, hotels, restaurants suitable ase of fire the wax which holds up a weight is melted, permitting the latter to drop into a pan on the end of a lever. The lever thereupon
turns on its pivots, making an electric contact which causes a bell to ring

## Engineering Improvements.

ORE-DUMPING APPARATUS.-N. A. H SALOMONSON, Norway, Mich. In ore-dumping
apparatus as usually constructed the ore hoist ed from a shaft is delivered into a car, which os then run out on the trestle to a chute and is then run out on the trestle to a chute and
pocket into which it is to be discharged. It is the object of this invention to discharge ore di-
rectly from the car into the chute and pocket inrectly from the car into the chute and pocket in tended for it without requiring that the car shall
be run out on the trestle, whereby time and be run out on the trestle, whereby time
AIR AND STEAM FEEDING ATTACH MENT FOR BOILER-FURNACES.-G. MAR-
Low, Sr., Spokane, Wash. The invention is low, Sr., Spokane, Wash. The invention is
embodied in an improved apparatus whereby mingled air and steam are introduced into the
fre-box of the boiler or other furnace to effect a more perfect combination, and especially to consume the carbon particles and such gaseous
products of combustion as ordinarily esoape products of combustion
into the air and are lost.
INTERNAL-COMBUSTION ENGINE.-C. A.
WILKINSON, Worcester, Mass. The present inWilkinson, Worcester, Mass. The present in-
vention relates to an internal-combustion engine in which a relatively heavy or non-volatile oil may be used for fuel, this oll being heated from the cylinder of the engine and a current of air under pressure being ejected through it
so as to carburet the air, which is then passed into the cylinder to be compressed and ex ploded.
ROCK-DRILL-C. MeAd, Murray, Idaho. n rock-drills of that class which are actuate by striking the drill forcibly with. a sledge in the hands of a hammersman, and an object he has in view is the provision of a compact ma-
chine whieh may be easily set up or adjusted to work in any desired position for the purpose of drilling a hole in the floor, wall, roo or any other surface in a mine or other place

## Household Utilities.

FLY-TRAP.-E. F. DAvison, Marysville, to fly-traps adapted to door and windowscreens. The improvement consists in a new
and novel trap especially designed to form a part or the whole of the upper panel of a screen door. It is also adapted to be used in connec tion with window-screens.
SAD-IRON.-C. W. Johnston, Meeteetse Wyo. The purpose of the improvement is to
so construct the handle and the body of the so.construct the hande and the body of the ron that one can be quickly. and conveniently
separated from the other and the two parts as readily connected, and to provide such a locking engagement between the handle and the
body that there will be no side motion of the handle at any time while the parts are in lock ing. engagement.
Hat Rack OR HANGER.-J. G. White, Meriden, Conn. The principal object of the im provement is the provision of an ordinary rack
with simpiified and effective devices or means whereby a hat or similar article may be held thereon without liability to accidental dis placement, as frequently happens with hangers
in use, and also to provide a device of this kind in use, and also to provide a device of this kind
which is simple in the construction and the organization of the parts.
Kitchen-CABINET.-L. Hockman, Marion provision of details of construction for as th net which render it very convenient for holdIng utensils and cooking material, and, further more, to provide doors, drawer fronts, and
sides, and other parts made of laminated matesides, and other parts made of laminated mate
rial to prevent warping, twisting, and undue rial to prevent warping, twisting, and undue
expansion and contraction when subjected to changes in humidity and temperature.

## Of Interest to Farmers

FRUIT-PICKER.-M. AKSILA, Worcester Mass. In carrying out this improvement the in-
ventor has in contemplation an improved fruit picker, which may be extended to a consider able height to enable the fruit to be removed from the highest branches of fruit trees while
the operator is standing on the ground, but the operator is standing on the ground, but
when the device is out of use it may be colWhen the device is out of use it may me atored in a very small space.

FOLDABLE FRUIT-LADDER.-S. S. WARD, apa, Cal. This improvement relates to a class
of step-ladders particularly well adapted for se in picking fruit from trees in orchards, and has for its object the provision of novel dewhich afford a light, strong, portable device hat has a very wide base and is therefore renered stable in service, will not tip sidewise while occupied, and that will sustain a heavy weight without penetrating the soil deeply. KNIFE-HEAD FOR MOWERS.-L. Mitchell, Hart, Mich. This improvement provides for raising the pitman above the danger line of obstructions and away from the heavy wath of grass; furnishes a bearing easily kept oiled and all wear taken up; provides spring
cushions for the knife stroke running free the cushions for the knife stroke running free the
intermediate space, eliminates vertical knife motion in the guards, and insures perfect shear ut of knife sections; provides for detachin knife from the cutter bar with the bar in any position; and overcomes noises, reduces friction, and avoids breakages in pitman, knifeheads, and knife-bars.
FOUNDATION-FASTENER FOR HIVE-FRAMES.-O. O. Bordson, Black Earth, Wis. The purpose of this invention is to provide device adapted to secure a foundation-comb in a frame placed in a hive so that bees may build construct the device that it will comprise but few parts and wherein the parts may be operated to securely place the foundation-comb in the frame, and so that all parts of the device may be kept clean. This device is light, yet
durable, and readily carried from place to place.

## Rallways and Their Accessories.

Railway-Switch.-F. W. Aley, el Paso, Texas. The principal object of this invention is to overcome the disadvantages and inconeniences common to many similar devices, and provide a device of this kind which is not n the construction and organization of the parts thereof, besides possessing the capacity safety are distinguishing factors in this rail-way-switch.

## Miscellaneous.

ARM-REST FOR CRUTCHES. - H. S. Cole, Newtonsville, Ohio. In this case the improvement has reference more particularly to heads or arm-rests for crutches, and the prin-
cipal object of the invention is the provision of a device of the invention is the provish may be readily of a device of its kind which may be readily
attached to or detached from the upper ends of the uprights or standards of a crutch and also to provide means whereby a comfortable
yielding action is derived therefrom in the use yielding action
of the crutch.
bail-Ear for vessels.-J. F. Vogt St. Louls, Mo. The principal object of this keg or similar vessel, with a bail and attachnead thereof the whereby on removal of the head thereof the keg or vessel may be con-
verted into a bucket or similar structure, and also to provide an attaching-ear for the bails of vessels which is durable and possesses
apacity for long and continued service.
Lace-Fastener.-J. h. O'Brien, lilon, N. Y. This fastener is adapted for use in connection with shoes or boots, although the desirable to securely hold a lacing or cord The object in view is to produce an article
or contrivance which makes provision for taking up a length of a lace or cord and operates sufficiently to secure the lace or cord against displacement or unfastening under the strain puescrap
FLUE-SCRAPER.-P. F. Vogt, Dayton, Ohio. This inventor claims as the object of his imdurable in construction, very effective in operation, not liable to easily get out of order, and arranged to readily yield for automatic adjustment in the flue and to scrape the flue both on the inward a
artificial hand.--.-H. Patron, Crípplecreek, Col. In this case the improvement has o the stump of an amputated ans by which tools of various sorts may be grasped, thus en-
abling the wearer to do manual labor. The abling the wearer to do manual labor. The
device comprises a peculiarly-constructed gripper and also a novel device for enabling the jaws to be opened with one hand.
NECK-YOKE COUNTER-STOP FOR AR tillery-Carriages.-F. Wenke, San an onio, Texas. This counter-stop and its ac and a plug and its cap are then secured in posi-counter-stop is pushed inward against the tension of a double-acting spring and the ring is slipped up against a neck
joke stop. The counter-stop is then released and is pressed back by the spring into its pro truding position, and the ring, held between a
downwardly-depending tongue and the stop, is prevented from slipping forward over the and of the pole.
DESIGN FOR A BELT-BUCKLE.-L. L Prahar, New York, N. Y. Thls design com
prises two overlapping pointed ellipses in the
shield, the whole presenting a neat, graceful,
and ornamental buckle. Mr. Prahar has also and ornamental buckle. Mr. Prahar has als
secured a design of another belt-buckle com prising two tilted overlapping pointed ellipses of two other ellipse

## of two other ellipses.

BOTTLESTOPPER.-E. A. Nugent, Union ville, N. Y. This stopper is for milk-bottles de signed to be filled with milk through the operaMr. Nugent in a former application for paten the object of the improvement being to provide means for sealing the bottles from which air exhausted before removing the bottles from the machine, thus preventing the entrance of im purities from the air in the stable an
ing the milk a greater length of time.
POWDER-PUFF.-J. F. Rowland and G. Hull, Asheville, N. C. The intention of this improvement is to furnish a puff especially de
signed to contain talcum powder, and to so construct the puff that the material may be placed in large quantities in the puff and held distributed and in such manner that the puff may be manipulated to cover large or small surfaces, and so that all the working surfaces of the article may be utilized at all times and dapted to all parts of the human form.
LIFE-BOAT.-A. LaSSERRE, Buenos Aires, Argentina. The present invention relates improvements in life-boats; and the objects $M$ Lasserre has in view are the provision of a sim ple and strong construction of boat which can not be submerged in heavy weather at sea, is
not liable to capsize or overturn from the force of wind and waves, and is capable of discharg ing an
storm.
worsted-box.-Grace m. Wooster, New York, N. Y. An object in this case is the provi sion of a device in which a toy is placed and by dismembering, but which may be disclosed worsted shall have been reached, thus aftordin amusement to a child having possession of th box and inducing diligence in crocheting to
reach the end and reveal the hidden toy or wonder.
folding case.-J. J. O'Brien, San José Cal. The purpose of this invention is to prointo a compact form without in any way de tracting from the durability and neatness of ap pearance of the article and without materially is especially designed for application to tel scopic valises, although it may be used in othe
port-light.-C. f. Petersen, Wilmingto Del. This invention refers to an improved con struction for closing the port-ights in the sides of marine vessels, and it embodies in its gen eral form a glass and a glass-frame connecte which is hinged to the body and provided at it free side with a releasable clamp for holdin it in place, and an opaque or metallic cover which parts may be used concurrently with or independent of the glass, and by means hich the light may be hermetically closed.
REAR-VIEW HAT-MIRROR.-L. D. MER case is to provide a . The purpose in this and means for attaching the frame to a hat o cap and for adjusting the mirror in its frame of the brim of a hat or to the visor of a $a$ at one side of its front center, whereby the wearer without turning his head may see the reflection of any objects in the road, street room, or space behịnd him.
FOLDING bOX.-M. Hirsch, New York, $N$
This box is bent from a one-piece blank

This box is bent from a one-piece blank of peculiar form, which not only secures a debut also provides a double bottom and double sides, having the plies or layers interlocked to overcome the possibility of displacement, where-
by the stability of the box is increased without appreciable cost in the manufacture and with out an increase in the time and labor to ben complete the box
BENZIN-PAN.-C. E. HowARD and J. C. M. Ungeheuer, Jersey City, N. J. The purpos to contain benzin or like material and to so construct the receptacle that it will be provided with a cover having a tight but yielding con nection with the upper marginal portion o the pan, so as to prevent ignited material being accidentally brought into contact with the con tents and to so mount the cover that it may be pressed down by means of a brush to enable the
brush to take up material for effective applicailon to
example.
example.
DOOR OPENER AND HOLDER.-J. D inventor has for his object the provision means for the opening of a door, and more particularly for the raising of a horizontal trapdoor into a vertical positior after it has been manually released by a slight upward pull, a
further object being to adapt the improved door-opener for the retention of the door eithe in open or in closed adjustment. until it Note-Cople
Notre-Copies of any of these patents will be
rnished by Munn \& Co. for ten cents each.

Business and Personal Wuants.


Marine Iron Works. Chicago. Catalorue free.
Inquiry No. 4564.- For manuracurers and deal-
ars in Ave and ten cent hardware and other goods. Autos.-Duryea Power Co., Reading, Pa.
Inquiry No. 4565.-For manufacturers of type
writer carbon paper. Cassenger purposes; want 82200,000 backing. Address $G$. G., Box Tis, N. Y.

Inquiry No. 4566 .-For manufacturers of water
C. 8" Metal Polish. Indiauapolis. Samples free.

## Inquiry No. 4567 -Fior

Mechanics' Tools and materials. Net price catalogue
Geo. s. Comstock, Mechanicsburg. Pa. Geo. s. Comstock, Mechamicsburg, Pa.
Inquiry No. 45 f8. - For a machine for the utillzaSawmill machinery and outits manufactured by the Lane Mff. Co.. Box 13, Montpelier, $V$ t.
Inquiry No.
cheese press.
Let me sell your patent. I have buyers waiting.
Charles A. Scott, Granite Building, Kochester, N. Y. Inquiry No. 4570.-For a dealer or manufacturer Inventions developed and perfected. Desligning and
nachine work. Garvin Machine Co., 149 Varick, cor machine work.
Spring Sts.. N. x .
Induir. No. $\mathbf{4 5 7 1}$ - For manufacturers of blank
Cape, such as tape measures are made from. If you want any metal novelty manufactured or
metal working dies write Metal Stamping Co., Niagara
Inquiry
carriages. No. 457\%.-For manufacturers of baby
The largest manufacturer in the world of merry-gorounds, shooting galleries and hand organg. Fo
and terms write to C. W. Parker. Abllene, Kan.
Inquiry No. 4573.--To obtain pulverized carbon
used in the manufacure of dry batteries.
We manufacture anything in metal. Patented arti-
cles, metal stamping, dies, screw mach. work, etc. cles, metal stamping, dies, screw mach. Work, etc.
Metal Novelty Works, 43 Canal Street, Chicago. Inquiry
contract.
The celebrated "Hornsby-Akroyd" Patent Safety Oll
Cngine is bult by the De La Vergne Refrigerating Ma any. Foot of East l38tb Street, New York. Inquiry No. 4 57 5. - For manufacturers or dealers
in a machine for changing moues. Contract manufacturers of hardware spectalties, ma-
cbinery, stampings, dies, tools, etc. Excellent market ing connections. Edmonds-Metzel Mfg. Co., Chicago. Inquiry No, 4 5y $\mathbf{5}$. - For manuract
Manufacturers of patent articles, dies, metal stamp. ng, screw machine work, hardware speciaities, machin-
ry and tools. Quadriga Manufacturing Company, is South Canal Street, Chicago.
Inquiry No. 45
patent shoe lace.
ETPD for new and complete catalogue of Sclentidic nd other Books for sale by Mann \& Co., 361 Broadway New York. Free on application.
WANTED.-Names and addresses of Grms handing
he hand rotary fan. Buyer, Box Ti3, New York.
Ina iry for 4578.-For a paper perforating ma

 Inaulry No. 45881-Wantod a "Humanaton,",





## NEW BOOKS, ETC.

Mechanical Refrigeration. By Hal Williams. London: Whittaker \&
Co. New York: The Macmillan Com Co. New York: The Macmillan Com
pany. 1903. 16 mo . Pp. 406, plates.
Price, $\$ 2.25$.
This is a practical introduction to the study of cold storage, ice-making and other purposes
to which refrigeration is being applied. It imo which refrigeration is being applied. It imcal book, dealing in a lucid manner with the various problems which are constantly confronting the refrigerating engineer. It is only in recent years that ice has been used to any
extent in England for table purposes. A de mand, however, has sprung up in that country for hygienic ice, therefore the present book is very timely. It will be valuable to American

Smith's Scrap Book of The Bible. By
1903. 16 mo . Pp 551 . Providence. 1903. 16mo. Pp. 551.

Quotations from the Bible arranged in al phabetical order, the same as a dictionary or
concordance. It will prove very useful, espe cially to ministers.
ton, Canada.
We have received the special Carnival num Augisit 15 enterprising Canadian journal of Augist 15, and note that it is flled with excel ada s industrial center, the city of Hamilton together with numerous portraits of the people
prominent in bullding up the city.


HINTS TO CORRESPONDENTS. Names and Addross must accompany anl letters or
no attention will be paid thereto. This is for our niformation and not for publication.
Referencos oto former arttcles or answers shivel give
datite of paper and page or number of question
Inquiries not a nswed in reasonable time shoul dhe

some answers reauire not a little research, and
though we endeavor to reply, to all elther b
letter or in this department, each must tak his turn
Buyers wishing to purchase any article not adver
tige in our columns will be furnished with
addresses of houees manufacturing or carrying

 price.
dinerals sent for examination should be distinctly
marked or labeled.
(9171) G. G. P. W. asks: Will you please answer the following question . Whether
it ever blows so hard that a sea cannot rise. A. If a wind of a certain velocity will raise velocity will raise the sea higher. There is no velocity at which the effect of the wind ising. Such an tdea is absurd. If the sea is running high and a wind arises which blows against the sea, it will soon beat it down, but
will raise a sea in the direction of the wind ery scon afterward.
(9172) E. A. E. says: In an explosive engine of the gasoline type, what would you consider essential to reach perfection? Cut-
off where? When to explode? How soon after exploding should exhaust open: Why not use
a double-ended cyllnder, assuming such to be possible? When hydrogen gas is exploded, is its relative gravity compared with hydrogen? eply to your question, we would say that in an explosive engine of the gasoline type, the compression, just as the plston is starting on its forward stroke. If the misture of the
gases is weak, so that an appreciable amount of time is necessary for the combustion to be completed, ignition should take place just a trifle before the engine reaches the dead point.
If the exhaust valve is of sufficient size and the valve motion properly designed so that the cylinder, the exhaust valve should not open until just a trifle before the engine is on the orward dead point. It should open in time to allow the gases to escape sufficlently to
bring the pressure almost to the atmospheric pressure before the piston starts on its return stroke. By. cut-off we assume you mean the closing of the admission gases. This should not take place until the end of the stroke with is desirable to have a cyllnderful of air and gasoline before thè, compression begins. double-ended cylinder is not desirable in a gaso very much increases the difficulty of keeping the engine cylinder cool and properly lubricated. hydrogen gas is burned or exploded in air, it forms $\mathrm{H}_{2} \mathbf{O}$, which is the chemical symbol for water. The temperature at the time the water
is formed is always so high as to cause it to exist as steam. After this steam is sufficiently one pound of hydrogen is burned, it produce 62,000 British thermal units. The resulting gen under the same pressure and temperatur so long as the temperature is high enough to
(9173) G. N. asks: Would it be pos sible to use a spark coil in wireless telegraphy less telegraphy a distance of 50 feet provided a sensitive receiver is used? A. For wireless
telegraphy an induction coll is required which has a primary and a secondary winding. Thes are properly called spark colls, but often a col with only one whding is also called a spar coil. These will not transmit in good shape inch spark will transmit to a distance of 50 t inch spar
100 feet.

INDEX OF INVENTIONS

## For which Letters Patent of the

 United States were Issued or the Week Ending September 1, 1903,
## AND EACH BEARINGTHAT DATE.







## 























## culinary articles, ventilating id or cover for









Electrical devices, screw attaching mean




$\qquad$


| 37,804 | $\mathbf{M}$ |
| :--- | :--- |
| 37,610 | $\mathbf{M}$ |
| 37,923 | $\mathbf{M}$ |

## 


come

> 5 Acres, $\frac{\text { A }}{(48 \text { Loto })}$ Cost 12.500 .00 47Lot onhation 22992.50 Pioplizt $\quad \frac{\frac{2375.00}{23.4650}}{10.987 .50}$


|  |
| :---: |
| 39 Lots solditor 25.439 .50 |
| Porit $\frac{30.93950}{24.550 .34}$ |

## of earlety that the foreqoing <br> Dtatecucute ars a thue aud accunate Qhowing of profici: based ow the Yurahare ave obeling price of the Oleveral acre tracte hounded byo The faucporel ernesturenti bompanys letere o from" A Ato C. ascertacmed Trom the boatco and papere of the (empany:- <br> Frederec Ath heatox. Exfair- blacountace.

## $170 \%$ PROFIT FOR YOU

 ANOTHER LAND SYNDICATEThe Campbell Plan of syndicated land purchases has been in successful operation for the past 12 years. During that time no less than nine syndicates have been formed, every one of which has been extraordinarily successful.

They have involved the purchase of land to the amount of $\$ 210,-$ 652.29, and the acres so bought have been subdivided and sold in lots, with a NET profit to the syndicate of $\$ 358,539.77$, or more than 170 per cent. on the investment.

This means that for each $\$ 500$ invested the investor has received back his original capital and $\$ 850$ additional.

We are now forming Syndicate No. 10.
The amount involved is $\$ 50,000$, of which we subscribe one-half. The balance of $\$ 25,000$ is open to public subscription in sums of from $\$ 500$ up.

The terms are 25 per cent. down and the balance in four payments.
We refer to Dun's, Bradstreet's, or The American Trust and Savings Bank of Chicago as to our standing and responsibility.

Upon application we will furnish fullest particulars.

> The certificate herewith from Frederic S. Wheaton, a chartered accountant, covers the first three syndicates. They were floated during the hard times some years ago, and were less profitable than the average, showing a net profit of a little less than 150 per cent. Schedules of the other syndicates will be printed in this paper from time to time or may be had for the asking.

Write for our plan.
CAMPBELL INVESTMENT CO.,
650 Royal Insurance Building,
Chicago, Ill.


## WGINEFOOT MACHINE SHOP OUTFITSS


Schieren's Weekly Advice:


 BUY SCHIEREN BELTING
 Chas. A. SCHIEREN \& CO.

$\qquad$




The Apple Automatic Igniter For Jump Spark or Touch 8park,
Forany gas engine, stationary, at Forrany gas engine, stationars, av
tomobile orm $m$ mine.
Does away with battertes and belts. Writefor circular.
THE DAYTON ELECTRICAL MFG. CO
No. 80 south St. Clair St. Dayton, Ohio. U.s. A.

## MURRAY



SEYENTEEN YEARS of honest, stralqhtforward and enviable business
repatation ia back of every .Murray" Vehicle, Har-

 Buggies, Sureys, Phaetons, Road Carts, Road
Wagoss Blike Wagons, raps. Spring Wagois, De; Wagons Bike Wagons., Traps, Spring Wagons, De,

SADDLES and HARNESS We Fill be glad to mall you our large Illus-
trated Catelog Fo. 33. its free for the asking. WILBER H, MURRAY MFG. CD.,


Patents, Trade Marks, COPYRIGMTS ${ }_{3}$ etcop aderass MUNN \& CO ag of Poctersts.
 Honderit semt Frw on $A$ pphtin








 Veitain


 Water closet fushing apparatus.
Water heater, L. M. Rebnquist.
Water heater, Sebadd $\&$ Schmidt. Water heater, Seba'd \& Schmidt
Water regulator, R.
W. White Well cap w. F. shutt

 Whiffetree hook, W. D. Sutton. $\ldots \ldots .$.
Wigs, manufacturing, Wigs, manuracturing,
Windmill, H. B. Smith
Window cleaning chair,
Win
 Wire fasteerer,
Wire stretcher, $\mathbf{W}$ D. F Fkson
Jennin

## Wire working tool, J. W Wrench, A. P. Miller Wrench,

$W$ rench,
Wrench,
G.
A.
A. Cumble
Yarn, manufacturing cotton, $\mathbf{H} . \mathfrak{W}$. Kearng

## DESIGNS.


TRADE MARKS.
Advertising
wholly or in ities
part of pyroxylin or Wholly or in in part of pyroxylin or it it
compounas,
$\mathbf{F}$.
$\mathbf{F}$. Beverage, carbonated, L. Goulding
Books, blank, Salmon \& Tredway
Brushes, tooth, noil, and fesh, Brashes, tooth, nall, and flesh, Martin \&
 Cards, playting, E. H. H. Roy
Chemical compound poison for insects, E. .........
Clgars and cheroots, Havana Cigar Manufac
turing Company
Cocks and valves, stop, waste, and bail.. w.
H. Rawe


Flour, wheat, Duifith Superior Mining Co............
Gar gent suporter clasp, Hirsh Brotherr....
Garments, certain named, Bliss, Painter
Hair grower and dandruir cure, Youngio.

Long coth, Sherman, Reld \& Co.......
Magneslim dorid, BBogen Company
Musical





$\underset{\substack{\text { mogen } \\ \text { Martin }}}{\text { Redes }}$


Soluble receptacles, certain named, J. Schmi
Steel, tool, Sanderson Brothers Stee Co...
Tea, Loudon $\&$ Jobnson $\&$ Jobnson........ Tea, Loudon \& Johnson \& Johnson...........
Toilet cream, Adair Manufacturing Company
Washing compounds, T. Water closet and water closet fittings, $G$
Helbing $\&$ Co. Stuart \& McEnnery
Whisky, D. Leffngwell.

Bok Ale," LABELS.







 PRINTS.
"Brotberbood Handkerchief," for handker-


A printed copy of the speciflcation and drowing in print issued since 1863, will be furnished from
this omtes for 10 cents, provided the name and

Cork.
Cenadian patente may now be obtained by the in
ventors for any of the inventions named in the fore


"The Pen That Fills Itself"

 A11 we askis that you let us send our
bewififul new illustrated catalogue.
The Conklin Pen Co ${ }^{8 / 818}{ }^{80}$
 Manufactory Established 1761.
lead pencils, colored pencils, slate PENBLS, WRITING SLATES, INES, STATIONER 78 Reade Street, New York, N. Y. GRAND PRIZE, Highest Award, PARIS, 1900.
K Magical Apparatus.


$\$ 100$. to $\$ 300$. MONTHLY



${ }_{T}^{\text {THAT }}$ Schapirograph?


F. N. Roehrich \& Co. Machinery 102 fulton street, Designing. new york. Mechanic

MASON'S NEW PAT. WHIP HOIST


Metal Patterns and Models
 THE C. E. WENZEL CO., 313 Market St, Mewark, N. .


 Craig Mänufacturing Co.

39-43 w. Waabington Street, Chicago, I. In. MODELS \& EXP ERIMENTAL Work.


SPECIAL MACHINERY Tooisand Men Mond Experimental \& Model Work





NOVELTTES \& PATENTED ARTICLE8
GOLD GALVANIZING



 Waltham Mrit cor Cotalowe Waltham, Mass. IT GETS YOU THERE AND BACK
WARWICKMOTOR CYCLE


45 Miles an Hour
 Warwick Cycle \& Automo.
bile Co.. Springfield, Mass.

Single and Double Tube Fisk Tires
FISK RUBBER COMPANY Chicopee Falls, Mass.
mosLer SPIT-FIRE
SPARK pLug Hhetuph Nime PALMER MOTORS
 Send for Cotatioupue.


## TOOLS

FOR MECHANICS. Send for Free Catalogue No. 16 B. The L. S. Starrett Co., Athol, Mass., U. S. A.
 IECDMGG RALROADS, MANUFACTURERSARCHITETSAMOBUIDERS (WRITE FOR TESTIMONIALS PHOTO PAMPULET ANS S
$\qquad$



CRUDE ASBESTOS DIRECT FROM MINES PREPARED
ASBESTOS FIBRE M. MARTIN, ASBESTOS FIBRE OFFICE, ST. PAUL BUILDING (tor Manufacturers use 220 B'way, New York.
 GCEAMPYALANGESGirgofa



