


Willimn brooke.

SCIENTIFIC AMERICAN established 1845
MUNN \& CO., - - Editors and Proprietors

## No. 361 Broadway. New York

## terms to SUBSURIBERS

 the scientific american publications.


MUNN \& CO., 361 Broadway. New Yor

## NEW YORK, SATURDAY, AUGUST 8, 1903.

## The editor is always glad 10 receive for examination iilustrated ticles on subjects ot timely interest. If the photographs are

 icles on subjects ot timely interest. If the photographs arero, the artucles short and the fact authentic, the coutributions
receive special attention. Acceped articles will be paid 1or at regular space rates.
the transatlantic run of the "kearsarge." The notoriety given by the public press to the recent run of the battleship "Kearsarge" across the Atlantic at an average speed of 13.1 knots an hour, and the mutual felicitations indulged in thereat, must have proved somewhat puzzling to the average layman, who is accustomed to read on any day of the week that such and such a transatlantic liner has come into port after making the same transatlantic run at an average speed of 23 knots an hour or over. "Why," he must have said to himself, "all this jubilation because a first-class battleship has sailed the seas at a speed which would be only respectable for one of the better class tramp steamers?" Not only must the average speed seem to be in itself very low, but he will probably have in mind the fact that four years ago, when the "Kearsarge" underwent her otficial trials, she maintained for four hours an average speed of 16.84 knots an hour. "Why, then," he will say, "must we have all this mutual congratulation over a United States battleship which, on a speciallyordered sea voyage, cannot come within four knots per hour of the speed she made on her acceptance trials?
And yet, in spite of the apparent discrepancy, this run of the "Kearsarge" was a really creditable performance, since it was made entirely under natural draft and at an average speed only one knot lower than her natural draft speed at the time she was built. Battleships and cruisers are designed to steam at varying rates of speed according to the particular needs of the occasion. For cruising purposes and making such long runs as that which she has just completed, the "Kearsarge" was given sufficient motive power to enable her, when steaming under natural draft, to maintain a speed under favorable conditions of 14 knots an hour; and in order to give the vessel a reserve of speed which she can call upon when she is chasing or being chased by an enemy, or when she wishes to avoid torpedo attack or to make some sudden change of position in a naval engagement, she carries a set of blowing engines by which the rush of air through the furnaces can be speedily augmented, and the steam-raising power of the boilers and the horse power of the engines proportionately increased. Under the latter conditions, the speed increases nearly three knots an hour; and as a matter of fact, on her trials carried out in 1899, the "Kearsarge" during a forty-hour continuous run under natural draft, maintained an average speed of 14.1 knots an hour, and during a forced-draft trial of four-hour duration, she showed an average speed of 16.84 knots per hour. It will be seen, then, that on the recent run across the Atlantic, the performance of the ship was within one knot per hour of the speed achieved under natural draft during the highly favorable conditions of an official trial.
Unfortunately for the subsequent reputation of battleships and cruisers, the maximum forced-draft speed achieved under exceptionally helpful conditions is invariably taken as being the speed of that ship; that is to say, she is credited, not with the speed which she will show for 360 days out of the 365 of the year, but with a speed which she may not use more than two or three times in the year, and which she can only reach when she has the best of coal in her bunkers, and when the boiler-room crew is in a state of first-class efficiency.
Hence it is misleading to talk of the 18 -knot "Maine" and the 17 -knot "Kearsarge." It would be nearer the truth to call them respectively 15 -knot and 13 .knot vessels.
Furthermore, the wide difference in speed between naval and merchant vessels, or say between a "Kearsarge" and a "Deutschland," is not in any sense due to imperfect design or poor handling in the former For we must remember that while the "Kearsarge" re quired during her transatlantic run only about 6,500 horse power to drive her at 13.1 knots, the "Deutschland" in making her record trip at 23.5 knots, required
over 37,000 horze power, or nearly six hundred per cent more power. Moreover, the model of the transatlantic liner is designed specially for high speed; for with a beam of 68 feet she has a length of over 680 feet, a ratio of beam to length of 1 to 10 ; whereas the "Kear sarge,": with a beam of 72 feet, has a length of only 368 feet, a ratio of 1 to 5 . The finer lines of the merchant vessel and her high freeboard are not only conducive to speed in ordinary still water, but they are especially helpful when driving into a head sea. We have traveled on the "Deutschland" when with 35,000 horse power she was maintaining 21 knots an hour in the teeth of a heavy southwesterly gale. The "Kearsarge," on the other hand, was obliged to slow down at times to 10 knots an hour on the same western trip, because she was taking green water over her forward turrets
The run of the "Kearsarge," therefore, was highly creditable, and had it not been for obstructions of fogs, icebergs, and heavy weather, it is likely that the vessel would have about maintained her trial speed of 14.1 knots per hour.

## THE BEHRING STRAIT TUNNEL AGAIN.

Once more the chimerical scheme for building a railroad from the Pacific coast terminus of the transcontinental railroad systems to Alaska, and carrying the road beneath the Behring Strait by a tunnel to connect with an extension of the Siberian Railroad, is being agitated. The improbability of such a railroad being built, or if built, being made financially successful, can only be understood by taking a map of North America and tracing the proposed course of the line. It will then be seen at a glance how vast are the distances which this proposed road must cover. From Vancouver on the Canadian Pacific line to Behring Strait is at least 2,500 miles. The Behring Strait would involve a tunnel nearly sixty miles in length, that would have to descend several hundred feet below sea level to find a stratum suitable for tunnel operations; then on reaching the Asiatic shore, there would be another stretch of about 2,700 miles to be surveyed and constructed before connection was made with the present Trans-Siberian system. The difficulties in locating and building such a line can only be understood by engineers who are familiar with the physical and climatic obstacles to be overcome. No mere hasty reconnaissance would be sufficient to give even an approximate estimate of the cost of the TransAlaskan portion of the route. As to the construction of the tunnel, the mere preliminary borings to ascertain the character of the material to be encountered would be an enormously formidable task in itself, and when this was successfully completed, there would still be a grave element of doubt as to the practicability of keeping. the tunnel free from an inrush of water which, if it should occur under the pressure due to the great depth, could not fail to be disastrous.
We are aware that the enthusiastic promoters set down the cost of the 60 -mile tunnel at twenty million dollars; but when we consider that the twenty miles of subway tunnel in this city are to cost thirty-five million dollars, it is pretty safe to say that the twenty million dollars would not be sufficient to cover the cost of the tunnel and the surveys, to say nothing of the 5,000 miles of connecting railroad that would be necessary. Even if the engineering difficulties could be overcome (as undoubtedly they could with sufficient time and capital), where is to be found a bod of financiers to put through an undertaking which could not possibly render any return on the invest ment for many a decade to come, if ever it did?
Moreover, even if the road were built, it is pretty safe to say that it would have to depend almost entirely upon the passenger and local traffic for its development; for it could not possibly hope to compete in the carriage of freight with the large merchant steamships that are being built for the Trans-Pacific trade. The idea of an all-rail route from Paris to New York is picturesque, sentimental, and quite impractical. It is certain that in the present stage of development of Northwestern America and Northeastern Asia, the scheme will never get beyond the paper stage.

## THE SPEED OF THE AUTOMOBILE.

There is something in high-speed travel that appeals, with the strongest fascination, to the general public. Just why a record-breaking run should have such fascination, it is difficult to determine; but perhaps it is that, unconsciously, we realize that every mile per hour added to our high-speed records is another evidence of the gradual victory of man over that allpervading inertia which it is his constant effort to overcome.

The present year has witnessed some remarkable feats of speed, particularly in the field of the automobile. Unquestionably, the most astonishing performance was that of Gabriel, the winner of the first stage of the Paris-Madrid race, who covered a stretch of 331.2 miles at an average speed of 56.25 miles per hour. To maintain such a high average over roads
that are more or less hilly must necessitate extremely fast running over certain portions of the road.

Although the meet for the Gordon Bennett cup, recently chronicled in this journal, did not witness any such high average speed as was achieved in France, the speed trials for short distances were the France, the speed trials for short distances were the
most successful ever held. Although it is true that the course in Phœnix Park is an ideal one for speeding, we must admit that the performance of Baron de Forest, when he lowered the world's record for a kilometer to $263-5$ seconds, which is equal to a speed of $861 / 2$ miles per hour, is truly astonishing. No less astounding, either, is the record of Barney Oldfield, made recently on an oval track, of a mile in 55 4-5 seconds, or at a rate of $641 / 2$ miles an hour.
As far as we are able to ascertain, the highest speed attained by a railroad train on a trial that was properly tested by competent time-keepers, was a fraction of over 900 miles per hour, so that the automobile is to-day practically as fast as the locomotive. Of course, it is a very different proposition to run a single ntachine capable of carrying only two persons at high speed, and to do the same thing with a train capable of carrying three or four hundred people. The fact that nearly 90 miles an hour has been achieved by an automobile proves that it is merely a question of weight and horse power before these machines will be running a trial mile at the rate of one hundred miles an hour or over. Such performances, however, are merely sensational and spectacular; they have no practical value, except so far as they may afford data to the automobile makers on the action of the more delicate and sensitive parts of the engines when they are pushed at their utmost limit.

MARVELOUS PRODUCTION OF IRON AND STEEL.
In spite of the fact that during the past twelve months the iron and steel industry has been hampered by a long coal strike, and by something of a deadlock in transportation facilities, the total production of iron and steel in the United States has grown to truly enormous proportions. Probably in the whole history of the world there has never been a period when a single industry witnessed such a phenomenal development as that of the American iron and steel trade. We have been accustomed to regard the great industrial establishments of the country, and particularly those identified with the steel industry, as more than equal to any possible demands of the home market, yet so great has been our prosperity that our great blast furnaces and steel mills have been unable to cope with the demand, and it has been .necessary to import a certain amount of pig iron from abroad.

During the last year the total production of pig iron was $17,821,307$ tons, an increase of over two million tons on the preceding year and a gain of foür million tons over the year 1900. Perhaps these figures are best understood when it is stated that last year's production was nearly double that of the year 1897.

## THE SLAUGHTER GOES ON.

The rate at which our railroads are killing and maiming people continues steadily to increase. According to the report of the Interstate Commerce Commission on Railroad Accidents in the United States, within the three months ending March 31 last, 300 people were killed and 2,834 injured in train accidents. Other kinds of accidents, including those sustained by employes while at work, run up the total casualties to 827 killed and 11,481 injured. That these accidents cannot be put down entirely to the fault of the passengers and employes themselves is shown by the fact that during the quarter under consideration, 1,650 trains were in collision and 1,181 trains were derailed.

MORE NEWS ABOUT EDISON'S STORAGE BATTERY.
The latest authentic data concerning Mr. Edison's storage battery are found in the following interview published in the New York Times:
"The popular impression seems to be that my new storage battery was more or less a possibility, but that it began and ended there. That is not so-one of them has been in operation for the last three weeks in one of Altman's delivery wagons, and is doing all that I expected and claimed for it.
"There is a great deal to be said for the new battery, and all in its favor. It will average more than a third greater mileage for half the weight than will the old lead battery. It has an additional advantage inasmuch as it can be recharged at a much faster rate than the old battery. As much electricity as will send the motor forty miles can be put in it in less than an hour.
"Ever since I took up this problem of the greater capacity battery I have worked with the idea of using it for street locomotion-in automobiles and trolleys. And now the auto battery is finished. Last Monday three friends and myself took a trial run to Atlantic City in a car consisting of a Mors frame and one of
my batteries. We wished to attain great veloçities over rough surfaces, and we succeeded beyond any of our expectations. The idea was to find any defects in either the frame of the car or the battery and motor. The latter two were entirely successful, but there are a few things which can be bettered in the car.
"My experience shows me that we have much to learn from the French makers-they have been at it longer than we have, and are still several years ahead. Several of the auto makers in this country have sent for my battery specifications and are beginning to make types of their machine in which it is to be used.

I have been experimenting with an electric coach to-day, and it is surprising how well it showed up. We climbed Eagle Rock, where the hill-climbing contests are held, with the greatest ease, and we really did not dare to attain our maximum speed
"We cannot put the new battery on the market in any quantity as yet. The best we can do now is to make one a day. By October we will make at least six daily, and about Christmas we will be in shape to meet any demand. The trouble has been that special machines had to be built, but the last of these will be completed next week. Another disadvantage I have to contend with is paying 40 per cent duty on a. certain sheet steel that must be imported from England or Germany, and then in only limited quantities. By Christmas three rolling mills will be able to make it for me here in this country, and then the present high price for the batteries will be reduced.
"This battery will drive all other methods of locomotion out of business, and in less than ten years the horrible odor of gasoline on the public highways will be unknown. As for lack of recharging stations, that is nonsense. In the last month forty-five new ones have been installed in the New Engrand States alone, and this is going on all over the country.
"Next year I will wager that I can take a car of my own design, fitted with my motor and battery, and go to Chicago and return in less time and with more pleasure than any other machine in existence. There will be no breakdown, no explosion of gas or gasoline, and the trip will be made at an even twentyfive miles an hour.
"Another thing, the battery will be made in four sizes, so that when ${ }^{\text {f }}$ fully charged it will run $25,50,75$, or 100 miles, and if wanted, they will be made any size larger or smaller. Of course, the running power of the battery will depend to a certain extent on the work it is called upon to do. If the roads are rough and there are many hills, a charge will last a shorter time than if the conditions were such as are found in the city. But taking the maximum of bad going, the battery will only be exhausted about 25 per cent sooner than it would be under favorable conditions." In looking up the official test made of the new battery in the delivery wagon at Altman's, the books showed that the old lead battery weighed 1,260 pounds and had a maximum of 25 miles, while the Edison battery which replaced it weighed 650 pounds and drove the wagon 36.8 miles. Besides which the old battery occupied 12.8 cubic feet, while the Edison took up only 8.5 cubic feet. This comparison was made by the Times.

## PROPOSED FORTH-CLYDE SHIP CANAL

The feasibility of a ship canal between the Forth and Clyde has been for many years a subject of discussion in shipping and commercial circles in Scotland. Several routes were suggested at various times, but no definite steps have been taken toward the preparation of plans. At present the prospect of the construction of such a waterway is, however, considerably brighter. A company of London financiers is taking an active interest in the project, and has, it is said, adopted the scheme put forward by Messrs. D. and $C$. Stevenson, a prominent firm of harbor engiand C. Stevenson, a prominent firm of harbor engi-
neers of Edinburgh. Messrs. Stevenson surveyed the route some years ago from Alloa, on the Forth, to Arrochar, on Loch Long, and are now making a further survey in detail, preparing plans, etc. An Edinburgh committee or syndicate is acting in conjunction with the London promoters, and the sum of $£ 10$,$000,000(\$ 48,665,000)$ has been pledged, on condition that Parliament shall guarantee interest on capital. The promoters are confident that Parliament will aid the enterprise to this extent, in view of the importance of the canal for naval purposes.
In regard to this proposed deep-water canal across Scotland, David Alan Stevenson, C.E., says:
"The east and west coasts of Scotland are now connected by two canals, namely, the Forth and Clyde, from Grangemouth, on the Forth, to Bowling, on the Clyde, and the Caledonian, constructed at national expense, between Inverness and Fort William. Both of these canals are quite inadequate to meet the present wants of shipping, as they can only accommodate vessels of a small class. The first named is mainly used by barges, while the Caledonian can only be used used by barges, while the Caledonian can only be used
by vessels of about 150 feet in length, 38 feet beam,
and 17 feet draft. Both canals are seriously incum bered by numerous locks.
"At present all vessels bound from the east to the west coast of Britain, or vice versa, have to pass around the end of the island, through the Pentland Firth, with its rapid tide and dangerous sea, combined with deceptive currents and prevalent fogs, or 'south about' through the overcrowded English Channel, so frequently the scene of disastrous collisions. It cannot be doubted that a ship canal through the narrow neck of land which separates the east and west coasts of Scotland, capable of carrying the largest vessels, would not only obviate all the dangers and delays incident to the 'north about' and 'south about' routes, but would effect much saving in time, in the cost of insurance, in wear and tear of vessels and their engines, and hence in the cost of transit; it would also for strategical purposes be of the greatest importance.
"In designing such a canal the first points to be settled were, What are the essential requisites? These may be stated as follows:
" 1 . That it should be of such dimensions as to admit ships of the largest class of merchantmen, and also vessels of the royal navy, passing freely and with perfect safety from sea to sea, practically at all times.
" 2 . That it should be as íree as possible from locks, hydraulic lifts, or other mechanical appliances, involving possible delay or risk to ships using it.
"Having assumed these, as I think, indispensable conditions, the next question for solution was, Can a route be formed from the German Ocean to the Atlantic which fulfills them, and also can the canal be formed at a cost which will prove remunerative?
"After careful study of the country and the levels, the conclusion was arrived at that a route along the valley of the Forth gives the only practical solution of the problem. There is, as is well known, a tract of country, extending from Alloa, on the Forth, westward along the valley of the Forth to within about 10 miles of Loch Lomond, where the surface of the ground is only from 30 to 50 feet above mean sea level and the stratum is an alluvial deposit. Between this and Loch Lomond the ground rises rapidly and attains a maximum height of 236 feet above mean sea level and dips again to the south end of Loch Lomond, the surface of which is only 22 feet above mean sea level. The distance across this higher ground, from the 50 foot contour on the one side to the 50 -foot contour on the other, is about 8 miles, $13 / 4$ miles of it being above the 200 -foot line.
"Loch Lomond (which has ample depth for vessels of the largest draft) is to be utilized as canal toward the north end of the lock to Tarbet, and thence across to Loch Long there is only a distance of $13 / 4$ miles, the ground attaining a maximum height of 130 feet above the mean sea level. Loch Long is practically the Atlantic. Ocean, and the navigation of it is safe and the water of ample depth. This, then, is the route proposed by my firm, and the surface of Loch Lomond, which as I have said is only 22 feet above the mean level of the sea, is the proposed summit level of the canal, and having a water area of 21,000 acres and ample gathering ground- 290 square miles-it would form an inexhaustible reservoir for supplying the locks with water. Only two locks at either end, at Alloa and Loch Long, would be required, as the level of the canal is only 13 feet and 17 feet above high-water level at these places, respectively. The exact route to be chosen will, of course, depend upon more minute inquiry than has yet been made.
"The eastern approach to the canal, which will be tidal, will be formed by deepening the Forth or making a cut inland, with a depth of 25 feet at a low-water spring tides, from opposite Grangemouth to the locks which it is proposed should be placed about 2 miles above Alloa. This will give a depth of 43 feet at highwater spring and 38 feet at neap tides. The distance from Grangemouth to Alloa is 6 miles. From Alloa the canal will pass to the north of the links of Forth and to the northward of the town of Stirling, then along the valley of the Forth to Gartmore and enter Loch Lomond near the mouth of the Endrick, a distance of 29 miles.
"Near the Loch Lomond end there are 5 miles of high ground, which, according to the geological survey, is the old red-sandstone formation. This part of the work will be open cutting. The distance from the junction of the loch and canal to Tarbet is 14 miles, and across the neck of land to Loch Long $13 / 4$ miles. Loch Long is 15 miles in length to its junction with the Firth of Clyde. The total distance from Grangemouth to the Firth of .Clyde is $653 / 4$ miles.
"Regarding the dimensions of the canal, it is essential to its success that it be made on a large scale and free from locks, excepting at the seaward extremities. As the level of the water of the canal will be only about 13 feet above high water, one lock will be sufficient at high water, but two may be necessary at other times of tide. It is proposed to make the canal throughout with a depth of 30 feet, with a width at the bottom the same as the Suez Canal-namely, 72
feet-and side slopes varying with the nature of the material. The locks will be capable of passing the largest vessels afloat, or about 600 feet in length and 80 feet in width, with smaller locks alongside for smaller vessels.
"It would have been desirable to have proposed a canal of sufficient width to allow two of the largest vessels to pass each other at any place on the route; but in roughly estimating the cost it was found that this would involve so large an expenditure as to make it doubtful whether such a work would, in the meantime, prove remunerative. Frequent passing places, however, will be made at suitable intervals.
"There are no very serious difficulties to be overcome; though the cutting is no doubt a heavy one. There are few railways or road crossings of any importance, and the excavations are largely in soft material and the disposal of the excavations could be easily effected, owing to the proximity to the canal banks of waste ground.
"A ship canal of these dimensions would not only accommodate merchant vessels, but would prove of the greatest advantage to His Majesty's navy, as the largest ships of war at present in existence could pass through from the one coast to the other in about eight hours, and thus the facility for defending the coast in time of war would be very much increased.
"It is believed that the route suggested through the Forth Valley would prove the most satisfactory for a ship canal. Both approaches are in smooth water and free from every danger to navigation. The western outlet into Loch Long is exceedingly favorable, as ships of the largest class could at once proceed to sea quite free from the interruption and liability to grounding which they would meet with had the canal debouched into the River Clyde. The entrances to the Forth and Clyde are now so well marked by light. houses and fog signals that vessels of any burden can run for these waters with the most perfect confidence. "When considering the best route for the canal after vessels enter Loch Lomond, two other routes were feasible besides that already described:
"1. Across Lock Liomond to the opposite shore near Arden and then by a cut about 4 miles in length, partly open and partly in tunnel, to the Clyde to the northward of Ardmore Head.
"2. Along Loch Lomond to its southern end and through the vale of Leven to the Clyde at Dumbarton. "The relative merits of the different routes from Loch Lomond to the sea, so far as distance is concerned, are as follows:
Tarbet route (Endrick to mouth of Loch Long) . 28 Arden route ......................................... 14 Dumbarton route .. $201 / 2$
"The Arden route is therefore the shortest, but it would be the most expensive, owing to a length of tunnel of $13 / 4$ miles, which could not be overcome by open cutting, as it passes under land about 300 feet in height. The Dumbarton route is shorter than the Tarbet route by about $71 / 2$ miles, but as the Dumbarton route involves 5 miles additional canal, where vessels could only go about 5 miles an hour, and 6 miles of the Clyde, where the speed will probably be restricted to about 8 miles an hour, the time occupied by the journey either way will be about the same. In steaming up Loch Lomond and also down Loch Long vessels may go at full speed, and there would be no interruption from river traffic.
"The cost of the undertaking cannot be more than approximately estimated without particular investigation as to the nature of the strata in the line of the canal; but my firm estimate the cost of the Tarbet route, with their present knowledge derived from the ordnance and geological surveys, and including interest during construction, at $£ 10,000,000(\$ 48,665,000)$. The cost of the management and maintenance my firm estimate at $£ 60,000(\$ 291,990)$.
"The saving in distance that would be effected may be stated thus:
" 1 . From the Clyde to ports on the east coast of Scotland, northeast of England, and northwest of Europe the distance saved would be from 529 miles to 238 miles, in the majority of cases the distance being much more than halved.
"2. From the Forth to ports on the west coast of Scotland, northwest of England, Ireland, America, and the Mediterranean the distance saved would be from 487 to 141 miles; in all cases, except the American and Mediterranean route, the distance being more than halved.
" 3 . Tyne ports to the St. Lawrence River, the distance saved would be 150 miles.
"4. West of Britain and northeast of Ireland to middle western ports of the Continent, the distance saved would be from 377 to 98 miles."
The canal will affect an enormous tonnage, estimated by the sanguine engineers at $9,500,000$ tons per annum. At an average rate per ship and cargo of 1s. 6d. ( 36 cents) per ton, this would yield a revenue of about $£ 700,000(\$ 3,406,550)$.-Rufus Fleming, U. S. Consul at Edinburgh.

## RECENT AUTOMOBILE TRACK RECORDS

The midsummer automobile race meet at the Empire City Track, Yonkers, on the 25 th ultimo, was devoted exclusively to the lowering of records by gasoline racers, although several of the events were open to machines of any kind of power.

Barney Oldfield, on the Ford-Cooper racer with which he has been steadily lowering track records since he first drove it a mile in 1 minute, 11-5 seconds on December 1, 1902, once more reduced by three-fifths of a second his previous record of $562-5$ seconds, made on the 4th of July last, at Columbus, Ohio His new time is accordingly $554-5$ sec onds, or a rate of speed of $641 / 2$ miles an hour. This is faster than most express trains go on a straigh line of rails, and what it means to ride on a machine that turns sharp corners while going at this rate, can carcely be imagined by one who has not seen it actually done. Every time Oldfield's racer started to make a turn even though he kept close to the out side fence and turned the front wheels very gradually, the rear end of the machine would skid around so far that the whole car appeared for the mo ment to be aiming straight for the in ner fence. In an instant it would straighten out again, however, skim round the bend, and dart along the farther side of the course at more than express train speed, only to be seen a few seconds later making its last turn amid a cloud of dust, and then its final rush down the home stretch. Recognizing the tremendous peed at which Oldfield was running his machine, the spectators cheered him as he finished, and a moment later, when the time was announced, all present realized that they had seen a new world's record made. Oldfield rounded the course a second time at high speed and coasted up to the starting point. This was invariably the custom, in bringing the fast machines to a stop The new record was made f course, with a flyins start, the racer having been first towed back ward to the end of the rack, where the moto was started and the machine got up to speed in he quarter of a mile before it crossed the line.
Oldfield's race agains time was the second event of the meet, the first be ng a five-mile race for machines of any motive power weighing less than , 200 pounds. This brought to view another American triumph in the perfecting of automobiles n the shape of a Frank in 10 horse power, four cylinder, air-cooled racer of 900 pounds weight, which won easily in $6: 54$ $2-5$, making the fastes time on the third mile, which was covered in 1:213-5. The time for each mile and for the en tire distance was a new world's track record for light - weight machines Darracq racing. cars of 16 and 12 horse power wer second and third respec ively, while the little Or ent buckboard, propelled by a 4 horse power air cooled motor, took fourth place. As the Franklin driven by John. Wilkin son, its designer, also wo a 10 -mile race from Jos eph Tracy in a 10 hors power Renault ( t i m e 15:50 1-5) besides making a mile from a flying star in $1: 202-5$, it can easily be seen that the day was on of victory in the racing line for the air-cooled mo tor, whicin, though discarded by its originators, the French, has been brought to such a state of perfection in America as, after completely demon-
it to the end. The steady, smooth, quiet running of this car is remarkable, and stamps it at once as a perfect piece of mechanism. It reeled off the miles at the steady pace of $1: 043-5$ with but fractions of a second variation, save once or twice. The first, sixth, and eighth miles were the slowest, being run in 1:10 2-5, 1:05 1-5, and 1:05, while the twelfth and thirteenth were each covered in 1:03 4-5, and the fourteenth and fifteenth in 1:04 and 1:03 $2-5$ respectively. The times for the last five miles were all world's track records. With the completion of the 15 miles in a total time of $16: 104-5$, Fournier's record for this distance was beaten by 3 minutes. The French Decauville finished second, tieing Fournier's old record of 19:104-5, after having made as good a performance as the Mercedes in proportion to its power. The highest-powered car of all took third place, and was beaten a full mile by the winner. It seemed to miss fire considerably, and consequent ly did not have very much speed.
The second great event of the day was two 5 -mile heats between Oldfield on his Ford-Cooper racer and F. A. La Roche on an American-built Darracq. The machines were started at the half and mile posts respectively. They had to be started a second time, owing to the engine of Oldfield's racer missing fire badly in the first mile. The latter

0. W. Bright's $\mathbf{6 0}$ H. P. Mercedes Car Making a Worla's Record of 15 diles in 16 Minules, $10 \frac{4}{5}$ Seconds.

The Large Assemblage of Automobiles seen from the Grand Stand. the midsommer automobile race meet at the empire city track.

feurs who drove them in that event. A 35 horse power Darracq and a 35 horse power Panhard were third and fourth respectively.
One of the most interesting events of the afternoon was an international 15 -mile race, in which Mr . 0. W. Bright's new 60 horse power Mercedes-a duplicate of the machine that won the Gordon Bennett race -represented Germany; the 40 horse power Paris-Madrid Decauville racer, France; and Louis P. Mooers’ 80 horse power Gordon Bennett cup racer, America. The Mercedes took first place at the start and held
nally won both heats in 5:091-5 and 4:55 respective y, for, although La Roche's machine was a fast one it seemed not to be in the same class with the FordCooper racer as run by its dare-devil chauffeur
The final race was a 15 -mile one for machines of any weight or motive power. It was won by the 40 horse power Decauville, driven by Henri Page, who brought it again to the finishing post in the fast time of 16:39 2-5. A 35 horse power Darracq came in second, and 40 horse power Darracq third The latter stood every chance of winning the race when M. C. Herman's 70 horse power Pan. hard dropped out on account of a loose valve spring, after leading dur ing the first mile, until a punctured rear wheel tire gave out during the sixth mile and caused it to fall behind. Jules Sincholle ts driver, pluckily finish ed the race, however, with the spectators fearing an accident every moment from the rapidly demolishing tire.
The mile speed trials, made from a flying start, concluded the meet, and resulted as follows: 60 horse power Mercedes, 1:031-5; 70 horse power Panhard, 1:05 2-5; 40 horse power Decauville, 1:07 1-5; 80 horse power Peerless, 1:093-5; 35 horse power Darracq, 1:15 2-5; 10 horse power Franklin, 1:20 2-5.
The races were t h most successful yet held in this country. Fivo or six thousand'people witnessed them from the grand stand, and many rode to the track in their automo biles, and viewed the events from the seats of their vehicles, which filled the lawn near the track Over three hundred ma chines were present in the inclosure, and the only horses seen were attached to two watering carts which slowly sprinkled the course before the big events. It seems quite time for the firm that manufactures these ma chines to make them self propelling, now that auto mobile lawn mowers, etc. are on the market, and this it ought easily to do, as it is turning out electric automobiles already Then, in future meets, the horse will have vanished entirely, and none of the animals will be present to
remind enthusiasts in the sport that the horse is not yet a back number and may some day be needed to help them.

Complete illustrated descriptions of the Ford-Cooper racer and of the Franklin car have already been published in our issues of January 31 and April 11; and by reference to these numbers, any of our readers interested in the construction of the machines can obtain full particulars concerning them.

## A MULTIFACE LINOTYPE MACHINE.

The original linotype machine, illustrated in the Scientific American, vol. LXX., page 17, is adapted for composing solid matter in one face or style of type only, without italics or small capitals, and to this end it contained a single set or font of matrices, each representing a single character. These matrices were selected by means of a finger-key mechanism, assembled in line with expanding spacers, in the order in which the characters were to appear in print; the composed lines were transferred to the front of a slotted mold and there justified by adjusting the spacers through the line to increase their thickness; the mold was closed at the front by the line of matrices, and was filled from the back with molten type metal issuing from the mouth of a melting pot provided with a pump or plunger. The result was a slug, or linotype bearing on its front edge in relief the characters formed thereon by the matrices.
After the casting of a slug the matrices were lifted to the top of the machine, and returned through distributing mechanism to the upper ends of the channels in the magazine from which they were delivered.
In the progress of the art it became necessary to adapt the machines to produce italics and small caps or black faces, in connection with the body faces. This was in order to adapt them for the demands of the book offices. This result was accomplished by providing each matrix with two characters, separately usable. A switch under the control of the operator was provided for the purpose of directing the matrices to the composed line, at a higher or a lower level, in order to cause the presentation of the upper or the lower character to the mold. By this simple modification of the original machine, it became possible to introduce italics, small capitals, or black letters, in
matrices. Both of these magazines are controlled from the ordinary single keyboard. By simply throwing a lever, the operator is enabled to cause the discharge of matrices at will from either the upper or the lower magazine. The magazines may contain two fonts of similar face differing in size, or fonts of the same size and different faces; or one may carry a font


## ARRANGEMENT OF THE MAGAZINES.

of matrices for body faces and the other an assortment of black letters, arbitrary characters, etc. Matrices for three hundred and sixty characters are carried at one time in the machine, and the operator is thus enabled to set matter in one face or another at will. The matter may be composed wholly of characters represented in the upper magazine, wholly of those represented in the lower magazine, or in part of each. By means of this remarkable machine, it becomes possible to set a page of any ordinary book, including a large body face, a different face for foot notes, extracts, etc., or chapter heads, side heads, etc., together with italics and small capitals, at approximately the speed of ordinary or straight composition. In short, this is the first and only machine by which compli-
sembling belt, from which they are delivered into the assembling elevator.

As shown in the accompanying illustration, the lower magazine delivers its matrices through guide channels to a second carrier belt, which, in turn, delivers them through a special guide or channel into the assembling elevator. After being used in front of the mold, the matrix lines are lifted to the level oin the upper distributor. Matrices belonging in the upper magazine pass through this distributor to the magazine in the usual manner. On the other hand, matrices belonging in the lower magazines are permitted to fall from the line to a lower distributor, which delivers them to a second distributor overlying the lower magazine, to which they are delivered. The two distributors are alike in all respects. The matrices for the lower magazine differ from those of the upper only in having a distinguishing notch in the lower end.
The linotype machine is so complicated, both as to its construction and operation, that we have not attempted in the limits of this article to do more than outline the new features of the machine.

## The Monument of Mont Pelé.

Prof. Angelo Heilprin, whose work in studying the Martinique eruptions is doubtless well known to our readers, announces a most curious and wonderful phenomenon which he had the opportunity of studying on Mont Pelé. He states that from the crater of the volcano there has been forced up a column 840 feet high, having a diameter of about 300 feet at the base. Prof. Heilprin asserts that he himself witnessed part of the upward movement of this enormous mass. He noted that in the space of four days there had been an èlevation of 21 feet. It seemed to him, however, that the upward movement of the mass had slightly subsided, and that it had at one time been very great.
This natural monument, according to Prof. Heilprin, must have been twice as high and at least four times as thick as the Washington Monument.

Just what caused the upward projection of this material cannot very well be explained. Prof. Heilprin suggests that the internal stresses of the earth have forced out molten lava, which cooled sufficiently to solidify when it emerged. The phenomenon was all the more remarkable because no lava whatever. was

dotble magazine linotype composing machine.
rear view of double magazine linotype composing machune.
connection with the body matter, without appreciable loss of time.
Within the present year a linotype of radically new design has been developed. This machine is provided with two magazines, each of which is adapted to carry a complete font of either single letter or double letter
cated composition, involving a combination of different sizes or styles of type, ordinarily known as "twoprice" matter, may be composed continuously and at approximately the speed of straight composition.

The matrices from the upper magazine are delivered, as usual, through vertical channels to the inclined as-
ejected in 1902. The account then published simply stated that ashes, rocks, steam, and gas had been vomited. It is not, however, impossible that there may have been a slight ejection of lava then, and that the present manifestation is simply proof that the disturbances have not reached low levels of lava.

ECCENTRICITIES OF THE STATIC DISCHARGE.

## by walton

In Fig. 1 is represented one of the fundamental experiments of Hertz. Two Ruhmkorff coils, $A$ and $D$, of different sizes, are so connected that their pri-


Fig. 1.
mary windings are in series with a single interrupter $C$ and a battery $E$. The secondary winding of the larger coil $A$ is provided with ordinary spark terminals $B$, while the secondary winding of the coil $D$ is connected with a spark micrometer $F$.
The instruments are so arranged that the spark terminals $B$ are visible from the position of the spark micrometer. A plate $G$, which may be of glass, mica, metal, or almost any substance available, is now placed in such position that it screens the spark terminals $B$ from the light of the spark micrometer, and the spark terminals $B$ are so adjusted that the sparks just miss fire, while the sparks of the micrometer are allowed


Fig. 2.
to play freely. If, now, the plate $G$ be removed, a vigorous and continuous torrent of sparks is set up between the terminals $B$. The spark discharge may be repeatedly stopped and started by inserting and withdrawing the plate $G$. Hertz attributed this phenomenon to the action of ultra-violet light radiating from the spark micrometer and falling upon the terminals $B$, the effect of the illumination being to increase the ease with which the sparks can leap. During the perfod when the spark terminals are thus freely illuminated by ultra violet light, no Hertzian waves are generated.
Other investigators have discovered that the cathode


Fig. 3.
terminal is the one chiefly affected by the light.
In Fig. 2 is shown a modification, by Elster and Geitel, of Hertz's experiment.- The spark terminals $A$ and $B$ are connected together, a cathode plate $C$ of polished zinc being: substituted for one of the knobs. At $D$ is a steady source of ultra-violet light, removable at will, and preferably consisting of a burning ribbon of magnesium. $E$ and $E$ represent the respective anode and cathode conductors of a Holtz static machine. A plate $F$ of mica, glass, or other material opaque to ultra-violet rays, is located between $A$ and $B$. When light from the source $D$ illuminates the zinc cathode $C$, all sparking at $B$ ceases, contrary to what might be expected in view of the experiment above described, and a continuous spark discharge is set up at $A$. This experiment is what Lodge calls " a curious inversion of Hertz's fundamental experiment." According to
this authority, the ultra-violet rays increase or de crease the leaping distance of the static dissharge accordingly as the normal difference of potential may be impulsive, as in a coil, or steady, as in a static machine.
In Fig. 3 is illustrated a modification, by the writer, of Hertz's experiment. A coil is provided with the usual knobs $A$, and with an interrupter. Two pieces $\boldsymbol{C} \boldsymbol{C}$ of thin bare wire are mounted upon the knob stems,


Fig. 4.
and bent into the conformity indicated. The adjust ment is such that sparks are normally just able to leap the gap between the terminals $A$, but that no sparks can pass between the points $C C$. The plate $D$ now being inserted between $A$ and $B$, not only does the spark discharge at $A$ cease, as might be expected from Hertz's experiment; but a continuous discharge is now abrupt ly set up between the points $\boldsymbol{C} \boldsymbol{C}$. Withdrawing the plate $D$ causes this discharge to disappear, and the discharge between the knobs $A A$ to reappear, so that, in effect the spark discharge may be shifted back and forth from one spark gap to another by merely inserting and withdrawing the plate. It will be noted that in this experiment there are two spark gaps parallel to each other, and that each gap is exposed to the other when the plate is removed and each is screened from the other when the plate is inserted. The direction and character of the potential of each gap are apparently the same as that of the other. Why, then, does the plate thus apparently affect the two spark gaps unequally?

In Fig. 4 is represented a very simple experiment which, so far as known to the writer, has hithert escaped observation, and in which the behavior of the spark is quite erratic. The coil shown is thrown into action so that the spark $B$ plies steadily between the knobs $A$, and a small spherical body $C$ of glass, rub ber, or other insulating material is placed in imme diate proximity to both knobs, but without, touching either. The spark bends outward at its middle and hugs closely against the surface of the insulating body partaking of its curvature, as indicated in the figure The spark may thus double or even triple its original length. Moreover, by doing this the spark deserts a beaten path in which the air is heated, rarefied, ionized and permeated with metallic vapor, all tending to increase its conductivity, and cleaves for itself a new path apparently offering a much higher resistance.

Sir William Crookes and Prof. James Dewar on Radium Emanations at Low Temperatures. Sir William Crookes and Prof. James Dewar have examined the action of extreme cold on radium emanations, and published the results of their work in the Royal Society Proceedings.
The first endeavor was to ascertain whether scintil lations produced by radium on a sensitive blende screen were affected by cold. A small screen of blende, with a morsel of radium salt close in front, was sealed in a glass tube. A lens was adjusted in place so that the scintillations could be seen. On dipping the whole into liquid air they grew fainter and soon stopped altogether." Some doubt was felt whether this might not have been caused, (1) by the presence of a liquid; (2) by the screen's losing its sensitiveness; and (3) by the radium's ceasing to emit heavy positive ions. To test this, two tubes were made, in one of which the radium could be cooled without the screen; while in the other the screen could be cooled while the radium salt was at the ordinary temperature. When the radium salt was cooled by liquid air, and the screen was at ordinary temperature, the scintillations were quite as vigorous as at the ordinary temperature, the screen and radium being in vacuo. With radium at the ordinary temperature and the screen cooled, in liquid air, it was observed that as the screen cooled the scintillations became fainter and at last could not be seen. On allowing the temperature to rise, the scintillations re-commenced.
The screen with a speck of radium salt in front of it was then sealed in a tube.
Water was put in the other end of the tube, and the tube sealed on the pump. A good exhaustion was kept up and the water boiled away, the vapor being con densed in phosphoric anhydride. The tube was sealed off when a few fine drops of water were still remain ing in the tube. The scintillations were well seen in this saturated aqueous vapor. The lower end of the tube was dipped in liquid air, which instantly con-
densed the aqueous vapor and left a very good vacuum. On now examining the scintillations, they were, if anything, brighter and more vigorous than at first. When liquid hydrogen cooling was used instead of liquid air the action was equally marked, showing that the highest vacuum that can be obtained by the action of cold does not diminish the scintillations.

In the upper part of the tube, away from the radium and screen, two platinum wires were sealed to show the state of the vacuum. The spark passed easily at the ordinary temperature, showing a reddish line of aqueous vapor. When the other end of the tube was in liquid air the spark refused to pass.
It was thought that perhaps the passage of the induction spark might have liberated some occluded hydrogen, so another tube similar to the foregoing was made without the platinum wires. Here also immersion in liquid air, if it had any effect, brightened the scintillations, and on replacing the liquid and cooling by liquid hydrogen no change was observable.
In order to test the activity of radium in rendering air electrically conductive, some radium bromide was sealed up in a glass tube and heated to the highest temperature the glass would stand, during the production of as high a vacuum as the mercurial pump would give. The whole tube was then immersed in liquid hydrogen contained in a vacuum vessel. On bringing the radium in such a vessel into a room in which a charged electroscope was placed, it began to leak when the tube of radium surrounded with liquid hydrogen was some 3 feet away, and was very rapid in its action when a foot away from the electrometer. On immersing the tube containing the liquid hydrogen with submerged radium in another large vessel of liquid air and bringing the combination near the electroscope, the action was the same.
The luminosity of the radium salt in liquid hydrogen was much more marked with the pure compound than had been formerly observed with the diluted mixtures containing large quantities of barium salts.
Prof. Rutherford and Mr. Soddy made the important discovery that a considerable emanation is diffused into gases from solutions of radium salts, which emanation is capable of condensation from the gas mixture at the temperature of liquid air. As it was important to ascertain what was taking place in this respect with the anhydrous radium bromide when isolated in the highest vacuum, an interesting experiment was made.
A glass apparatus was used, consisting of a fine capillary tube, drawn out some 5 or 6 inches in length from an inverted U-tube, the two legs of which were each about 6 inches long, one leg terminating in a bulb. This latter leg was filled with hard-pressed purified asbestos. The radium salt was located in the bottom of the bulb. The whole, after being most carefully heated and exhausted to the limit of the mercurial pump, was sealed off. In the dark, no traces of phosphorescence could be seen in any part of the apparatus, unless from the pieces of radium bromide.
The fine capillary tube was now immersed in liquid air in a large glass, so that distillation might proceed undisturbed for days. After twenty-four hours of this operation, the capillary tube while still covered with liquid air, was examined. A marked phosphorescence was recognizable owing to some condensed emanation. The luminosity became naturally more marked the longer the action was allowed to proceed.

## Extermination of Worms and Snails by Electricity.

 by hugo halberger.It was largely through an incidental observation that I was led to carry out a series of experiments for the purpose of ridding soils of worms, snails, and like creatures. I conceived the idea of drying by means of electricity a mold which had been constructed directly on the soil. Shortly after turning on the current, I noticed that worms were hurriedly struggling out of a neighboring bed. In crawling from one clod to another they writhed as if in pain. It seemed to me that the effect observed could have been produced only by the electric current. Indeed, the worms seemed to be immensely relieved and to return to their normal condition when the current was interrupted.
After this first observation I carried out a number of experiments. One terminal of an electrical circuit of 110 volts war thrust into the earth, the terminal being compriséd of brass rods. The effect produced was even greater than that which I first studied. Within a radius of two meters the worms and snails emerged from the earth and crawled out of the influence of the electrical current. In this manner, by employing several brass rods, I succeeded in driving all the worms out of a bit of land.
The current used is of comparatively feeble strength. The voltage, however, must be correspondingly high. I believe that the remarkable effect of electricity on plants, which has been studied of late years rather narrowly, is to be attributed not so much to any beneficial influence on the plant itself, as to the extermination of the parasites that nest about the roots.
Munich, Germany.

## PROF. SIR WILLIAM CROORES, F.R.S.

Scientific men are very like paviors; they lay down stones for future generations to walk over, and wear out." Such is the prescient explanation of scientific esearch and pursuit of a new discovery, expressed by Prof. Sir William Crookes, F.R.S., the eminent British chemist. Science, although it possesses a bewitching glamor to its disciple, is yet a lonely occupation. Great ideas and possibilities of the hitherto unknown, awn upon the mind of the chemist, only to be followed by years of patient investigation, ceaseless experiments, and repeated failures. When an epoch-making discovery bursts upon the world, not an evanescent thought is bestowed upon the years of protracted labor and intricate calculations that such a discovery has ntailed. Sir William Crookes can relate many such xperiences. When he discovered the new element thallium, he promptly set to work among other numerus experiments to ascertain its atomic weight-203.642 The figures were worked out as far as the first decimal point with comparative ease, but to determine the secnd decimal figure involved no less than two years of patient labor
Sir William Crookes is a born scientist. He played with chemistry in his infancy, practised it during his youth-much to the discomfiture of his parents, whose goods and chattels suffered from the effects of his ex-periments-and has developed it ever since. He is now in his seventy-first year, having been born in 1832. At sixteen years of age he entered the Royal College of Chemistry as a pupil of the famous Dr. Hoffmann, and acquitted himself with such distinction that two years later he was appointed Hoffmann's assistant. In 1854 he obtained the much-coveted post of Superintendent of the Royal Meteorological Department of the Radcliffe College of Oxford, which post he subsequently relinquished in order to devote his entire energies to the pursuit of chemistry.
Although his work has been rigorously scientific, Sir William Crookes is gifted with a poetic imagination that has often enabled him to set forth tellingly in his papers the results he has attained. Once he has embarked upon a project, he knows no turning back. "To stop short in any research that bids fair to widen the gates of knowledge, to recoil from fear of difficulty or adverse. criticism is," he considers, "to bring reproach upon science." He goes straight on, feeling his way with the utmost caution, exploring up and down, right and left, inch by inch, following his reason wheresoever it may lead him, even although occasionally it may prove a veritable will o' the wisp. It was this dogged perseverance which resulted in his discovery of thallium and its remarkable properties. The experiments with this new element were continued for a period of about eleven years, from 1862 to 1873, and throughout the whole of this time the study of the occurrence, distribution, and reaction of this substance was his paramount work.
Prof. Crookes's discovery of thallium, like Dr. Roent en's discovery of the X-rays, was to a very great ex tent the result of an accident. He was engaged in the examination, by the spectroscope, of the residue which results from the manufacture of sulphuric acid, when his attention was attracted by a bright emerald-green line which asserted itself. This line had never been noticed before, and he consequently followed up its appearance, with the result that he succeeded in isolating a new metal which he called thallium. The first piece of this new element was placed on view at the Great Exhibition in London of 1861, and commanded universal attention. During the next eight years he carried out minute investigations of the many properties of this substance. It was in the course of his experiments to determine its atomic weight, during which, in order to obtain accuracy, he weighed it in vacuum, that he discovered that even under these conditions the balance behaved in a most irregular maniner. The metal appeared to be heavier when cold than when in a heated condition, and this phenomenon he explained as an "expulsion from radiation." He showed that in a vessel from which the air has been extracted, a body has a tendency to repel itself from another body which has a greater heat than itself. It was this observation of the anomalous behavior of thallium that led to his invention of the radiometer, which by the way he regarded as an apparatus for the direct transformation of light into heat, but which was subsequently perceived to be dependent upon thermal action.
He next devoted his attention to the discharges of electricity through highly rarefied gases, and to the development of the theory he had formed in the course of his previous experiments with thallium, of the exist ence of a "fourth state of matter."
The name of Crookes will forever be associated with his remarkable discoveries in connection with radian matter and his evolution of the Genesis of Elements. The results of his researches in highly rarefied tubes caused him to assume the existence of matter in ultragaseous form, to which he applied the term of radiant gaseous form, to which he applied the term of radiant
phorescence, trajectory shadows, mechanical action, magnetization, and intense heat, possessed by matter in ultra-gaseous state. It was a remarkable discovery that stormed the scientific world, for it was of enor mous range, as the discoverer conclusively proved by demonstrating that while some radiant matter was as stable as a chair other forms were of the character of radiant energy. It was the fringe where matter and force appeared to merge into each other.

At first Prof. Crookes's thesis was regarded with skepticism by the scientific world, until the elaborat and numerous experiments of the discoverer proved unassailably convincing in the natural progress of events. But the times have changed, and we have changed with them since Crookes's discovery was first announced. What he originally termed radiant matter has developed into electrons-the separate units of elec tricity; which is as atomic as matter. Dr. Johnstone Stoney by his discovery of electrons not only estab lished Prof. Crookes's earlier discovery, but success fully elucidated many problems which had previously defied solution, for a chemical ion consists of a mate rial nucleus or atom of matter, which constitutes the greater part of the mass, and a few electrons or atoms of electricity. He demonstrated that all liberated elec trons do not pass off in the form of gas, but act more in the form of a mist, are mobile, and are carried to and fro in currents of air, finally settling on the walls of the settling vessel if left undisturbed.
The mass of an electron, according to J. J. Thomson, is calculated at $1 / 700$ part of a hydrogen atom, and as these masses start from the negative pole in a vacuum tube with a velocity of about one-half of that of light, naturally their heating, phosphorescent, and mechanical power is tremendous.

The course of time has proved that Prof. Crookes's thesis of 1879 was no wild chimera of the laboratory, but an indisputable fact which opened up a fresh un trodden field in scientific investigation. The existence of matter in an ultra-gaseous state, the existence of material particles smaller than atoms, the existence of electrons, the emanations from uranium, and the dissoeiation of the elements have now all been proved to be one homogeneous theory, by the remarkable discovery of radium and the experiments with this new element by M. and Mme; Curie, so that what was twenty-five years ago regarded as Prof. Crookes's dream, has at last been realized.
With regard to Prof. Crookes's researches concerning the Genesis of Elements, it is difficult to estimate ade quately the value of his investigations in this direction to science. It was in 1883 that he commenced opera tions in his work which was attended with such mo mentous success. It was a laborious task, this inquiry of the nature and construction of the rarer earths, but by dint of repeated chemical fractionations he suc ceeded in dividing yttrium into distinct portions, which yielded different spectra when exposed in a high va cuum to the spark from an induction coil. 'At first these phenomena were regarded as due to the removal of impurities in the metal, but Prof. Crookes conclu sively established his' claim that they were the result of the actual splitting up of the molecule of yttrium into its fundamental constituents, and he provisional ly concluded that the so-called simple bodies are in reality compound molecules. This discovery led him to advance the supposition that all the elements are de rived by a process of "evolution from the primordia matter or "protyle" as he called it.
In his presidential address to the British Association in 1898 he announced the discovery of yet another member of the rarer earths-monium or victorium The spectroscopic examination of this showed the spec trum crossed by an isolated group of lines high up in the ultra-violet end, and the existence of which could be detected only upon the photographic sensitive nega tive.

The investigations of this eminent scientist have not been confined to a selected few of the many fields of chemical research, but to all its ramifications, with the result that he has bestowed incalculable benefits upon various manufactures. He discovered the sodium amalgamation process of separating gold and silver from their respective ores; he carried out numerous experiments with M. Moissan's method of the manufacture of diamonds, by which our very limited knowledge of the nature of this substance has been considerably extended; he is deeply interested in dyeing and calico printing, the manufacture of beet sugar, and the derivatives of anthracene, while he is one of the greatest authorities on sewage and artificial fertilizers. In 1871 he accompanied the scientific expedition to Oran; and in 1866, when the cattle plague caused such widespread alarm in Great Britain, he was appointed by the English government to report upon the application of disinfectants for arresting the scourge. Perhaps his most famous invention familiar to the lay mind is the Crookes tube, by means of which Prof. Roentgen was able to make his famous discovery of the phenomena of the X-rays.

Owing to his immense knowledge, he is naturally associated with the leading learned and scientific so-
ieties of Great Britain, the presidential chair of many of which he has occupied at one time or another. He as also made many valuable contributions to scientific literature. His best-known publications comprise: "Select Methods in Chemical Analysis;" "Manufacture of Beet-root Sugar in England;" "Handbook of Dyeing and Calico Printing;" "Dyeing and Tissue Printing;" "The Profitable Disposal of Sewage;" and "The Wheat Problem." In 1859 he founded the Chemical News, and in 1864 he became editor of the Quarterly Journal of Science.
He has received many distinguished awards in recognition of his many valuable contributions to science. In 1880 he received from the French Académie des Sciences their gold medal and a purse of 3,000 francs; in 1885 the Davy medal of the Royal Society of Great Britain was bestowed upon him. He is a Royal medalist, and his crowning recognition came in 1897, when e was knighted for his achievements by the late Queen Victoria
Prof. Crookes is also deeply interested in psychical research and its attendant phenomena, by which he is endeavoring to effect some conjunction between psychical and physical waves. Marconi has forcibly demontrated the presence and possibilities of ether waves, and this eminent chemist is attempting to establish the existence of brain waves. We hear a good deal about telepathy, by which one person can receive intelligence from another human being without speech. But what is a brain wave, or in more explicit words, what is thought? Prof. Crookes maintains that there are rays of perhaps $9,223,052,036,854,775,808$ pulsations per second, which are capable of penetrating the most dense mediums without suffering any diminution of intensity, and capable of passing through unrefracted and unrefiected light, finding a center in the brain in much the same manner in which sound vibrations are received.
In the course of his presidential address to the British Association in 1898, Prof. Crookes raised the alarming theory that in the near future the world would be faced with starvation, owing to the wheat supply being insufficient to meet the exigencies of the population. He drew attention to the small harvest of wheat at present received per acre of ground and the limited area of wheat-growing will. The present receipt per acre is 12.7 bushels, and he pointed out that it might $b e$ increased by means of a moderate dressing of chemical manure. "Starvation may be averted through the laboratory," he explained, and his solution of the difficulty was to draw upon the inexhaustible quantities of nitrogen present in the atmosphere, and render it practicable to utilize it for fertilization. The artificial production of nitrate is within view, and by its assistance it will be possible to obtain as much as thirty bushels of wheat per acre.
The charm of Prof. Crookes's character is his honest, frank, and simple manner. He believes in the truth, and is kindly and courteous to all those who approach him. Hîs laboratory is his haven, and therein he passes the greater part of his time among his retorts, spectrographs, test-tubes, and numerous other scientific appliances, and what he regards as much more important, his extensive library of works upon every conceivable branch of science.

## An Exposition of Child Life.

A curious international exposition is to be held All in the Imperial Palace of St. Petersburg. The undertaking is called "The Child's World." According to the Russian Consul-General at New York, there will be a complete picture of child life from birth to school days-nourishment, dress, instruction, physical and moral education, and in fact all the surroundings of the early years of life.
The exhibits have been divided into five sections, as follows: Section 1 on scientific teaching will show the aids in teaching children by means of manuals, books, maps, and pictures. It will also show exhibits of the establishments for child education in all parts of the world.
Section 2 will be devoted to that which pertains to the physical development of children. In this section will be considered the care of the new-born, hygiene before school age and of school children, nourishment, children's playgrounds, and the like.
The third section is the industrial one, where there will be exhibits in nursery surroundings, furniture, lighting, heating, ventilation, beds and bedding, and children's clothing. In this section will be shown also the toys and games of children all over the world.
Section 4 will be the art section, in which child life in pictures, by artists of all schools, will be shown in oil, water colors, pencil drawings, and all methods of eproductive art.
Section 5 is the historic-ethnographical section, where there will be illustrations of historical events from the lives of child heroes, discoveries and inventions made by children, works and compositions by oung artists and composers, and ethnological peculiarities in the lives of children of different nations.

MARCONI WIRELESS TELEGRAPH RELICS
Commercial wireless telegraphy may hardly be said as yet to have a history. Many years from now, however, when the story of its rise will be written, the historian will find it necessary to present no smal account of the first messages that were sent across the Atlantic, as well as of the practical uses to which wireless telegraphy was applied in the early days of its development. The story would not be complete without some account of the first wireless newspaper published on shipboard, and without reproductions of the first messages transmitted across the Atlantic waters
Not the least interesting of the records which will be carefully preserved for this future historian is a copy of the first newspaper ever published aboard ship, containing wireless news sent from shore. Through the courtesy of Messrs. Munroe \& Munroe, of New York, Mr. Marconi's representatives n this country, we are enabled to present a facsimile reproduction of this interesting

## THE TRANSATLANTIC TIMES.

FACSIMILE OF THE FIRST NEWSPAPER EVER PUBLISHED ABOARD SHIP CONTAINING WIRELESS NEWS FROM SHORE. MARCONI'S SIGNATURE AUTHENTICATES THE ORIGINAL.
THE TRANsatlantic TIMES

orifices holds in solution a large percentage of bicarbonate of soda, which solidifies as it spreads over the surrounding land, leaving the surface as white as though covered by snow. Few persons visit these springs, on account of their inaccessibility, but, with the extension of the railroad from San Francisco, the place will certainly become a popular resort. The water is ice cold, but those who venture to take a mud bath profess to find great relief from their maladies.
In the vicinity there are numberless mineral springs of great volume and potency. A remarkable fact relat ing to the mud springs is that every earthquake shock in the State, no matter how distant it may be, can be detected by action of the springs, for either the flow of water is in creased or the soil which surrounds them quakes. It is said also that at regular periods the water of the springs ebbs and rises like the tide.

It is said that work on the mono-rail high speed electric railway from Liverpool to Man chester will probably


THE MARCONI APPARATUS WITH WHICH THE NEWS FOR THE FIRST WIRELESS PAPER WAS RECEIVED.


THE HAND PRESS ON WHICH THE EIRST WIRELESS NEWSPAPER EVER ISSUED ON SHIPBOARD WAS PRINTED
sheet. The paper was published on board the "St. Paul" of the American Line, at sea, en route for England, on November 15, 1899. It bears Mr. Mar'coni's signature.
The apparatus used for the publication of this first of wireless newspapers involved no additional expense. Indeed, the newspaper may be said to have
been the logical outcome of wireless communication itself. News was received from shore by means of the regular working outfit of the vessel. It was set up in type, and then printed on the small hand-press with which every ship is provided for the printing of
menus. The first example of the possibility of transatlantic telegraphy without wires was afforded on the occasion when Marconi received, on board the "Philadelphia," messages up to 1,551 miles, and a test let ter up to 2009 miles. Marconi's record of that fact


## facsimile of marconi's original record of the first transatlantic messages received on board the "pHiladelphia."

is here presented in facsimile, and will constitute what will some day be still another relic of early wireless telegraphy
For Americans, the most important step in the development of wireless telegraphy was the transmis sion from Cape Cod of President Roosevelt's greet ings to Edward VII. That message, written in the President's own hand, has been carefully preserved. Mr. Marconi's transcript is h ere reproduced. Other wireless curios could be pictured, al most without number. Those that have been shown, however, may be considered of most historical value.

## The Mud Springs of

 Mendocino.The mud springs of Mendocino County, California, are located
be begun this summer. The trains on the new road are to run at the rate of 110 miles an hour, and are expected to reduce the time from Liverpool to Marchester from 40 minutes to 20 minutes.

$$
\begin{aligned}
& \text { thin Miguty hing 2dumad Brentr. } \\
& \text { Smann' }
\end{aligned}
$$ sixteen miles northeast of Westport on the coast They occupy a space of 25 acres at an altitude of 1,400 feet above the sea, and number thirty or forty, with vents ranging from three feet in diameter to three inches. The water which bubbles out of the

MR. MARCONI'S TRANSCRIPT OF THE MESSAGE SENT BY PRESIDENT ROOSEVELT TO KING EDWAKD VII.

## MOTOR BOAT RACES IN IRELAND FOR THE HARMSWORTH CUP.

by our special correspondent in ireland.
The first International Motor Boat Race for the Harmsworth cup took place in Queenstown Harbor on Saturday, July 11.
The trophy is offered by Mr. Alfred Harmsworth, proprietor of the London Daily Mail, for any type of motor boat not exceeding 40 feet over all, fitted with any form of power and with no limit as to the amount thereof; it is essential that the man who steers the boat shall be a member of a recognized club, just as in the contest for the Gordon Bennett cup.
The more important conditions imposed by Mr. Harmsworth are the following:

The cup shall be for internation al competition, and the trustees of the same shall be the Automobile Club of Great Britain and Ireland.

The cup sha'll be competed for annually under the racing rules for the time being of the Marine Motor Association of the United Kingdom.
There shall be not more than three vessels representing earh country.
Each competing vessel shall be constructed wholly and in every particular in the country which it represents.

No limitation shall be placed on the form or description of motive power, provided that the motive power is wholly mechanical.
Each vessel shall carry not less and not more than two hands, of whom the helmsman shall be a member of the competing club, and both hands shall be natives or naturalized subjects of the country which they represent. The entries were:

1. Mr. S. F. Edge's launch, 40 feet in length, driven by a 75 horse power, four-cylinder, Napier gasoline motor attached to a two-bladed propeller. The size of the cylinders of the motor used are $61 / 2$ inches bore by $71 / 2$ inches stroke; its normal speed is 800 R. P. M.; and jump spark ignition is employed.
2. Mr. F. Beadle's launch, 30 feet in length, constructed of cedar wood and driven by a 50 horse power, eight-cylinder, gasoline motor, with two twobladed propellers on the same shaft.
3. Mr. J. E. Thornycroft's launch, 30 feet long, driven by a 20 horse power, four-cylinder, Thornycroft gasoline motor connected to one 18 -inch three-bladed propeller.
The first winner was Mr. S. F. Edge's Napier racing launch, a photograph of which is here shown.
The course extended from the quarters of the Royal Cork Yacht Club, Queenstown, up the River Lee to Cork, a distance of $81 / 2$ miles. In the draw, Thornycroft's boat got a bye. Edge, who covered the distance in 24 min ., 44 the distance in 24 min., 44 sec., beat Beadle, who took 27 min., $44 \cdot 2-5 \mathrm{sec}$. Thornycroft was then pitted against Edge, the boats returning to Queenstown so as to travel to Cork over the same course Edge was an easy victor, beating Thornycroft by 5 min., $83-5$ sec. The winner's time was 26 min., 6 sec. A handicap race for the Yachtsman's cup (given by the proprietor of a yachting newspaper) of a yachting newspaper) trants being the same as in the previous race. Edge was scratch, Beadle had a handicap of 6 min ., 55 sec ., and Thornycroft 11 min., 50 sec. The last-named won in 33 min., 51 1-5 sec., Beadle's time being 33:12 3-5, and Edge's 27:9 1-5.
The 40 -foot Napier launch entered for the race


THE RIBBON FISH, OFTEN MISTAKEN FOR THE MYTHICAL "SEA SERPENT.
motor and separate thrust bearings. There is no deck to the craft, but merely a covering of canvas stretched tightly over the hull. She has a beam of 5 feet, molded depth of 2 feet, and an over-all length of 40 feet; her total displacement is $11 / 2$ tons.
H. Stassano has collected measurements of as many lines as possible which have been observed by various physicists, and compared them with Liveing and Dewar's measurements of the spectrum of the most volatile gases of the atmosphere. He has also done the same for the chromospheric and prominence spectra of the sun. He comes to the conclusion that the aurora consists of helium, hydrogen, neon, and argon. Many of Liveing's and Dewar's lines he selects are yet unassigned.

the napier launch of s. f. edge, esq.


THE FIRST RACE FOR THE HARMSWORTH CUP IN QUEENSTOWN HARBOR.
Mr. Edge's Boat Appears on the Left ; Mr. Beadle's on the Right.

## tHE RIBBON FISH AND THE SEA SERPENT.

 by charles f. Holder.One of the most interesting questions relating to the sea and its inhabitants, and appealing strongly to popular fancy, is that of the sea serpent, which, literally, will never down. Hardly a month passes but some strange creature is seen by the men who go down to the sea in ships; everything that is seen is reported as a sea serpent. It is inconceivable that these people are always mistaken, or that a large percentage are plain prevaricators, or that a still larger percentage are practical jokers. In a word, something is observed out of the common, reported as a "sea serpent." Some see a giant squid, fifty, perhaps seventy feet in length, darting along the surface, tail first, the latter out of water at times. I have seen a wounded squid, two feet in length, moving in this way, occasionally projecting its tail a few inches out of the water; its tentacles forming small "undulations" behind, and from a distance of thirty feet presenting a marvelous resemblance to a snake or serpent. A large squid could easily simulate a sea serpent. Some observers see lines of porpoises; others, whales in a line or seaweed, or birds, and the unskilled observer firmly believes he sees something strange and uncanny, which he assumes to be the sea serpent.

That there is a literal sea serpent is not believed by scientists, but that there may be some large and unknown, or uncaught fish, long, slender, and serpentlike, inhabiting the ocean, attaining a large size, is not beyond possibility. An animal that doubtless has figured as a sea serpent is shown in the accompanying photograph. Specimens sixty feet in length have been observed, and if this fish should attain a length of seventy or eighty feet and be seen rushing along at the surface, one could hardly picture a more remarkable "sea serpent." The subject of the illustration is an oar or ribbon fish (Regalicus), and was, possibly, the largest ever taken in American waters. It came inshore at Newport, on the Santa Catalina Channel. opposite the island of that name. An Indian was riding up the beach when he observed a large fish in the surf, and after considerable difficulty hauled out what he supposed to be a sea serpent high on the sands. Not being aware of the value of the specimen, he stripped off some of its beautiful "plumes," or dorsal fins. and carried them to the town. Crowds soon went. to the shore to see the monster, which was duly reported in the daily papers as thirty feet in length and weighing one thousand pounds. When the excitement had subsided, Mr. Horatio J. Forgy an attorney of Santa Aña, measured the strange fish. The length was found to be twenty-one feet; its weight was estimated at between five and six hundred pounds, but judging by the photograph, and an "angler's guess," three hundred pounds would seem ample, though the writer has no desire to trim the wonders of this remarkable fish. The creature was, fortunately, photographed by Mr. G. T. Peabody, and probably this is the only photograph extant of a large specimen of Regalicus. From this photograph the accompanying illustration was made. Unfortunately, no one present realized the importance to science of saving the fish. It is estimated that hundreds of persons saw the remains, and none rec. ognized it as a ribbon fish.

The ribbon-fish is one of the most beautiful and interesting of its kind, and up to this time was generally supposed to have been unknown in American waters. The writer has seen several dead specimens, and one live specimen at Santa Catalina Island, but all were very small. Doubtless such come inshore after storms in winter, though the specimens observed were found in summer. The large one taken at Newport came ashore in February after a severe storm, which strewed the beach with numbers of fish strange to the inhabitants, including several small ribbon-fishes.
The ribbon-fish is a deep-sea form. As it attains a large size, it doubtless has been seen and chronicled as a sea serpent. Its appearance is remarkable. The fish is literally like a ribbon. Those handled by the writer were beautiful diaphanous creatures, clear and jellylike. The color was silver, tinted with blue and splashed with black tigerlike stripes. The forehead is very high, and from the top of the head rise a series of dorsal spines, eight in number (Regalicus Russelli), a vivid coral in color, and when erect resemble pompons, or a red mane, giving the fish a most fantastic appearance. The fin continues the entire length of the body, and just below the pectoral fins extend two long rays which represent the ventral fins. The head is long and oblong; the teeth absent; the body ribbonlike, that is, flat, gradually tapering to the tail.

The history of this rare fish is extremely interest ing. While fairly well known in other localities, it was not reported in American waters until the writer observed the Santa Catalina specimens and wrote to Dr. G. Brown Goode regarding them several years ago; other finds have been so rare that it is believed that all are known. Goode and Bean say: "Within the past one hundred and fifty years individuals have visited the shores of Norway, Finmark, the Faroe Islands, Scotland, Ireland, England, France, Mediter ranean, Bermuda, the Cape of Good Hope, Hindostan, and New Zealand." Gunther reports forty-four, seen by naturalists, and doubtless others have been observed and not reported. The exact size to which Regalicus attains is not known, but specimens rang ing up to sixty feet in length have been examined and may be considered, so far as known, giants of the tribe. Goode and Bean, referring to a specimen twenty reet in length, state, "and it is more than probable that they grow much larger, and that many of the creatures popularly identified with the sea serpent are only large animals of this type." In 1860 an individ ual seventeen feet in length went ashore in Hungry Bay, Bermuda. The giant of the tribe is chronicled by Dr. Andrew Wilson, of the University of Glasgow who states that Lord Norbury engaged the smack "Sovereign," Capt. Baillie, of Hull, to trawl for him in the Frith of Forth, and among other fishes they one day hauled up an oar-fish, which when stretched upon the deck of the smack, which was of 40 -ton bur den, was larger than the vessel, or sixty feet in length; and some of the men stated that they had seen much larger specimens. Lord Norbury did not realize the value of the catch, and as it was an interference to the work, he ordered the men to throw it over. This fish at the surface, with its waving red plumes, would fully have realized the ideal "sea serpent."
The royal yacht "Astern" once reported having seen a remarkable sea monster near Sicily, which in all probability was a ribbon-fish. The writer has never doubted that some remarkably large animal had been observed in Massachusetts Bay after receiving the following letter from one of the most intelligent men in Essex County, and has thought this "sea serpent" a Regalicus approximating the one observed by Lord Norbury. The letter is as follows:
"Lynn, Mass., June 26, 1881.
"Mr. C. F. Holder:
Dear Sir: Yours of the 24 th instant came duly to hand, and, in reply to that part of it relating to the account given by myself of a strange fish, serpent, or some marine animal called a sea serpent, I have to say that I saw him in a pleasant, calm summer morning of August, 1819, from Long Beach, now Nahant.
"At this time he was about a quarter of a mile awáy; but the water was so smooth that I could plainly see his head and the motion of his body, but not distinctly enough to give a. good description of him. Later in the day I saw him again off 'Red Rock.' He then passed along one hundred feet from where I stood, with head about two feet out of the water, and his speed was about the ordinary of a common steamer. What I saw of his length was from fifty to sixty feet. It was very difficult to count the bunches, or humps (not fins), upon his back, as by the undulating motion they did not all appear at once. This accounts in part for the varied descriptions given of him by different parties. His appearance on the surface of the water was occasional, and but for a short time. The color of the skin was dark, differing but little from the water or the back of any common fish. This is the best description I can give of him from my own
observation. And I saw the monster just as truly, although not quite so clearly, as I ever saw anything.
"This matter has been treated by many as a hoax, fish story, or a seaside phenomenon, to bring trade and profit to the watering-places; but notwithstanding all this, there is no doubt in my mind that some kind of an uncommon and strange rover in the form of a snake or serpent, called an ichthyosaurus, piesiosaurus, or some other long-named marine animal, has been seen by hundreds of men and boys in our own, if not in other waters. And five persons besides myselfAmos Lawrence, Samuel Cabot, and James Prince, of Boston, Benjamin F. Newhall, of Saugus, and John Marston, of Swampscott-bore public testimony of Marston, of Swampscott-bore public
seeing him at the time. Yours truly,

> "Nathan D. Chase."

## A Forty-Thousand Volt Power Transmission.

 by emile guarini.The Oerlikon Construction Works, at Oerlikon, near Zurich, Switzerland, have recently received an order which commands attention as much on account of its importance as because of its special character. The order in question rests upon the utilization of the water power of the River Caffare and the transformation of that power into electric energy

The Caffare River rises in the Alps on the border between Italy and the Tyrol, and falls into the Chiese River. The installation is calculated to deliver a total of 15,000 horse power to turbines disposed in two generating stations.

The upper station, the building of which will be undertaken at some later period, will furnish 5,000 horse power, while the lower station, which is to be situated upon Italian territory, near the town of Bagolino, will be commenced within a few days. It is expected to deliver 10,000 , horse power. When the two stations are finished, they will work in parallel, and the tension at the terminals of the three-phase current generators will be 9,000 volts, with a frequency of 42. This tension will be raised by transformers to 40,000 volts for transmission over the main line. The current, at this high tension, will be carried to Brescia, about 25 miles distant, and there a part will be used to feed the reducing transformers, a part for electric lighting in the province of Brescia, and the rest will be sold to the large electro-chemical establishments there. At the lower hydro-electric station the estimated flow of water is about 876 gallons a second, which, with a fall of 833 feet, is calcualted to deliver 10,160 effective horse power at the turbines.
To lead this water to the penstocks it will be necessary to build a canal 14,760 feet long, which will pass through four tunnels, one of which will measure 7,544 feet in length.

Five groups or power units will be installed at the lower hydro-electric station, each having a capacity of 2,500 horse power. Each unit is to consist of a turbine, making 350 revolutions a minute and connected direct with a three-phase current dynamo. At a convenient spot in the main building, near the abovementioned units, will be installedotwo smaller turbines of 160 horse power, each making 600 revolutions a minute; their function will be to run the exciters, one each, to which they will be also directly connected. Since one exciter is sufficient to energize four of the power units, the plant will thus be provided with one large generator and one exciter as a reserve in case of accident.

Five transformers each will also be provided to raise the tension to 40,000 volts. At the point of consumption this current must again be reduced by five other transformers to a tension suitable for distribution.

This power plant is the more interesting since it is the first plant of the kind in Europe to make use of a tension of 40,000 volts as well as of transformers of a capacity exceeding 2,000 kilowatts.

## The Current Supplement.

The current Supplement, No. 1440, opens with an illustrated article by Emile Guarini on the power plant of the Metropolitan Street Railway of Paris. Dr. Franz Meyer reviews the history and commercial development of the Schroeder contact process of sulphuric acid manufacture. Of technical interest are articles on "An Unrecorded Propert" of Clay," "The Coloring of Metals," and "The Prestrvation of Wood." The English correspondent of the Scientific American describes the Hattersley automatic loom. In a very full and well-illustrated article, the magnetic observatories of the United States Coast and Geodetic Survey are excellently described. Prof. J. Reynolds Green discusses vegetable physiology. An article on impurities and purification of acetylene will probably be found of valae

The large fleet of United States sailing vessels which hitherto has been employed in the petroleum oil deep sea trade has recently almost completely been driven out of the field by the subsidiued French sailing craft.


## WIRE GRIP FOR LINEMEN

Our illustration shows a simple form of wire grip for the use of linemen in stringing electric wires. Provision is made, in connection with the grip, of a simple device for holding a length of wire while twisting its ends around the wire held in the grip. The grip comprises a fixed jaw $A$ and a movable jaw $B$. The jaw $B$ is movable at all times in parallelism with the fixed jaw by reason of its double pivotal connection therewith through the lever $B$ and the link $\boldsymbol{E}$. To the outer end of the lever $B$ are pivoted the links $F$ which extend to a bolt movable in a slot formed in the outer end of the fixed jaw. Secured to this bolt is a loop $H$ to which a draw-rope or strap may be attached. A spring $G$ arranged between the


## WIRE GRIP FOR LINEMEN.

links $F$, and engaging the upper end of the lever $D$, serves to normally close the jaws sufficiently tight to frictionally engage a wire which is held in the V shaped slots $K$. When, however, strain is put upon the device the jaws will be drawn tightly together through the medium of the lever and the links connecting with the loop $H$. On one side of the jaw $B$ is a keeper $C$ for the wire which is designed to have its end turned around a wire engaged by the jaws. In operation, the main wire is clamped between the jaws and then the wire which is to be twisted around the main wire is placed in the $L$-shaped keeper $C$, thereupon, with the ordinary tool, the end of the wire may be twisted around the main wire. The keeper $C$ will prevent the wire engaged therein from swinging outward. Our readers will recognize as commendable features of this device the extreme simplicity of its construction, the provision of the useful retainer for the wire which is to be twisted about the main wire, and the peculiar arrangement of the jaws, which, by reason of their parallel movement, present a gripping surface throughout their entire length. Mr. James C. Logue, of Haze Hill, Canada, is the inventor of this improved wire grip.

## a fOUNTAIN PAINTING apparatus.

The time consumed by a painter in dipping his brush into a paint bucket and removing any excess of paint taken up thereby is greater than might at first appear, and any device which would do away with this irk some detail would surprisingly increase the amount of work that a painter could accomplish in a given time. Such a device has been invented by Mr. John Grahn, of Stoughton, Wis., and an illustration of the apparatus is shown herewith. The apparatus comprises a reservoir for the paint, which is led to the brush through a flexible tube by air pressure. The air

a fountain painting apparatus.
pressure in the reservoir is attained by means of a hand pump at the side, as shown in section in our engraving. The pump connects with the bottom of the reservoir, and forces the air through the paint to an air space at the top. A vertical tube mounted outside of the reservoir connects at the top and at the bottom with the interior of the same. This tube is provided with two valves, and secured to a nipple between these valves is a flexible tube, which at its lower end connects with a fixed tube in the brush handle. A valve located at the base of the handle is provided with a thumb piece, which by means of a leaf spring is normally held in such position as to close the flxed tube. The lower end of the handle is formed with a threaded stem, onto which the brush proper is screwed. The stem is also provided with an internal thread adapted to receive a short tube to which is secured what is called the "distributer." The distributer consists of fan-shaped canvas web made double, and between the folds of which cords are placed. The webs are sewed together between the cords in such manner as to form channels through which the paint can freely flow to the bristles. The distributer is necessary only for use in connection with flat brushes. When brushes of the type known among painters as "dagger stripers" are used, the distributer may be dispensed with and the paint fed to the bristles through a small nipple threaded onto the stem of the handle. In use the painter can accurately control the flow of paint through the brush by depressing the thumb piece on the thumb handle. After the painting is done the lower valve of the reservoir is closed and the upper one opened to admit a flow of compressed air through the tube and brush, discharging all paint therefrom.

## A NOVEL PICTURE EXHIBITOR.

We illustrate herewith a toy picture exhibitor for which a patent has recently been procured by Mr .


## A NOVEL PICTURE EXHIBITOR

Ulysses L. Berger, of 1332 11th Street, N. W., Washington, D. C. The principal feature of the apparatus lies in the provision of simple means for producing the effect of a moving panorama. A brief description of the construction of this apparatus will enable one to readily understand the method of producing this effect. The picture exhibitor comprises a box provided with two partitions at one end, which are separated by a narrow space in which the transparency to be exhibited may be received. A tube extends from the inner partition lengthwise of the box, and projects through the opposite end. A shorter extension tube is adapted to slide within the main tube. An arm $B$, which projects through a slot in one side of the box, serves as a means for sliding the lens in the tube $A$, being connected to this lens by a pin extending through a slot in the tube. Lying above tube $A$, and hinged to a bracket at one side of the box, is a lever $C$, which is adapted to be operated by engagement with a pin $D$ on the arm $B$. The longer end of this lever projects through slots in the partitions referred to above, and rests against the picture when it is introduced into the box. Projecting from the side of the box at the point where the picture is introduced is a sliding support or guide, which affords a ready means for inserting the picture in position. Light is admitted to the transparency through coincident openings in the center of the partitions and the end wall of the box. In use the picture is first inserted and the extension tube drawn out, then the apparatus is held to the eye as shown in our illustration. Un sliding the lens back and forth in the tube the figures in the transparency will be correspondingly enlarged or diminished in size, giving the effect of an advancing or receding panorama. When the lens is moved. further back beyond the pivot of lever $\mathcal{C}$, the pin $D$ will engage the shorter arm of the lever,
swinging it about to the position shown in dotted lines. This causes the longer arm to move the transparency $E$ across the field of vision and out onto the sliding support at the side of the box. Thus the effect of a sidewise movement is added to the effects above mentioned.

VACUUM PUMP FOR BULBS OF ELECTRIC LAMPS.
A new form of vacuum pump for exhausting the air from the bulbs of incandescent electric lamps has been provided by the recent invention of Mr . Rudolph A . Steeb, of Roselle, N. J. The pump is provided with two cylinders, one of which is fixed and the other mounted to rotate. The revoluble section is shown at $A$ in our illustration. A piston rod runs through both cylinders, and is provided with two pistons, one in each cylinder; the pistons are normally held in forward position by means of a spiral spring in the fixed cylinder. The cylinder head $B$ of the revoluble section is secured to a shaft $C$, which is provided at its outer end with a hand wheel, by which the operator can turn the cylinder $A$. Connecting with the cylin$\operatorname{der} A$ at its forward end is a tube $D$, provided at its upper end with a funnel. A similar pipe $E$ leads from the cylinder in the

producing the vacuum in electric lamp bulbs. opposite direction, terminat-
ing in a coupling $F$. The coupling connects with the tube extending integrally from the bulb in which the vacuum is to be produced; the bulb is supported in holders adjustably secured to a rod mounted on the shaft $C$. In operation the hand wheel is turned to bring the parts in the position illustrated, then mercury is poured into the funnel, and passing into the cylinder through the pipe $D$, it thence forces its way through pipe $E$ into the electric lamp bulb. The air in the bulb slowly bubbles out during this operation, and after the bulb is completely filled, a valve on the pipe $D$ is closed. Then the hand wheel is given a half turn, reversing the positions of the funnel and the bulb, that is, bringing the bulb to the top. The motive agent is now admitted to the fixed cylinder through pipe $G$, which forces back the pistons, producing a vacuum in the cylinder $A$, and drawing the mercury out of the bulb. The valve on pipe $E$ is now closed, and the bulb sealed by melting and closing the tube extension thereon. A new bulb may then be placed into position, and the hand wheel is again operated to bring the bulb to its lowest position. The three-way valve on pipe $G$ is then turned to permit the escape of the motive fluid. This permits the pistons to move forward under action of the spiral spring, forcing the mercury into the new bulb, after which the operation is repeated as described above. A spring catch which engages the hand wheel serves to firmly hold the parts in their two positions.

## FREIGHT CAR WITH REMOVABLE ROOF.

The ordinary covered freight car-a huge closed box with a narrow door in the center of each side through which every piece of freighted merchandise must be twice handled-can hardly be said to have kept pace with modern requirements. In many cases articles which need protection from the weather have to be loaded onto flat or open cars, because they are too large to pass through the car doors or are too cumbersome to be carried therein; for, obviously, a crane or the like cannot be readily used in loading a covered car, and consequently the work must all be done manually. Another objectionable feature of the ordinary box car lies in the difficulty of completely filling the upper part of the car, and in subsequently unloading the car without dropping and injuring the merchandise. Aside from these, other difficulties will readily suggest themselves to all those acquainted with freight handling.

With this brief summary of present conditions in mind, we will more readily appreciate the advantages offered by the car with removable roof which is illustrated herewith. The car roof comprises a number of sections or doors, which meet at the center line of the car, and which at their outer edges are bolted to hinged brackets, mounted to slide on vertical guide rods at the side of the car. By this

In order to prevent rain and moisture from enter ing the car at the joints of the roof sections, the sections are provided with weather-strips and as an extra precaution the cross-beams on which they rest are channeled so as to catch the water and conduct it out of the car. The center longitudinal joints of the roof sections are protected by runways secured to the sections at one side and fitting over weather-strips on the meeting sections. A simple locking-device holds the roof sections firmly together. The device may be unlocked by the manipulation of a lever at the end of the car. A patent for this improved type of freight car has recently been obtained by Mr. H. Addison Johnston, of Ingersoll, Canada.

Dr. George Cohen, an Allegheny inventor, has re cently announced the perfection of an invention on which he has been working for some time past, and which promises to overcome the defects of the railroad block system by means of electricity. A company was formed some time ago to develop his invention, and it has been agreed to increase the capital stock to three million dollars and put the device on the market after it has been thoroughly covered with patents. Dr. Cohen is about to sail for Europe with the object of securing these patents, and on his re turn the details of the invention will be made public. He has announced, however, that his perfected invention will protect a train from almost any character of accident. A broken rail, for instance, will be the means of throwing the system into operation, and a train moving along in the vicinity of the danger will be stopped automatically. This invention was demon strated some time ago in the presence of a number of railroad men, and at that time it was pronounced to be a remarkable device, but since then the doctor has spent a great deal of time in further improving it.

freight car with removable roof.

## Legal Notes.

What Constitutes Invention.-Joseph B. Mock ridge on March 14, 1893, was granted a patent for an invention, the purpose of which was to provide a new and improved means for securing railroads and shippers of merchandise against loss of freight, by pre venting the merchandise from being sent to wrong places, and keeping a record of the merchandise loaded into each railroad car, so that it could be easily traced, until it finally arrived at its proper destination. The invention consisted in means by which the shipping was controlled in such a manner as to prevent the merchandise from being loaded into the wrong car at the shipping station; and secondly in case it should happen that a package was wrongly loaded into car, then to detect at once the respective car int which it had been wrongly placed.
The means described in the specification may be briefly summarized as follows:

1. The cars upon which the merchandise is to be shipped are numbered, the numeral upon each car des ignating a destination
2. A shipping receipt is prepared at the shipping office, containing, besides the usual descriptive matter the number of the car into which the package is to be oaded and designating the package by a given number.
3. A check is prepared simultaneously with the shiping receipt, containing the number of the car and the numbers of the packages.
4. A removable box is placed upon the car for re eiving the checks of the merchandise loaded into it.
The validity of this patent came up for decision in the case of Hock vs. the N. Y. C. \& H. R. RR. The court said: "Whether the patent is to be regarded as one for an improvement in an art, or as one for a machine, we are of the opinion that it discloses noth ing of patentable novelty. It purports to disclose to the public, and especially to that part of the public engaged in shipping and transporting, an improved method of preventing and rectifying mistakes in the transaction of their business. Such improvements generally suggest themselves, as their nécessity becomes apparent, to the intelligent and enterprising men who usually conduct this kind of business, and it would be surprising indeed if the long and extensive experience of forwarders. and carriers had not dis closed so obvious a method as that which is disclosed. What the patentee seems to have done has been to provide evidence that a certain parcel or lot of merchandise has been deposited in a predetermined place, or, if it has not been deposited there, to denote at what other place it has been deposited. There are various ways of doing this, so familiar that the court can take judicial notice of them. One is by having the person with whom the parcel is deposited preserve a record of it, to be returned for examination to the sender. Another is by having a record kept by a tallyman. Another is by having the truckman or other person making delivery return a voucher from the receiver to the shipping clerk. A common instance is that adopted by express companies who provide their expressmen with a book in which, when the parcel is delivered at a store or house, the receiver signs his name. The patentee has provided a box in which the truckman is to deposit the voucher instead of return ing it to the shipping clerk, and has located it at the most convenient place, and where there is the least likelihood of his making the mistake of depositing the voucher in the wrong one. All this evidences good judgment upon the part of one who is experienced in the particular business, but it does not rise to the level of invention."

Construction of Patent Claims.-The Nash patent, No. 433,088 , covers a water meter with its chamber forming case made relatively strong, in combination with an inclosing head therefor made relatively weak, either by being made thinner throughout, or by having a weakening groove, to form a yielding part against interior pressure, the object being, as shown by the specification, to prevent injury to the other parts by freezing. This patent was made the basis of an in fringement suit. brought by the National Meter Com pany against the Neptune Meter Company (122 Fed Rep. 75).
In delivering the opinion of the court, District Judge Archibald stated that the idea of a weakened head or part to relieve from the strain of excessive interior pressure in an inclosed chamber was not new with Nash, but that he was the first to apply it to water meters and to obviate the danger in case of freezing. To this extent he was a pioneer. He was, therefore, entitled to the fruits of his inventive skill. The expanding power of water in freezing is substantially irresistible, and operates in its own peculiar way. It is not a fluid pressure, so as to have the strain transmitted from one point to another, but it is a
pressure exerted as the water turns to a solid. If freezing occurs in a meter chamber, something, by predetermined arrangement, must be prepared to give way, or the meter case will be rent asunder. Nash's fourteenth claim reads:
"The combination with a water meter having its chamber-forming case made relatively strong, of an inclosing-head therefor made relatively weak, whereby to form a yielding part against undue interior pressure."

The fifteenth claim reads:
"The case or inclosing head of a water meter case having a groove or surface recess to reduce the thickness of the inclosing-head over the measuring-chamber, substantially as described, and for the purpose stated."

The first of these claims is in very broad terms, and covers every case where the inclosing head is made relatively weak, by whatever device effected, and comes very near in this to an attempt to claim a result or idea, rather than the structural means by which it is produced or carried out, which latter is alone patentable. Neither is there any reference back to the specifications by the usual formula "substantially as described," or "for the purpose designated." Thus the ground is laid for the contention that the claim is not limited to provide against strain from freezing only, but from undue interior pressure of every character as well. The same was urged with respect to the fifteenth claim where the reference appears, but is equally unavailing as to both. Says the court: "The manifest purpose of endeavoring to broaden their scope in this way, so as to make them apply to all cases of excessive interior fluid pressure, such as water hammer or abnormal hydrostatic head, is to enlarge the art to which they are to be assigned, and so the easier to demolish them." But it seemed useless to the court to argue that either claim can be so separated from the connection in which it is found or extended to embrace a function not there specified. It is no doubt true that an element not stated in a claim cannot be brought forward from the specification and imported into it. But, said the court, that is by no means to say that the specifications which precede did not limit it, or that they are not to be resorted to as they always freely are, to explain it and give it character. It seemed to the court that the inventor, in the present instance, did not and could not claim what was thus sought to be thrust upon him. He was not seeking, in this feature of his invention, to provide against anything else but ice pressure, and while it may be desirable in all water meters to have a yielding part that will go down under stress of undue internal forces, he must abide by what he has described and claimed.
The defendants contended that a water meter is nothing more than a water motor, reference being made to a Scotch patent to show that they are interchangeable. "In structure and general mode of operation, this may be true, but for the purpose of this case it is not. A meter, however actuated, is not designed for exerting or transmitting power, but simply for measuring, registering fluid volume, and as a matter of applied art the two are essentially different. The manifest object of this opinion
is to draw the relied upon, or at least to establish a close analogy to that art." To the court this seemed not very material.

Analyzing the various points relied upon by the defendant, the court came to the conclusion that the claims of the patent must be sustained and that the defendant was chargeable with infringement.

Infringement of a Trade Mark Committed in a Foreign Country.-In the action brought by the Vacuum Oil Company vs. the Eagle Oil Company (122.Fed. Rep. 105), infringement of a trade mark and unfair competition were charged. The defendant filed a plea to the bill stating "that all such acts and deeds" complained of, "if performed or done at all,
wholly done or performed by it without the borders and boundaries of the United States, and wholly within the boundaries of some foreign nation." The plea further alleged that "legal proceedings had been introduced by the plaintiff to restrain the defendant from the consummation of the very acts and deeds performed in the German empire with regard to the word 'Vacuum,' which the plaintiff here again asks relief against and recovery in this suit." It was further stated in the plea that "the plaintiff had instituted legal proceedings in the kingdom of Denmark to restrain the use of the word 'Vacuum' on oil products." The complainant very properly objected to the plea on account of multifariousness, but the court overruled him, holding that all the facts stated tended to a s.ngl: "ssue.
The point, however, upon which the case hinged, was the general question whether the courts of the United States can decide the manner in which business in a foreign country should be conducted. If the complainant's contention be true that the court acquires jurisdiction whenever it can obtain jurisdic-
tion of the parties, it is immaterial whether the defendant, in cases of this character, be a citizen of the United States, an alien, or a mere sojourner here. The court decided that trade-mark rights acquired in the United States, whether by registration or by common law, afforded no protection against acts committed wholly in a foreign country.
To the lawyer who is at all familiar with equity practice the decision seems contrary to the long. established doctrine that equity acts in personam, and that it matters little where the subject-matter is situated, or the acts complained of were performed. Even before Lord Hardwicke's day, English Chancellors interfered to protect rights in property situated in other jurisdictions (witness the Penn vs. Lord Baltimore case), and sometimes even protected foreigners in their property rights, as in the case of the Emperor of Austria vs. Day and Kossuth, in which it was decided that Louis Kossuth should be restrained from printing in England banknotes which when circulated in Austria-Hungary would depreciate the value of the imperial currency. Why then should a court of equity not restrain a defendant residing within its jurisdic tion from committing acts without that jurisdiction, to the detriment of the complainant?

The Limit of a Man’s Right to Use His Own Name as a Trade Mark.-In the case of the Royal Baking Powder Company vs. Royal ( 122 Fed. Rep. 337), it appeared that the complainant company had for many years been making and selling a baking powder under the name of "Royal," by which name its product was called for by purchasers. The defendant, whose surname is Royal, commenced the manufacture and sale of a baking powder which he packed in cans similar in size and shape to complainant's, and having a label similar in color and general appearance, bearing his name in large letters. He also advertised his baking powder as the "New Royal." Having been enjoined from such advertising and from using the labels, he changed the color of the label from red to blue, on which was printed the name "Maxim Baking Powder;" but still having his name in prominent letters on the front of the cans. There was evidence that this bak ing powder had, in some cases, been sold as that of complainant's, and that retailers had given it to customers calling for Royal Baking Powder, without explaining that it was not the well-known product of the complainant company.
The court held that all the facts. showed a purpose on the part of the defendant so to use his name as to sell his product as that of complainant, and that while he would not be enjoined from using his name, he would be restrained from placing it on the front label of his cans.

A person has the right honestly to use his own name in connection with his business, even though he may thereby interfere with or injure the business of an other, but a court of equity will restrain him from intentionally so using it as to deceive the public-or enable others to do so-into buying his goods as those of another, and will require him, when entering a business in which another is engaged, and using the name, to use every means reasonably possible to dis tinguish his own business and goods from those of his competitor.

Laches in Infringement Suits.-In July, 1901, the Circuit Court for the Second District of New York sustained the first three claims of a patent which was made the subject of the suit of Timolat vs. Manning, and found them to be infringed by the device then be fcre the court. Subsequently, in November, 1901, suit was brought against another infringer upon a different device and a preliminary injunction was granted by the same Judge who heard the Manning case. Appeal was taken in that case. The case which recently came up before the Circuit Court of Appeals was the case of Timolat vs. Franklin Boiler Works Company (122 Fed. Rep. 69). The appellant in this suit con tended that some laches of the complainant should re quire a denial of injunctive relief. The defendant did not put his tool on the market until the spring or sum mer of 1899. Then a month or so thereafter complainant began litigation with the infringers, and have con tinued to litigate ever since. Circuit Judge Lacombe, who wrote the opinion, states that they were under no obligation to sue everyone at the same time.

The use of a different, but mechanically equivalent, method or material to construct some of the elements of a patented combination will not avoid infringement where the principle or mode of operation is adopted, and the elements, when constructed, perform the same functions by the same means as or by mechanically equivalent means to, those described in the patent.

The commercial success, of a complicated machine covered by a patent containing a large number of claims is not persuasive evidence, in itself, that a single element or part of the machine involves invention.

RECENTLY PATENTED INVENTIONS. Electrical Devices.
ELECTRIC ILLUMINATION FOR RAIL ROAD CARS.-M. Buttiner, Deutsch Wilmers dorf, Germany. The object of the improvement
is to provide certain new and useful improveis to provide certain new and useful improve-
ments in electric illumination of railroad-cars ments in electric illumination of railroad-cars
whereby the incandescent lamps burn uniformly at a predetermined candle-power irrespective of the varying speed of the train and
use of electromagnetic regulators.
ELECTRIC SIGNAL.-H. L. Lee, Timpas, Col. In this case the invention relates particu-
larly to electric signals for railways, designed arly to electric signals for railways, designed of a train, the object being to provide in con nection with the signal a circuit-closer of simple construction that may be readily attached to a railway-rail at any desired point remote
from the operator's station, and designed to be from the operator's station,
closed by a passing train.

## Engineering Improvements.

 SAND-DISCHARGING SPOUT.-A. M.Howery, Eastbank, W. Va. In this patent Howery, Eastbank, W. Va. In this patent
the invention relates to improvements in devices for sanding railway-rails, an object of
the invention being to provide a sand-discharge the invention being to provide a sand-discharge pout so constructed whole width of the rails either on curves on the whole wides.
or straight lines.
SAFETY-CATCH FOR ELEVATORS.-J Genisio, Duquoin, Ill. The present invention pertains to improvements in safety-catches for mining shafts; and the object is to provide a safety-catch of simple construction that will quickly and automatically operate to prevent the falling of the cage should the cable break.
EQUALIZING-DRAFT HOISTING-GEAR. EQUALIZING-DRAFT HOISTING-GEAR.-
J. G. DELANEY, New York, N. Y. Mr. DeJ. G. Delanky, New York, N. Y. Mr. De-
laney's invention relates to a hoisting-gear, and his object is more particularly to produce a the load substantially equal when the device is actuated in connection with a hoisting-bucket whether the bucket is loaded or empty.
CRANE.-A. P. Van Tuyl, Brooklyn, N. Y The object in view is to produce a self-support ing crane provided with a windlass or rope cles of moderate weights perpendicularly or a an incline-as, for example, out of or into a
well-hole, cellar, or stairway.

## wh-hole, cellar, or stairway.

NUT-LOCK Hardwar
a. One of the principal objects of this in Pa. One of the principal objects of this in
vention is to provide a device which shall be simple in construction, positive in operation durable, and at the same time capable of se-
curely retaining a nut against movement, thus curely retaining a nut against movement, thus
preventing the nut from "working off" or preventing the
adjustable wrench.-E. F. Hirst, Richmond, Ind. The object of this improvemen
is to provide details of construction for a is to provide details of construction for a adjustment for the movable jaw of the wrench, adapt the jaw for quick, convenient, and reli able adjustment toward or from the fixed jaw,
and provide means for reliably securing the movable jaw at a desired point.

## Household Uilities.

## folding bed.-A. W. Prle, Hopkinsville

 Ky. Mr. Pyle's invention relates to improve ments in beds of that class wherein a non cabinet; and the primary object in view is the provision of a portable structure which may be easily taken apart to facilitate storage andtransportation and which may be assembled transportation and which may be assembled
together for the several parts to occupy a solid together for the several pa
firm relation to each other.

Machines and Mechanical Devices. BRUSH DEVICE FOR CLEANING EOLT NG-CLOTH.-C. W. Mann, Greenville, S. C The purpose of the improvement is to pro-
vide a brush which is made to travel with a circular motion in engagement with the bolt ing-cloth, morement being imparted to the
brush through the gyratory movement of the brush through the gyratory movement of the
bolting machine. Means are provided whereby the brush will be made to take a course par allel with and at each side of a line drawn
horizontally through a portion of the center horizontally through a portion of the center frame, and means
moving backward.
HAT-FORMING MACHINE.-G. W. Cham berlain, Atlanta, Ga. This invention per-
tains to improvements in machines for forming shoddy or other felt hats, the object being to form them directly from a roll of material cut to the proper width instead of cutting
the material into squares, as is the usual practice, thus simplifying the operation, reducing the waste, and saving labor.
WORK-HOLDER FOR ENAMELING.-S. H. Frist, Chattanooga, Tenn. The improvemen
is in machines for holding work to which enamel is to be applied, such as washbowls sinks, bath-tubs, etc., an object being to pro-
vide a device for this purpose by means of vide a device for this purpose by means of
which the work while applying the enamel may be rotated axially and vertically or in two planes substantially at right angles to each
other, so that the enamel may be applied even
ly on all parts and much more easily and rap
idly than is possible by ordinary methods. PERMUTATION-PADLOCK.-T. A. DINSvention refers to improvements in locks, bein particularly applicable to padlocks, its object being to provide a lock which can be opened
without the use of a key, thus doing away without the use of a key, thus doing away
with the annoyance of having to supply se eral persons with a key and the consequen ability of loss of
WOOD-CARVING MACHINE.-A. W. H. Raettig, New London, Wis. This invention
relates to improvements in wood-carving marelates to improvements in wood-carving ma-
chines designed to be manipulated and guided by hand in a way to rapidly and accurately impart a desired shape to irregular pieces of ood of all kinds, such as crooked stair-rail an unlimitaings, straight work, and, in far The casing of this device is made in a form
and of such advantageous dimensions as to be nd of such advantageous dimensions as to be or. The machine can be used for offhand or
then carving work or worked to a drawing on exhibiting apparatus.-E. Bartheemy, 34 Rue Caitbout, Paris, France. This is particularly an improvement in a mechanism for producing the successive movement of sev-
eral screens in a perfectly safe mancer, thus preventing the order of their succession and the full accomplishment of their movements until they come, respectively, into their poin case of stoppage of the main motor.
BREECH MECHANISM.-J. B. Moore, ashington, $D$. C. The claim for an object,
mong others, in this case, is the provision of a mechanism in which the threads between the block and the breech of a gun will be uninter-
rupted and cylindrice. in general form and mulrupted and cylindrice. in general form and multiple, together with means for operating the
moving parts of the mechanism in adjusting moving parts of the mechanism in adjusting
the breech-block into and out of position for the breech-block into and out
closing the breech of the gun.
LUBRICATING-CUP.-J. M. Stapp, Alamo sordo, New Mex. The primary obje in in this improvement is the provision of a simple
and cheap contrivance for use on revolving or oscillating parts of machinery for revolving or of automatically feeding oil thereto when the
part is in motion, while the feed is effectively part is in motion, while the feed is effectively
cut off on the stoppage of the part, thus overcoming the waste of the lubricant.
MACHINE FOR COVERING LITHOGRAPH-ic-printing rollers.-C. Wagner, New York, N. Y. In this patent the improvement
relates to the manufacture of printing-rollers elates to the manufacture of printing-rollers
for lithographic-printing machines; and the object is to provide a new and improved machine filling in a very simple, or cover over the manner without requiring skilled labor.
CRUSHER.-T. E. Hurley, Butte, Mont. This invention is of that class which relates to and the like; and the purpose intended is the provision of a crusher with its pitman-bearings
of novel construction so arranged that friction of novel construction so arranged that friction
will be reduced to a minimum. be reduced to a minimum.
MEAT-CUTTER.-A. W. Johnson, New
runswick, N. J. This invention may be classi Brunswick, N. J. This invention may be classi-
fied as relating to cutters which employ a trough-shaped bed and a suitable type of cutter mechanism arranged to operate in a way to cut
thin slices from dried beef or other meat placed on a bed. The improvement overcomes the or held against displacement on the movement
on of the cutter, the improvement allowing the free or uninterrupted movement of the meat toward the cutter.

## of Interest to Farmers.

WIRE-Stretcher.-H. S. Workman, Basin, Wyoming. The wire-stretcher improvement has for an object, among others, to pro-
vide a construction which can be readily utilized for taking out the slack of wires tretched along posts, can be used in stretching wires in erecting a fence, and can be used in
taking out the slack at any point between posts. FERTILIZER-DISTRIBUTER AND SEED-DROPPER-S. S. Cudd, Kelton, S. C. The nvention in the present case is an improve
ment in fertilizer-distributers and seed-droppers and the inventor has for his object in view the rovision of a distributing and dropping macorn, peas, beans, and the like.
Grain-loader.-D. Barnes, Axtell, Kan. This device is equipped with means to cut off the discharge of grain from the vehicle should the team start to pull the vehicle away from
an elevator during the loading process, thus an elevator during the loading process, thus
saving the loss of grain. Means are also proaving the loss of grain. Means are also pro-
ided to regulate the quantity of grain flowing to the elevator, and provision is made for lifting the gate subsequent to the application of a part of the loading apparatus.
FOLDING-CRATE.-E. G. Solomon, Omaha, Neb. This crate or box may be folded into a ery compact form for convenience in shipping crate, which are hinged or joined to the base thereof in such manner that they may be folded orard upon the base, are provided with means or supporting the removable top of the crate crate is provided with stationary water the
food receptacles, so arranged that they shall i
no way interfere with the folding of the box. DEVICE FOR PREVENTING SIDE DRAFT marvesters.-G. A. Smith, Cottonwood, J . L. Phillips, Minneapolis, and J. P. Smith
Cotonwood, Minn. The object of the inventors is to relieve the "side draft"-that is, the tendency of the machine to draw sidewise whe pulled by horses, and so increase the work some part of the frame projects aterally for some part of the frame projects laterally for
ward, and it is this part which carries the operative mechanism. Pulling is done at a dis advantage on this account. Their idea is t quicken the speed of the part of the frame in question, by drawing the grain-wheel by means
of a train of gearing, while leaving the whee ree to overrun its connections.
FLY-TRAP.-F. J. Lampton, Weir City, Kan. In this patent the invention relates to mprovements in devices for removing flies or similar winged insects from cows or other ani mals and trapping them, an object being to pro-
vide a contrivance for this purpose that shall be simple and durable in construction and com be simple and durable
paratively inexpensive.

## Pertaining to Vehicles

CARRYING ATTACHMENT FOR BICY CLES.-L. Murdoch, Washington, D. C. Mr Murdoch's invention is an improved carrying brella, luggage, and baby-seat, or any of said devices from the frame of the bicycle; an the improvement consists in certain novel con structions and combination of parts that en able the devices to be conveniently applied t
and removed from the bicycle whenever d sired.

Railways and Their Accessories.
TICKET-CASE.-R. A. Edgar and W. W Tobey, Iola, Kan. These inventors have made an improvement in that class of ticket-cases in
which the tickets or cards are held flatwise which the tickets or cards are held flatwise
in a series or column and are pressed to the front by a spring-follower in rear of the col umn, and one ticket from the front of th plunger moving in the plane of the front column into reach of the ticket-seller.
RAILROAD-TRACK CONNECTION.-W. F Miller, Brooklyn, N. Y. Mr. Miller's inven tion relates to the construction of railwayproved rail-joint arranged to allow of joinin the rail ends without the use of bolts, separate fish-plates, and the like, and to prevent sagging ROADWAY AND VEHICLE FOR TRAVEL ING . Y. This inven granted to Mr. Hansler. The object is to pro vide a roadway for vehicles especially designed
for use by automobiles and other similar pow-er-propelled vehicles, and arranged to properly steer the vehicle without the aid of an opera-
tor in charge of the vehicle and to allow of safely running it at a high rate of speed.

## Miscellaneous

MAIL-DELIVERY BAG.-JANE F. Stroh
Pittston, Pa. The aim of this inventor is to produce a simple, compact, and strong con classes and wherein mail-matter of diferen be safely carried and arranged in such a way that access may be obtained without loss of
time to any desired class of mail or othe articles contained in the bag. Designed fo use by letter-carriers, it may be used by oth persons for other purpose
BRIDLE-BIT.-W. T. Temple, Trenton, N. The object of this new and improved de vice is to provide a riding or driving bit which may be used on such animals as have
tender mouths or the reverse and afford means for the control of the animal in case it be but thactious and is hard in the mouth hurting the mouth
CoAT-LINiNG.-M. Weber, Brooklyn, N. Y In the present invention the object is to pro integral shoulder improved coat-lining having smooth fitting of the outer garment materia without danger of creating undue ridges,
creases, or humps, as is so frequently the case creases, or humps, as is so frequently the case
when using the ordinary separate shoulderpads.
Game apparatus.-J. n. arriaga, Mex ico, Mexico. This game contemplates the use visions and a plurality of succeeding divis di arranged in order, the starting divisions bear ing symbols, which appear in contrasting colors and each subdivision having similar sym bols. With the chart is associated a number of dice having symbols in contrasting colors to those in the initial divisions, a number of
ordinary dice, and a number of chessmen which are placed in the initial divisions and moved into or through the subdivisions of the
GAME APPARATUS.-C. Koch and J Fischer, New York, N. Y. This structure em bodies a table having at one end a yieldiable buffer fashioned to produce a plurality of
carom-surfaces, and along both sides of the carom-surfaces, and along both sides of the
table are pockets which afford track-surfaces
or a rolling object. The pockets are in two series, reversely inclined to each other and converging toward the buffer, and at the mouth of each pocket is a deflector. At one end is a rail having pockets. In front of this or placing the rolling object, the latter to be propelled by a cue
ADJUSTABLE REGULATOR FOR PIC-GURE-FRAMES--F. C. BROWN and W. E. Chenery, Framingham, Mass. The improvement of these inventors relates to an adjust--that is to say to mechanism for the line -that is to say, to mechanism for adjusting the display of pictures and for analogous purposes. The device is simple, cheap, and easily andled.
Chimney-cowl.-F. W.. Stein, Jersey ity, N. J. The object in view in this case is th provide a cowl which will insure an effective y providing a cowl with means forming an air-duct leading upward from the back of the cowl, over the top thereof, thus causing the gases or smoke to be drawn upward through
the flue and out of the cowl with the beforehe flue and out of the cowl with the before mentioned current of
Game-board.-H. Frank, New York, N. Y. This game-board is particularly adapted for the mechanical playing of the game of base-ball, and the object is the provision of a board so ate the various plays, that may be recorded in the usual manner, thus making the game interesting, and in the playing of it considerable skill may be acquired.
COMBINED BROOM-HEAD HOLDER AND ShAPER.-T. McE. Gill, Mexico, Mo. In the present case the invention relates to an igned to be attached to a wall or other loality, and has for its aim the provision of a head and at the same time restore and preserve head and at the same time res
STRAP GRIP OR BUCKLE.-J. H. WALace, The Brake, Fife, Scotland. A former mproved strap grip or buckle for use in snaffling or hobbling horses and for connecting the nds of straps for any other purpose. His resent invention is embodied in an improved form of grip or buckle adapted to secure a
strap by its automatic action, a tongue such strap by its automatic action, a tongue such
as is usually employed in buckles being dis-

FASTENING FOR SHOLS, Pas hen and J. Duckro, Tampa, Fla. The inlass of shee fasteners in which butt in that r lacings usually employed are dispensed with, More particularly the invention is an improvement in that class of fastening in which a slidable member engages opposite guides secured to opposite edges of the slot in the shoe-upper.
PENCIL-HOLDING CASE.-A. G. Blincoe, Bardstown, Ky. By means of this invention a pencil can be carried in the pocket with perfect safety without any danger of the point by the case can be adjusted to suit the length the pencil, and the lower end of the case is slips through the springs at the pencil slips through the springs at top it may be
pushed up by pushing the lower section up so it can be taken hold of by the upper end.
HAIR-BRUSH.-D. M. Newbro and E. E. Gallogly, Detroit, Mich. In carrying out their in view as an object the provision of a brush which will possess certain sanitary features and advantages. The article provided performs the functions of the ordinary bristle brush, the brush being manufactured only of such substances as are non-absorbent and capable of apid and effective sterilization.
ROPE-CLAMP.-A. A. Newell, Mellette, . D. The object claimed by this inventor is provide details of construction for a clamp wich adapt the clamp for the support of mato a whe the clamp is the clamp also to enable the convenient change in posiion of enable the conange in posiconnection of the clamp with a ring on a chain or an equivalent fixture on a rope whereon the lamp is mounted.
hOOF-PAD.-J. CAMpbell, New York, N. Y. In this patent the invention relates to pads ore particularly to pads of the cushions, and with particularly to pads of the type employed ect is to provide a pad of the type indicated hich will tend to expand the hoof and will eld in a downward direction to the pressure the frog as the latter grows. A further ob-
ect is to combine with solid heel portions a neumatic front portion and provide an arrangement for renewing the air in the hollow of the

DEVICE FOR FASTENING METAL, ETC., O STONE.- T. P. Hicks, New York, N. Y. Mr. Hicks in his invention provides a novel stone means whereby it may be securacket $r$ other suitable device for attaching to the or oth
stone
metal.

FAUCET.-W. T. Nichols, Hempstead, N. Y. he object in view in this invention is to pro-
in operation, and arranged to prevent leakage
as the valve proper is held to tits seat by the pressuresupply and opens agatinst the latter when manuality actuated.

## Designs.

design fir a whisk-broom holder. M. A. Skall, New York, N. Y. In the pres ent case the ornamental design relates to a
whisk-broom holder. The upper part of the whisk-broom holder. The upper part of the lower part
DESIGN FOR COFFEE-POT OR SIMILAR C. This design is for a coffee-pot or the D C. This design is for a coffee-pot or the like narrowing toward its upper and lower ends, the spout and the handle being correspond body near the lower end thereof and extending
upward alongside of and conforming to the upward alongside of and conforming to the
curvature of the body to a point near the upper end of the spout where the latter is urved outwardly.
Nore.-Copies of any of these patents will be furnished by Munn \& Co. for ten cents each. Please state the name of the patention. and date of this paper.

Business and Personal Wants.
READ THIS COLUNN CARRFULYF-YOM


Marine Iron Works. Chicago. Catalogue free.
Inquiry No. 4441.-For manufacturers of
In quiry No. 4441.-For manufacturers
sutue cuter.
AUTO. - Duryea Power Co., Reading, Pa.
Inquiry No. 4442.-For makers of wind mills.
 Pot. Wiry Nor 444.- For the
Howers and exh. Indanapolis. Samples free.
Inquiry No. 4445.-For makers of steam motor
cars.
Mechanics' Tools and materials. Net prioe catalogue.
Geo. S. Comstock, Mechanicsburg, Pa.

Sarmilil machinery and outhts manuf
Lanemig. Co.. Box 13 , Montpelier, Vt.
Inoquiry Mo. 4447;- For all gorts of flectric ayna-

Inanuurity. No. 4448.-For makers of foot power
Leet me sell sour patent. I have buyers waiting. Inquiry you duti-For,


 Clevelana, 0 .
Inturiar mo. 4451.-For a meehine for labelling
The largest manufacururer in the worl or merry-po-


 Ehnine comany. Foot of Fast 13sth Street New York. ${ }^{2}$ Ineatiry No.
 ing chin No.

 ohninues. Matthews Torpedo Launebes. Matthews \& Co., Bas-
com, Ohio, U.S. A. Builders of high grade power boats

 same un ouputabie bae.
gumguriv No. thas.-For machinery forrolling out
Manufacturers of patent articles, dies, metal stamp-
ing, screw machine work, hardware specialties, machin ery and tools. Quadriga Ma
South Camal Street, Chicago.
WANTED.-Philadelphia selling agency for leading
manufacturer. Buitding materials preferred.

## Philadelphia, Pa.

WANTED.-Patent Offle draughtsmen; only thor-
oughly oiperienced men need apply. Must, show spe-
cimens of patent drawings. Munn \& Co., Scientific
AMERICAN office, 36I Broadway, New York,
Send for new and complete catalogue or Scientific

##  Notes and Queries.

hints to correspondents.

 References to former articles or answers should give
date of paper and page or number of questivn.
Iniries not answered in reasonable time should be
repeated; correspondents will bear in mind that ome answers require not a little research, and,
though we endeavor to reppy to all either by
letter or in this department, each must take
his turn.
Buyis twinn
tised inhing to purchase any article not adver-
addresses of oumns will be furnished with
with the same.
Special Written Information on matters of personal
rather than general interest cannot be expected
 price. sent for examination should be distinctly
marked or labeled.
(9110) T. W. A. asks: 1. A railroad train going at a rate of over 60 miles per hour rounds a sharp curve. Will the train if it ward, or does the raising of the outside rail overcome this tendency and make it likely to
fall inward? Grant the following: If the fall inward? Grant the following: If the
track were level, the train would fall outward, ow if the outsiei ran is ralsed, win it fan curse at a high speed cannot under any supos the track. is made such as to overcome the tendency to overturn to the outward side of the track, and
the train goes round the curve as if on a level, when it moves at the speed for which the vation of the outer rail was calculated. the velocity of the train very much exceeds the
velocity for which the outer rail has been elevated, the train would leave the track on the outer side of the curve. The tracks for bicycle racing are made very steep at the turns in order to enable riders to go round the turns
at full speed, and when rounding a turn the rider feels in equilibrium while leaning far in toward the center. To him he is as if riding on a level. The centrifugal force is neutral What nationality was the captain of the Columbia" in the last cup races? A. Capt races. He was born in England.
(9111) A. H. S. asks: How much more sunshine is there at the equator than at the north pole during the yoar or the North Pole We have a great argument over this question. A school teacher and others contend that the
sun shone longer at the North Pole than at the quator, and I thought cided to leave it to your good judgment. At the equator the sun rises and sets at six
the entire year. All days are twelve hours the entire year. All days are twelve hours egarding the effects of refraction and cloudy weather, the sun is above the horizon at any equal parts of twelve hours each. At either pole the sun is above the horizon for six months and below it for six months of the year.
There is but one day of six months' duration There is but one day of six months' duration
and one night of the same length in a year. and one night of the same will see from this that there is the same duration of sunshine at the poles as at the thator. The same is true for any place on
the earth. Add the length of sunshine for all the days in a year in our latitude, and the sun is at the pole, and it is six months long.
(9112) E. R. says: Would you please blige me by answering a few questions con 1210, under the heading "How to Make a Sewing Machine Motor Without Castings," by Ceci Poole, for about $\$ 5$, with the labor? The
wire alone cost me $\$ 6.66-3$ pounds of No. 21 Wire on each field coil, 27 layers deep, and 66
turns wide. Why must the field have so many ampere turns? Would this motor work as generator with an adjustable rocker arm
Would it light nearly two 110 volt Would it light nearly two 110 -volt lamps? A
If you build the motor according to the last paragraph of the description on page 19394 and connect it in shunt, you will probably be able to light two 16 -candle 110 -volt lamps with it as a dynamo. As to the figure of cost given
by Mr. Poole ( $\$ 5$ ), while this was true in 1899 it can hardly be expected to remain true in definitely. Prices of material are very much higher now than they were then.
(9113) G. T. asks: How to remove gases of combustion and decomposition from
small room. Passing the air through a liquid would not be objectionable. A. To purify air remove the solid particles by passing the air
through cotton; the moisture and ammonia and germs, by passing through sulphuric acid the sulphur, by passing through a solution of
lead acetate. Pass now through calcium chloride or soda lime to remove last traces and argon remain.
(9114) F. C. F. asks: 1. What is the
the high lights will be clear glass and th print by contact, and have used for developin hydroquinone, metol-hydroquinone and pyro, and an acid fixing bath, yet there always is a mode in which lantern slides can be produced with no development in the sky and high lights is to have a negative which is opaque in the
high lights. 2. Can you give a simple method high lights. 2. Can you give a simple method
by which an amateur could color lantern slide by which an amateur could color lanes requires
trans a. To color slides rent artistic sense and knowledge of the mixing and applying of color. We think that is all that is the chapter on coloring slides in Hopkins' "Experimental Science." This book also gives instructions for making slides as well as cam-
eras, and an exhaustless amount of scientific eras, and an exhaustless amount of scientific
experimenting. 3. Why is it that water when experimenting. 3. Why is it that water when
flowing through a funnel or into a small outlet always whirls, producing a depression or an
opening over the outlet? Why is the whirling opening over the outlet? Why is the whirling
always counter-clockwise? A. There is probably something in the shape of the outlet of funnel or wash basin which determines the
course of the liquid as it runs out. A loss of equilibrium is soon seen, and the water whirls. Centrifugal force is produced, causing the op ening into the pipe below. We would try to explain why the whirling is always counter clockwise if it were so. We have just tried a
wash basin, and found the motion always clockwise when left to itself. By a motion of the hand it could be made in either direction mines the matter.
(9115) A. M. says: 1. In answer to query 8996 in the issue for May 9 , you clearly explain the working of a radiometer. Pleas air as in a vacuum. A. The radiometer only works at a particular degree of vacuum. Too
little gas in the tube and there is not little gas in the tube, and there is not enough energy to the radiation to rotate the disks
too much gas, and there is too much resistance to the motion for the feeble energy of radia tion to start the disk. 2. Why will a single phase alternating electric current not start direct-current motor, if the relative polarity
of field and armature be the same, of field and armature be the same, whateve
be the current phase? A. An alternating cur rent will only run a direct-current motor when the alternations exactly coincide with the change of the brushes from one segment of the commutator to the next. This is the case when the speed of the armature is in step with the alternations. For this reason the motor must
first be brought up to speed by some outside motor and the current then switched on. 3. Will the precession of the equinoxes put the
seasons, after a time, in different months, for seasons, after a time, in different months, for
example, summer in October or November? A The calendar is adjusted so that the year
will always correspond with the season. winwill always correspond with the season. Win
ter will be as now and summer in the same months as now forever.
(9116) O. D. says: Kindly inform me whether or not there is a substance which will resist the lines of force of an electric magnet,
I mean to resist them, not screen them as iron will. A. There is no known material which will present resistance to the passage of mag-
netic force. It must be apparent that a force which has passed through the earth and the air will not be retarded any more by passing through materials the same as it has already passed through. The screening action of iron not understood. It screens a space from mag netic force because iron furnishes an masie path for the magnetic lines than any othe naterial. Hence the magnetic lines leave that space and pass through the iron. Iron presents less resistance to the passage of
magnetism than any other known material.
(9117) C. K. B. N. writes: Can you tell me where I can gat a complete report of
the findings or extracts from the report of the delegation which came to this country several years ago from Russia, and which made a tour of investigation of our scientific
schools? A. If you write to the United States Commissioner of Education, Washington, D. C.; we think that he will be able to
tell where you could obtain the report you
(9118) J. B. M. asks: Can a single wire carry a current to produce electric light, run a sewing machine, operate telegraph instruments, and a telephone service, all to be use at the same time, and with perfect same current can be used for all the purposes ou name and for all others at the same time. It is done all the time. It is only necessary to have the various motors and instruments cannot guarantee perfect safety, however.
Electric service is safe if ordinary caution is exercised in its use at all points.
(9119) A. F. S. says: I am building Ruhmkorff induction coil to give a 6 -inch spark and write for some advice, for which
I would be very grateful. I propose to make the coil in eight sections insula ted from each
other with hard rubber disks and paraffine. The size of wire to be used in the secondar is No. 36 B . ${ }^{\&}$ S. Now what I desire to
know is this: Can a coil of this size be made to operate successfully by using single cotcoils boiled in paraftine? I think that cotto
would do well enough, especially if it is soaked in paraffine. And other precautions taken to horoughly insulate the windings. I made a
mall coil, using cotton-covered wire in the secondary when silk was advised, and the coil worked well, so $I$ am thinking that cot-on-covered wire would work successfully with large coil if built in a number of sections. If you know of coils being built by using cot-ton-covered wire, would like to know of it,
as it would give me some confidence in cotton. . We do not advise the use of cotton-covered 6 inches. The reason for using silk is not that silk is a better insulator. No porous insulation is any better, of course, than the same thickness of air. Silk is used because it
does not occupy as much room as cotton and does not occupy as much ioo the same space $t$ is most important to bring the turns as near the primary as possible where the inducion is strongest. With silk insulation this is best secured. We not doubt that a coil to give a long spark. More wire per inch will give a long spark. More wire per inch
$(9120)$ A. B. S. writes: As a long eader and subscriber of your publications, I desire to ask if there is any secret in the preparation of fluoroscopic screens for $X$
radiance, or if , the high price is due to the high-priced material-platino-barium-cyanide (or tungstate of calcium). Where can they be procured? A. There is no secret in makIng a fluorescent screen for X-ray work. Skill only is required to distribute the crystals with perfect evenness and to attach them to the cardboard by the adhesive employed. The
crystals must also be of uniform size, sifted crystals must also be of uniform size, sifed
through a sieve of rather a fine mesh. We should buy rather than try to make one. The that in the material used. It is advised isfactory, since tungstate of calcium is fluorescent for quite a time after it is excited. It is cheaper but poorer, and is little used now. (9121) J. B. S. says: I want to excaate earth and move the same to make a fill about 60,000 cubic yards. If you kould pleased to hear from you. I do not wan to go to the expense of a steam locomotive excavator. A. The only suggestions that we
have to offer you for excavating earth are a team shovel or to use hydraulic means in cas there is a sufficient supply of water in the icinity.
(9122) F. H. says: In Notes and Queries of June 13, 1903, No. 9056, C. B. C.
asks: "What would happen if a direct-current motor were connected with an alternating cur rent dynamo?" You answer: "If the alternat motor at rest, it would be heated and burn motor at rest, it would be heated and burn
out." The theory here may be all right, but in practice it does not work. I had a No. 2 Porter motor, and a 110 -volt direct-current dy-
namo, which I ran with a 110 -volt alternating current. The dynamo would run as a motor with the full current, but the Porter motor required to have some assistance put in the
circuit, or else it would burn out the one circnit, or else it would burn out the one
Both motors would ampere fuse which I used. Both motors would
start from a standstill, but the armature of the dynamo had to be placed in a certain posi tion, or else it would stick and emit a buzzing sound. What was the cause of the noise? It seems to me that as you can reverse a direct in ment, and have the motor go, just the same, back and forth, continually, would run the motor just as well as the direct current. A The dynamo which you say will stand an al series-wound, and so has the benefit of the en tire resistance of its coils to act by their self-induction in cutting down the current if you would turn the current upon a large shunt-wound motor, we think you would see the fire fly or the fuses blow. Your dynamo did say you had to set the armature to make it start. The usual way to run a direct-current
motor on an alternating current is to have the armature turning rapidly when the current is thrown on. The "sticking" of which speak is the refusal to turn. There is no sticking in the ordinary sense. The buzzing sound you hear is the note produced by the
alternations of the current in the wire of the dynamo. It can always be heard in an ar amp and coils generally when an alternatin current is passing through them. Your rea soning about reversing a arect current and still having a motor go, and applying this to a direct current is reversed in a motor, both the field and armature has the current re versed in them, and the resulting polarity is the same. Two reversals leave the curren the same as before. This is of cou
the case with an alternating current.
(9123) T. C. G. says: Can you give me reliable rules for finding the sets of ellipti cal and spiral car springs? Also the length biven free height? Do spiral car spring of buy a book dealing with car springs? A. Th question of calculating elliptical and spiral ca prings to give definite results is an exceed ngly complicated one, and one that requires nowledge You will find quite a complete dis knowledge. You will ind quite a complete dis-
cussion of the theoretical side of this subject.
n the last edition of Lanza's "Applied Me chanics," with
$\$ 7.50$ by mail.
(9124) A. E. K. says: The owners of one of the mills in this vicinity are having a great deal of trouble with foaming of the
water in the boilers, and have made a tria of very nearly everything that has been suggested to remedy this. A sample of the water
was sent to the University of Minnesota for was sent to the University of Minnesota for
analysis, and $I$ inclose copy of a letter reanalysis, and I inclose copy of a letter re
ceived in reply. If you can suggest anything that would be of service the favor will be
greatly appreciated. A. We doubt if it will be reatly appreciated. A. We doubt if it will be with water containing as much organic matter as the analysis which you inclose shows.
it is possible, we would advise another sou it is possible, we would advise another sourc of supply, even though the expense of procur-
ing it is considerable. If this is impossible, the only practical suggestions which we have to offer are: 1. Blow off your boiler very fre quently and very generously, so as to preven the impurities becoming concentrated
not force your boiler, but if necessary,
your boiler capacity so as to be able to generte the steam that you require at a low rate
f evaporation. 3. In case you have a sufficient supply of water, we would strongly advise you to introduce surface condensers, only adding enough impure water to your boil-
ers to make good the leakages. 4. In case there is not sufficient water supply to enable you to use surface condensers in the ordinary nethod, we would advise your building a shal
ow evaporation tank to cool the condensing water, so that you may use the same condensing water over and over again in your conto make good the evaporation. Either of the uggestions contained in No. 3 or No. 4 will give a satisfactory solution of you
but we doubt if anything else will.
(9125) M. F. F.asks: 1. State what ef ect oil or greases in a boiler may have upon the boiler itself. A. In answer to your first
inquiry, we would say that greases in a boiler inquiry, we would say that greases in a boiler foaming and are apt to decompose, forming cids which affect the plates of the boiler in il like kerosene will sometimes tend to loosen a scale which is troublesome and prove beneficial, but grease should not be used for this purpose. 2. Where low-pressure engines a
used, state what vacuum is maintained? We infer that your questions regarding low pressure engines refer to marine practice. The vacuum maintained here varies with the design
of the engines and the condensers from 24 to 25 inches of mercury to 27 or 28 inches. 3. What is meant by this amount of vacuum A. The amount of vacuum is usually expresse in inches of mercury. If the vacuum were per-
fect, it would be equal to the full atmospheric pressure, which varies with the weather, but on an average is equal to 29.9 inches of mercury, or 14.7 pounds per square inch. A con densing engine can never have a perfect vacuum because it cannot cool the exhaust steam far nough. The lower the temperature to which
it does bring the exhaust steam, the more per fect will be the vacuum.
(9126) T. N. K. says: Will you kindly give me horse power of a fore-and-aft compound engine 8 and $17 \times 12,200$ pound
boiler pressure, 300 revolutions per minute inches vacuum? A. You do not give sufficient nformation in your letter to make it possible for us to exactly calculate the horse power of 8 and $17 \times 12$ tandem compound engine which you mention. The power varies with the
point of cut-off in the two cylinders, the point of cut-off in the two cylinders, the
amount of compression and the throttling of the steam during the admission and exhaust If the engine is well designed, however, the
power does not probably vary very much from 250 horse power when running at 300 revolutions per minute with a boiler pressure of 200 pounds and 25 inches vacuum. We would re
quire indicator cards from both cylinders to quire indicator cards from both cylinders ts
(9127) G. G. L. says. Will you kindly gasoline engines. 1. What are considered the best relative positions of exhaust and inlet
ports. Should the exhaust be full open before the inlet is uncovered, or should it open some time before? What is the cause of
back firing? Is it due to slow burning of the mixture or bad position of ports A. Theoreti the inlet valve should open wide at the same nstant-when the piston is at the end of its travel. In practice these conditions are fulfilled as nearly as possible. The exhaust valve
should close just as early as is possible with should close just as early as is possible without compressing the burnt gases in the cyl
inder, and the inlet valve should open just as soon as the exhaust valve is closed. If the
action of the inlet valve is slow, it may action of the inlet valve is slow, it may
sometimes be set to open just a trifle before the exhaust is fully closed. Back firing is usually caused by the failure to explode the
gases in the cylinder and their burning after they are exhausted. . 2. What is the best ratio for compression space and how far can comture explosions? A. A common proportion for the clearance or compression of a gas engine is 33 per cent of the cylinder volume or
piston displacement. The best proportion varies somewhat, however, with the size, mak
be carried much beyond the point reached with causing premature explosion. 3. What is the ule for computing compression? Suppose we have a cylinder with 6 inches piston travel,
ad it is pushed up 3 and 4 inches respectively What would be the pressures? A. A very aproximate rule for computing roughly the reased in the same proportion that the volume is decreased." This would be exactly true if the temperature of the gases remained contant during the compression. As the gases han this rule indicates. Example: Suppos cylinder with 6 inches piston travel and 33 er cent clearance. Total volume $=8$ inches
$\times$ piston area. If piston is moved up 3 inches, $\times$ piston area. If piston is moved up 3 inches,
olume $=5$ inches $\times$ piston area. Absolute pressure before compression $=15$ pounds.
Pressure after compression $=15 \times 8-5=24$ pounds absolute $=9$ pounds above the $=24$ sphere. In the same way, if the piston moved 4 inches the pressure would be $15 \times 8-4=30$ pounds absolute, or 15 pounds above the at mosphere. The exact formula is
where $p_{0}$ and $V_{0}$ are the pressure and volume before expansion and $p$ and $V$ are the pressure and volume after expansion. 4. What is the
best proportion of bore to length? Is there ny objection, other than the cost of manufacture, to have the stroke say 50 per cent
more than the bore? A. There is no rule govrning the ratio of cylinder diameter to strok except the consideration of cost and conveniing the cylinder with water jackets. For coolengines a common proportion is to have the diameter equal the stroke, but for larger engines
(9128) W. B. M. says: Will you kindanswer the following inquiry? Is the re," additional pressure on bottom of boiler Is the result the same when the water is above
boiling heat, and when it is not? What makes boiling heat, and when it is not? What makes
a good belt dressing? A. The weight of water a good belt dressing? A. The weight of water
in a boiler under steam pressure is additional ressure on the bottom of the boiler, and the bove the boiling heat. Heating water not change its weight. One-half neatsfoot and one-half castor oil makes a good belt dressing. (9129) E.: C. T. says: I want to perorm before our Sunday school an experiment解解 the effect of sin a life, an experiment having been performed, and would like to know just what solutions to use.
prefer to start with a clear solution, and the by adding another preferably clear solution get a bright and attractive color, then by add gradually of the same or another solution gradually darken it until it becomes black, the
want to add something that will bring it back to its original clearness. If you can ggest the solutions you will confer a gre btaining a dark precipitate from two colorles solutions, but none of these are easily or quick y cleared to a colorless state again. They do not answer your purpose as an illustration of sin and forgiveness.
but why use a dark or
black color at all? he colors given in Scripture (Isaiah i: 18). These can be produced and cleared off very phenolphthalein, and a strong solution of sodic hydrate in water. Add the first solution to the nd delicate a rosy color as you may wish can be obtained. As the strength increases, the olor deepens to any degree of darkness, deep
nough for the verse referred to. Then add ydrochloric acid, and the red will immeditely disappear. This would seem to meet your wishes. We give you also a process by which ou can obtaln quark brown muday deposit thalein. and sodium hydrate solutions as above ut more dilute, and proceed as above; th solution of iron chloride, more or less to pro uce a thick muddy brown mixture. A solid is precipitated from the solution. It is hy-
drate of iron. To clear this away, add hyrochloric acid. This leaves a yellow liquid which, in a dim light, will look almost white r clear. Some practice may be needed to
btain the desired strength of solution, but hen the solions are right, the effect is su manipulation.
(9130) F. R. M. asks: 1. What is the reen deposit that comes on the binding post Bunsen cell? A. The green substance formed the binding posts of LeClanche cells is prin pally chloride of copper from the coppe might be nitrate of copper. 2. How are lanche and Joule commonly pronounced? he custom in America is to pronounce Le as if spelled Ler-clanch, $a$ having the sound $a h$. The second syllable is like the word avalanche. The correct French pronounciation is in three yllables, the first two pronounced as above, and he third like shay. The accent is on the last Jool. 'The oi has the sound of oo in school: . What is the pronunciation of Prof. Curie'
the discovery of radium is due to Mme. Curie, nounced Cu-ry. Ou has the sound of ku. What causes the great heat that is developed in with has lead plates and dilute $\mathrm{H}_{3} \mathrm{SO}_{3}$ The energy of the current is dissipated in the second power a the current gives four times the heat. heats? Is it due entirely to the rise in tem perature? $A$. We have no data for the change of resistance of water by heating. As an
electrolyte its resistance is less when hot, and more current would flow, which would in turn produce more heat. You probably have som salt in the water, and it would make the heat
ing greater. 6. With a bi-convex lens is possible for both object and image to be large than the lens? If so, how can the diagram b each extremity of the object is to draw from the center of the lens and one either throug the principal focus or parallel the throug cipal axis. But this latter line could not be drawn in this case. How then can the ex tainly, both object and image may be large than the lens which forms the image, else how could a photograph be made any larger tha the opening of the lens? The rule quoted for
drawing images is only useful in simple cases. The higher works on optics give general rule which depend upon the index of refraction an which will resolve any case. 7. On what prin operate? The one in my cellar has no make and break, and yet it gives a continuous spar at the burner. A. There are many forms of gas lighters, and we cannot explain the operation
of yours from your brief statement about it.
(9131) C. M. asks: Kindly inform me f I can make a plate electric machine from a sheet of glass 2 feet $\times 2$ feet $x 1 / 8$ inch, or
if shall need a heavier piece of glass. A. Holtz or Wimshurst machine can be made from plates of glass $1 / 8$ inch thick. There is little
lateral strain in running them at any usua peed.
(9132) E. S. asks: 1. Will a current from an alternating-current dynamo drive an etc.? A. An alternating current will drive an alternating current motor either for running a fan or sewing machine or any other machine which is to run 2 . Is the current as pow erful after it has gone through the motor as
it was before, or not? A. A current is not as powerful after it has done its work as before. If a motor requires but a part of th be used after the first has been used; but all the voltage is taken by the first motor there is nothing left to run a second. 3 . How
many small motors, say $1-60$ horse power could be run on one circuit of batteries, say four cells of ordinary dry batteries? A. As
many small motors can be run on four dry cells as will use up the voltage of these cells.
They will give about $5 \frac{1}{2}$ volts if put in
(9133) D. N. S. says: 1. I am sup plied with electricity for lighting my house, which is supposed to be a current at a press
ure of 50 volts. I have incandescent lamp that were purchased for a current of 55 volts When placed on my circuit of 50 "volts they give less light than the regular 50 -volt lamps.
Do they use a correspondingly smaller amount of electricity? That is, when the electric light company reads my meter, will it register a if $I$ use the 50 -volt lamps? A. It is not olt circuit. to use a 55 -volt lamp upon a 50 rent, to be sure, but it does not produce a pro light than a proportional amount. This is due to the fact that the smaller current does no iteat the filament to as high a temperature as
it should be heated to produce its rated candle power of light. 2. After incandescent lamps have been in use a considerable time, they give correspondingly smaller amount of electricity That is, if the light from an old 16 candle candle power lamp, will the meter registe faster if the old 16 candle power lamps ar used than if the 8 candle power are used? A.
An old 16 candle power lamp which is giving but 8 candles has passed its "smashing point," and should be broken forthwith. It will use
more current than a new 8 candle power lamp. The decrease in the amount of light an incan filament becomes smaller by the driving of the particles of carbon over upon the glass bulb 2, the inner surface of the bulb becomes black which partially opaque, so that all the ligh which is produced does not pass through the
glass; 3 , the filament becomes more able to emit heat, and thus does not become as hot as a the filament continue till it breaks. 3. Th manager of our electric light company say that an incandescent lamp that has been use more current than new lamps, so that it more current han new lamps, so that it been in use some little time, even though th
light given by them is sufficient for the purpose for which they are used. Is this true: . The lamp takes less current than when new nswer to last question. It does not take more current than when new, but it takes more in proportion to the light it gives than when it
was new. It is good economy to throw a lamp was new. It is good economy to throw a lamp nt of is intial canal whe whole ighting," Vol. ii., price $\$ 3$, in the chapter
(9134) G. H. H. asks: 1. Will you lease explain how to calculate the drop of a rimary battery-a Bunsen for instance? M. F. of a primary cell is hardy uite too abtruse, and would occupy too much space. We would refer you to the elec-one-chemistries; Arrhenius, price $\$ 3.50$, or ubject occupies large chapters in each of these works. It is calculated from the osmotic ressure and solution pressure of the subances. You whi require a workng knowledge . Also how to construct a Bunsen primary Also in E. M. F. at normal discharge. A. We coness we do not know and cannot find in any rop of 13 per cent in E. M. F. at normal ate of discharge." So far as we know, every ecting its poles by a wire, whether the rate discharge be normal or not. 3. The interal resistance of a battery is made less by dermines how close they may safely be put? A. The distance between the plates of a battery ay be as small as will allow a circulation f the liquid. The liquid becomes weak in the action of the cell, and if it cannot diffuse and bring other and stronger liquid into contact with the plates, the cell will give out sooner than it should. 4. If you want to construct a ertain number primpere hours, will the ex at number of ampere bours do, or is it better o increase them by say 20 per cent? In other hausted in practice? An allowance should be made in constructing a battery, so that it be made in constructing a battery, so that
will time of service. Otherwise the latter portion
of the time the service will be feeble. The principle is the same as a factor of safety in an engineering work, such as a bridge. 5. What
is the resistance of $r_{1} r_{2} r_{3}$ in parallel? Is it

\section*{| 1 | 1 |
| :--- | :--- | :--- |
| 1 | 1 |
| $x_{1}$ |  |}

. Your expression for the combined resistance three resistances in parallel is correct. See . primary battery, and how do you find it? How do you construct a battery to have a given normal rate of discharge with a given external
a. We never saw the phrase A. We nevistance? saw the phrase
"normal rate of discharge of a battery," so far as we can recollect. If you had referred to the ook and page whe
(9135) L. M. H. asks: Will you kindtell me if there is any way of telling accuattery? I find in my launch that the voltmeter does not fall much until the energy is ery much exhausted. A. A storage battery should be recharged when the voltage has ran lown to 1.8 volts per cell. This you can
alculate from the reading of the voltmeter. alculate from the reading of the voltheter. hich have been taken from the battery atd now how many remain. The ampere-meter ill enable you to do this. Apart from the ist the condition of the battery.

## (9136) H. M. W. says: Will you kind-

 tell us if a reversing gear as used on a the direction of the propelfer instantly, when the engine is running at full speed? We are nclined to think the reverse should be applife with a certain amount of time to allowthe clutch to engage. The effect of a gear we have, when suddenly houtd scarcely feel the reversing of the propeller. A. No reversing gear which is positive Its action should be thrown in suddenly hould be running at full speed. The to rest efore the propeller is reversed. To instantly everse the propeller at full speed would require an infinite force, and it is not to be
ondered at that the attempt to do so should top the engine. If sufficient time is allowed, the engine
(9137) C. S. says: I have a No. 7 Root blower making 100 revolutions per mith-
ute; discharge ping is 24 inckes ate; discharge pipe is 24 inckes in diameter; f 75 stations. Now I would like to know if can discharge the exhanst air from the with thio my smokestack without interferting
is square, 3 feet $\mathbf{x} 4$ feet 6 inches, and als
has an offset a little above the center of th stack. The only place where I could exhaust into the stack now is about five feet below the
boiler flue, that would be at the bottom the stack. If I can't exhaust in this place, would have to carry a line of pipe up on the
outside of the building to a point above the boiler flue. Which would be the best? A would I need an elbow in the stack, so the air
shoots up, or is it unnecessary? shoots up, or is it unnecessary? A. You do
not give the height of your stack, nor the velocity, pressure and volume of the air from the Root blower, so that it is impossible for you have a draft very considerably in exces of what you actually require when forcing your
boilers, it would not be wise for you to discharge the blower into the stack, because the would have the effect of materially reducin the size of your chimney. On account of th distance of the stack from the boilers, it
more doubtful if you have the draft to spar In case you try the experiment, insert the discharge pipe from the blower at the bas
(9138) F. A. T. asks: Is there any gain in power by using an Archimedes scre
beyond the power required to work an ord neyond the power required to work an ordi
nary pump? A. There is no gain in power by required for an ordinary pump. Its efficiency is so low that it is not used in practice, and see one. The principle of its action is just th same as that of the screw conveyors used fo feeding coal into furnaces, to convey grain, et
(9139) H. E. asks: 1. Has the Roent gen ray or a similar device ever been per fected to that extent that the human eye can
see through a solid body; as, for example, the human hand while the fingers are being moved A. There is no way known by which the ey can see through an opaque body, such as the seeing through the hand and other dense bodies. The action is in reality as follows: X-rays
traverse many opaque bodies quite freely, but traverse many opaque bodies quite freely, but
the eye cannot see X-rays. Bones are not easily traversed by X-rays, flesh is. Certain
chemical salts transform X-rays into light rays; then the eye can perceive the light rays. On the inside of the box which is held in the X-rays. Place the hand on the end of the box. The bones cut off the X-rays mor
than the flesh does. The chemical does no glow as much where the bones cut the rays off as where the flesh is, hence the bones cast
a shadow on the screen. This is called seeing through the hand. What we see is a shadow Thick flesh casts more shadow than thinner
flesh. By this fact much can be made out the body. It is wonderful enough, but it is not seeing through opaque bodies in any prope ense of the term. 2. Has there been manua solid body such as the human hand might
be introduced and then seen through? A. We be introduced and then seen through? A. W
do not know whether the slot machine ha been applied to X-rays or not. There would
no difficulty in doing this.
(9140) A. C. says: We have a well 184 feet deep that we wish to force water out
of to a tank 65 feet above ground. The water of to a tank 65 feet above ground. The water
stands 16 feet from the top of ground, but we do not know how low it will go when pump-
ing is commenced. The outside casing of well is 8 inches. The suction pipe and discharge 163 feet. The air pipe is 3 in inch and well down 157 feet. The air pressure is 100 pounds The question is, how far can the water lowe fully? In other words, how far must the ai pipe be down in proportion to the amount of
elevation of water? A. One hundred pounds air pressure will lift a column of water 230 feet high, neglecting friction. The amount of the friction is 30 per cent, the 100 pounds ai he friction is 30 per 100 pounds a high, or from 96 feet
(9141) J. A. says: I inclose an exract from a letter from John Anderson, Roa in the White Mountains, to Prof. C. H. Hitchcock, of Dartmouth College: "Won't you con sult your chemist at Hanover in relation to fighting forest fires? If we could send one hundred men into the woods, each having hung
over his shoulder thirty or forty pounds of over his shoulder thirty or forty pounds of
such material, which thrown by handfuls into the blazing points or scattered broadcast int a running fire would deaden it, enabling the
shovel men to finish it by throwing on fresh arth, we would have a pr the minds of all in this section. In view of the enormous annua loss it might avert, it would not really matte If such material were expensive. It should b
provided by the State in all localities subject t these fires." A. Sodium tungstate might an swer the purpose, but it would be too expen
sive. We do not believe that a forest fire will ever be extinguished without resorting to the methods already in use by all lumbermen a fire belt, etc. Powders are better adapted
that the chemical fire extinguisher
practical for fighting forest fires.
(9142) C. J. S. says: How long is the scaling ladder in use in the New York Fire Department, and where was it invented and how long is it in use in Berlin? Which is more improved-New York or Berlin? A. The
scaling ladders used in the New York Fire scaling ladders used in the New York Fire
Department were first used in 1883, and they run from 12 to 20 feet-12, 14, 16, 18, 20 at about the first time they were used, a ver Bat ilion Binns. We have no information rela iv to the scaling ladders in use in Berlin,
apt that they are used. In general, w may say American-built fire engines are the best made, and we have never heard it ques
tioned that the secondary part of the fire equipment was any less good. Owing to the methods of construction employed abroad they demand for improvements in fire apparatus as
(9143) S. B. E. writes: If G. B., Notes nd Queries, 9,076 , of your paper of July 11 52 inclusive, Popular Astromy," pages 38 t lated by Y. Ellard Gore, he will find the in formation he is seeking
motions of the earth.
(9144) F. R. M. says: I have been intensely interested in the unusually fine ar he Supplement during the past four wed But there are naturally several statements that I cannot understand or reconcile. Crookes, on
p. 23,015 , middle of third column, says the free positive electron is not known." This does not seem to agree with Rutherford's X-
rays referred to on p. 22,951, middle column, rays referred to on p. 22,951, middle column,
when they are called positive ions traveling hen they are called positive ions traveling
oward the cathode. Is any distinction agreed pon between electron and ion? Will cathod he act on a photographic plate if let out nd if so, how powerfully compared to Roent en rays? On p. 22,998, bottom of third col umn, "unless the gases in the tube are ex nd rarefied, the rays are quickly stoppe hen scattered by molecular obstructions. ed and scattered when they reach the air after passing through the aluminium window? Dastre, on p. 22,998, middle of second col-
umn, says cathode emission is rectilinear. umn, says cathode emission is rectilinear.
Crookes, on p. 23,015 , middle of second colmn, says electrons "can turn corners." How an these be reconciled? $A$. We do not won the varied and well-nigh contradictory state ments concerning electrons and other minute things claimed to exist by the more advanced theorizers. It is, of course, the of-
fice of a scientific periodical to print the pafice of a scientific periodical to print the pa-
pers read at the various meetings of scienpers read at the various meetings of scien-
tific bodies, but they rest for authority, not upofic bodies, but they rest for authority, not up upon the repute of the persons presenting orm. We cannot decide between the claims
o the several scientists, but must leave the matter just where they leave it. Only one engaged in investigation can speak with any authority about
to in your note.
(9145) $\mathrm{O} . \mathrm{N}$. writes us: Is a 16 canpower bulb frosted more luminous than one that is not frosted? That is to say, will one 16 candle power frosted bulb give more light descent electric lamp with clear glass bulb will emit more light than one with a frosted bulb. The bulb cuts off light. No arrange-
ment of the bulb can increase the light of the ment of the bulb can increase the light of the
filament. It is the filament which gives the light, and not the bulb. Even a bulb of clear lass absorbs some light. One of partly opa
(9146) N. A. N. says: Will you plea ecide if there is a difference between a mile quare and a square mile? I hold that a mile
square is a mile around it, and a square mile is four miles around it. A. A "mile square" and a "square mile" have each the same area, but the phrases have very different meanings. A mile square is a figure one mile on each side, and all its corners right angles. A
square field one mile on a side is a mile square A square mile contains 640 acres, and may be in any shape whatever, circul
etc., or of any irregular form.
(9147) F. A. F. asks: Kindly answer the following mathematical problem to set your readers right: We have an aquarium, a globe, $61 / 1$ inches in diameter, $61 / 2$ inches high; the
question is, How many pellets or buckshot $1 / 4$ nch in diameter will this globe or aquarium old? A. The problem you send us may admit of a mathematical solution, but so far as
we know it only admits of solution by experiment. Fill the globe with shot and count them. The globe is apparently an irregular solid. You give the dimensions as $61 / 4 \times 61 / 2$
inches. This is not a spherical solid, and its shape is not determined by two dimensions not given by knowing two dimensions only. If it be assumed that the dimensions are the axes of an ellipse, then the solid is an ellipsoid But it can hardly be assumed that a But it can hardly be assumed that a globe of
glass blown - by ordinary processes of the
base a mathematical calculation upon. If its
solid contents simply are known, the number ond contents simply are known, the number even then be calculated without more data. And if the problem were solvable, what would be the use of doing it? We are fond of working upon problems which lead to results of
practical value, and though we sometimes work practical value, and though we sometimes work
out problems for correspondents, which are simout problems for correspondents, which are sim-
ply puzzles, we always feel that the time is ply puzzles, we always feel that the time is
misspent, since we are beyond the age when do such work simply for mental gymnastics
(9148) A. L. asks: 1. What is the 148) A. L. asks a mind of iron or steel to make a magneto? higher the grade of steel, the better. 2. What is the best method of making a magnet the most powerful? A. The magnet should be hardened
at the ends as hard as it can be made. The at the ends as hard as it can be made. The
middle may be soft. It can then be magnetized by stroking with another magnet or the poles of a dynamo, or by placing it in a
coil of wire through which a current of electricity is flowing. All these methods are full described in textbooks. 3. When a magnet' lifting power is 6 pounds and the object it is lifting is a magnet weighing about 7 pounds and having a lifting power of also 6 pounds, exactly six lift six pounds, it can lift anything less than six pounds. If one of two magnets can lift
seven pounds, it will hold up seven pounds or seven pounds, it wall hold up seven pounds or
hold itself up against the other if suspended from it. 4. Has a magnet the same amoun of repelling force as attractive? A. A magne The lifting power of a magnet means that it will lift in actual contact with the weight to be lifted, and not at any distance from through the air. A narrow gap of air
duces the power of a magnet very greatly.
(9149) W. C. B. says: I am informed that there is a process for making ice where liquid air is utilized in place of ammonia acter the installation of a plant of that cha than the ammonia plant; that the maintenance is much less than the ammonia plant; and that it has other advantages. Will you be
kind enough to give me some information on this subject? Is it in its experimental stage or is the system being used to any extent?
Can the tubes of air be secured commercially like ammonia? I am told they are used prin cipally for small plants, but that larger plants plant of 20 -ton capacity per twenty-four hours be manipulated more economically with the air or the ammonia systems? A. We think we is liquid air in use for ice-making or refriger tion, and in our judgment it will be a long time before it is used for any of these pur
poses. It is many times as expensive as the ammonia process, and has other disadvantage
(9150) A. S. asks: A friend of mine says if a piece of iron is laid where the sun
can shine on it, it will get hotter than a an shine on it, it will get hotter than I claim he is wrong. If it would be as says, the iron would have the property
drawing heat, and an iron pail of water would than the air would spoken to says he is right, so as a last resort turn to you. A. Any metal laid where the time be protected from drafts of air will be come much hotter than the adjacent air. We
have just laid out a roll of sheet copper in which was a thermometer. The ends were closed by paper to protect the air from pass-
ing through the roll and cooling the thermometer. By its side in the sun was another shade close by. The thermometer in the thad showed 82 deg., that in the sun showed 122 deg., while the one in the copper roll read 138 deg. As the mercury rose to the very but that the temperature was higher still. Any had who ever picked up a piece of iron which
ha the sun of a summer day and found it too hot to hold in the hand, knows that the air in the neighborhood is cooler than walked barefooted over stones, or in the sand, a wour feet burned, the same fact could and had your feet burned, the same fact could have
been learned. The scientific reason for this is not difficult to understand. Water is used a the standard for measuring the quantity heat required to produce a certain rise of tem perature. One pound of water is raised 1 deg. only one-fourth as much heat to raise a pound of air one degree, one-eighth as much to raise pound of iron one degree, and one-tenth a much to raise a pound of copper one degree The same quantity of heat produces very differ strikes.
(9151) A. F. O. says: I know all about the ordinary thermometric scales, F., C., and R., and their mutual reductions, but " 600 deg In President Swinburne's address in the
Supplement is new to me. Will you kindly SUPPLEmENT is new to me. Will you kindly
enlighten me? A. " 600 deg. enlighten me? A. " 600 deg. A" are degree
of absolute temperature. The absolute zero is
ures are often expressed in the absolute scale, to each other. 400 deg. A is twice as hot as 200 deg . A. Of course 400 deg . C. is not twice as hot as 200 deg . C., since both are reckoned rom the freezing point of water, which is
(9152) C. H. S. asks: 1. Without using wireless telegraphy, is there any way to from one boat to another, 100 feet or les way, to affect the needle or an electrometer A. We do not know any way of sending and receiving electrical signals which is not equiv alent to wireless telegraphy; that is an in duction coil and receiving instruments, such a coherer of telephone, or some equivalen
lectromagnetic device must be used. 2. Ca n electrometer be made to register such current, no matter how feeble? Don't mean telegraph or telephone. A. An electromete not the instrument to employ. It receives alvanometer is probably intended. This may be used in the way mentioned.

## NEW BOOKS, ETC.

The Elements of Electro-Chemistry Robert Lüpke. Revised and augment ed by M. M. Pattison Muir, M.A.
London: H. Grevel \& Co. Philadel1903. 8vo. Pp. 255. Price, $\$ 2.25$.
lthough the main purpose of the book is to et forth the purely scientific aspects of elecect have not been left altogether unnoticed Technical electro-chemical processes, and espe ially the processes of electro-metallurgy which are so important at present, are referred to in their proper places. The experiments,
which form an essential part of the book, are carried out with the simplest possible appar

Les Industries Chimiques et PharmaCEUTIQUES. Par Albin Haller. Paris:
Gauthier-Villiers. 1903. Vol. I. 4to. Gauthier-Villiers. 1903. ${ }^{\text {Pp. }} 405$. Vol. II. Pp. 445

Prof. Haller eports on the chemical and pharmaceutical industries which were represented at the last tion he discusses the chemical industry of very European country and of the United tates, passing then to improvements intro
uced since 1889 His second chapter dis cusses pharmaceutical products and minor improvements, not the least valuable portion of the chapter being devoted to a résumé of antieptics and antipyretics. In a chapter on artiwhich colorants and them admirable review of the development of this mportant branch of organic chemistry since 1889. The products of the distillation of wood, resins, coal, and mineral oils are treated cial and natural perfumes. The sixth chapter is taken up by descriptions of mineral color ants or pigments, lacques, chapter soap-making and stearine industries re treated.
Die Weissgerberei, Saemischgerberei UND Pergament-FABRIKATION. Ein
Handbuch fuer Lederfabrikanten. on Ferdinand Wiener. Vienna: A. Hartleben

Mr. Wiener's book is essentially a practical reference book for the leather manufacturcribed can be comprehended en by the layman. In this second edition of his work Mr.
Wiener has carefully revised the text and inWener has carefully revised the text and inmprovements which have been made since the ppearance of the first edition.

Technik der Radierung. Eine Anleitung zum Radieren und Aetzen auf Kupfer. Von Josef Roller. Vienna:
A. Hartleben. $1903 . \quad 12 \mathrm{mo}$. Pp. 376. Price, $\$ 1.25$.
Prof. Roller's handbook on etching is inended not only for the artist, but also for the and clearly. the various operations of etchng on copper, and likewise contains many an interesting remark on artistic printing and very instructive review of the various calcographic methods.
The Chemistry of Pigments. By Ernest F.I.C F.C.S., Coste, wood \& Co. New York: D. Van Nostrand Company. 1902. 12mo. Pp. 280. Price, $\$ 4.50$

The publishers of this work have a reputation for issuing important books upon technical subjects and the present book fully sustains this hip, con. It indicates the chemical rest of the etter known pigments. The various colors are treated in groups allied chemically, rather than hromatically; an excellent arrangement. The considered rather from the chemical than the technical point of view. It is not suggested by the authors that the present work is in any
sense a manual of color making, but it will be
found most useful by those who are called upon to examine pigments as a guide to the selection of those which are suitable and the rejection of
those which as a class, or through individual inferiority are unsuitable for the class of work to be undertaken
Easy Lessons in Roof Measurements. By William Neubecker. New York:
David Williams Company. 1903. David Williams Company.
16 mo . Pp. $31 . \quad$ Price 25 cents.
Twelve short lessons on figuring from architects' or scale drawings the amount of materiai required to cover a given s
The Roentgen Rays in Medicine and Surgery as an aid to Diagnosis
and as a Therapeutic Agent. By and as a Therapeutic Agent. By
Francis H. Williams, M.D. New York: The Macmillan Company $\begin{array}{ll}\text { 1903. } & \text { 8vo. } \\ \text { tions. } & \text { Price, } \\ \$ 6 .\end{array}$
No discovery of modern times has made a more profound sensation than the discovery of the Roentgen rays, and it is fortunate that in-
stead of being a scientific plaything it has been put to practical use in the diagnosis of disease, and as a remedial agent. In two years there have been three editions of the volume before us, the first edition being exhausted in three months. The descriptions of the apparatus and methods employed are clear and concise, and the half-tones of radiographs are well executed. The subject is treated in a scholarly way and the book is one which we commend not only Electric Wiring. A Primer for the Use of Wire Men and Students. By W
C. Clinton, B.Sc. New York: E P. Dutton \& Co. 16mo. Pp. 179. Price 60 cents net.
This little book is intended as an introduction to the art of indoor electric wiring as practised with lamps and bell circuits. Worked examples have been given where possible. The book is intended specially for the use of those prepar ing for the preliminary examination of the City and Guilds of London Institute. We have already expressed our opinion of the English
examination system in this column. The prac tice is, of course, English, but it will prove use fue is, of course, English, but it will prove use
ful as well to the American student. We re gret to note that the title page has no date.
All scientific books should be properly dated. An Introduction to the Study of Tex-

New York: $\dot{E}$. $P$ Dutton
8vo. Pp. 211. Price, $\$ 2.50$.
A most admirable book. The primary ob
ect of this work is to show clearly how the pecial knowledge required in clearly he textile indus ries may be co-ordinated into a truly educational discipline. The numerous plates and de sign sheets are admirably engraved and printed
and the diagrams showing the principles upon which textile machinery is based are the best we have ever seen. The chapter on the Sci ence of Cloth Construction is particularly valu able. It is a book which should be in the hands of all those connected with mills.
The Principal Species of Wood. Their Characteristic Properties. By Charles
John Wiley \& Sons. 1903. 8vo. Pp 203. Price, $\$ 3.50$.

An excellent book, admirably illustrated by thirty-nine full-page plates and many figures in he text. It is intended for those who are no oresters or botanists, but who use woods or desire knowledge of their distinguishing properineers but all who have occasion to use woods will find it of great value. Under "Live Oak," for instance, we find that the author deals with Nomenclature, Locality, Features of Tree, Color, Appearance or Grain of Wood, Structural Qualities of Wood, Representative Uses of Wood, Weight of Seasoned Wood in Pounds pe
Cubic Foot, Modulus of Elasticity, Modulus of Rupture, Remarks. Other woods are treated in similar manner.
Foreign Trade Requirements. New York: Lewis, Scribner \& Co. 1903 4to. Pp. 532. Price, $\$ 10$
This reference volume, which is published an
aually, contains complete information concernnually, contains complete information concern ing the commercial countries of the world as
to trade conditions, traveling salesmen, agencies, and advertising, credit customs, commercial, trade-mark, and patent laws, transportation facilities, principal cities, postal regulations, coins and currencies, weights and measures, and cable rates. While the book was issued primarily for mand for it from England and Germany has been large, and this proves that the manufac turers of these countries are keenly alive to the extension of their foreign business. The work has been conscientiously done, and the book cane of great value
The Improvements of Rivers. By B. F Thomas and B. A. Watt. New York 356. 92 full-page and folding plates Cloth, $\$ 6$.
The second title is "A Treatise on the
Methods Employed for Improving Streams for Open Navigation and for Navigation by Mean of Locks and Dams." This is the first work of its kind published in the English language,
although engineers have long recognized the
treatise covering the principal features of tha branch of enginering pertaining to the improvements of rivers. This branch comprises a
great variety of works: Locks and Dams for great variety of works: Locks and Dams for
Canalization, Dikes and Jetties for Concen trating and Controlling Streams and Bank Pro tection in Regularization, Levee Building and dations, and Dredging and Snagging for Keeping Channels during Times of Low Water. The object of the work is to provide in concise form a description of the various systems employed for bettering the condition of navigable streams, together with the methods usually adopted for their design and execution. It is an admirable contribution to engineering literatur
torage Battery Engineering. By La-
mar Lyndon, B.E., M.E. New York: mar Lyndon, B.E., M.E. New York:
McGraw Publing Cony
8vo. Pp. 382. Price, $\$ 3$.
The evident and long unfulifiled need of a practical work on the storage battery, parare not chemists, and on the details of its engineering applications, has induced the pre paration of this work which is intended to assist the practising engineer in designing, installing, and maintaining battery equipments and to guide him in the selection of types of batteries and auxiliary apparatus best suited to the service which they are to per-
form and at the same time to impress on the orm and at the same time to impress on the echnical public both the advantages and limiauthor has performed an extremely difficult ask in a most acceptable manner
Fire Insurance and How to Build. By Baker \& Taylor Company. 1903. 8vo Pp. 860. Price, $\$ 5$.
It will prove a convenient book for archiects, builders, and property owners who conemplate erecting buildings, enabling them to would secure lower insurance rates and save the burden of a lifelong insurance tax. The dea and plan of this book are excellent. The systems in use oy the Fire Underwriters for puzzling to the lay mind, but with the aid of this book the principles which with the a a formation of a rate will be understood. The work also deals with fire prevention and extinction, special features of manufacturing
risks, the writing of policies, the adjustment risks, the writ
Modern Mexico's Standard Guide to the $\begin{array}{llll}\text { City of Mexico and } & \text { Vicinity. } & \text { By } \\ \text { Robert } & \text { S. Barrett. } & \text { Published by }\end{array}$ Modern Mexico," the City of Mexico and
186 , prof Yely illustrated.
price, 50 186, p
cents.
An admirable guide which should prove inare happily chosen, the plates have been well executed, and the printing is excellent. There s not a feature of the city, important or unimportant, which is not properly dealt with.
Treatise on Hydraulics. By Mansfield
Merriman. New York: J. Wiley \&
Sons. 1903. 8vo. Pp. 585. 192 illustraitions. Price, $\$ 5$.
The eighth edition has been rewritten and enlarged, which was rendered necessary by the draulics since 1889, when the first edition of his treatise was issued. Too much cannot be said in praise of this admirable book which a standard text book for engineers and enrange of hydraulics, taking in the flow of waters through orifices, tubes, pipes, and over weirs. It also deals with the flow of rivers, water supply and water power, water wheels, and pumping.
Experiments on the Flexure of Beams. Laws of Failure by Buckling. By Albert E. Guy. New York: D. Van Nostrand Company.
Pp. 122. Price, $\$ 1.25$.
The study of the failure of beams by the buckling of the compression side has been strangely neglected and now that it has been
taken up it proves to be the central fact and key to the entire subject when looked at in the broadest sense. The analogy of the ailure of the compression side of a beam by uckling to the method of failure of a long but we believe that there has been no previous attempt to connect the two by a formula. Mr. Guy's experiments have been very successful in connecting them and in showing that
Euler's formula for long columns is, in fact, Euler's formula for long columns is, in fact,
the fundamental formula which lies at the the fundamental formula
Hand Book of Climatology. By Dr. Ju-
lius Hann. Part I. General Clima-
Company. $1903 . \quad 8 \mathrm{vo} . \quad$ Pp. 437.
Dr.
Dr. Hann's book has been translated by Prof. Robert de Courcey Ward, of Columbia
University. The writer undertook the work primarily in order that it might serve as a textbook in the course in general climatology in Harvard University. At the same time the publication of a standard work on climate
will, he hopes, lead to the extension and improvement of the teaching of scientific
climatology in English-speaking countries. The
work is a very important one, and this new edition is an excellent contribution to the iterature of meteorology.
he New Onion Culture. By T. Greinier New York: Orange Judd Company 1903. 16 mo . Pp. 114. Price, 50 cents.
A complete guide in growing onions with the greatest profit, explaining the whys and wherefores. Clear and minute directions are
given of how the plants are grown; the cold given of how the plants are grown; the cold
frame; seed bed; planting; fire hotbed, hotframe; seed bed; planting; fire hotbed, hot market gardeners; greenhouse heated by hot water; quantity of seed required; time of
sowing; varieties; what soll to to manure and prepare it; onlons on muck soil ; clean soil essential ; how the plants are set in the ground; tillage as moisture pre-
server and weed killer; tools of tillage; when server and weed killer; tools of tillage; when and how to harvest the crop; danger in delay; signs of maturity; curing the crop; curing vantages and profts of the new way; estima tion of cost and returns.
The Resistance and Power of Steam
and A. L. Mellanby, M.Sc. Manches
ter: The Technical Publishing Com
pany, Ltd. 1903. 16 mo. Pp. 200 Price, \$2.
Almost all the recognized methods of determining the engine power required to propel tail, and examples of their application given The subject of the fouling of ships has also influence wn fully, because of its importan nfluence on the actual resistance of sea
going ships. The book will appeal to marine engineers and shipbuilders, and, in fact, to al who are interested in watching the develop

## A

Hand Book on the Steam Engine Medium-Sized Engines. By Herman Haeder, C.E. Translated by H.J. P Powles. London: Crosby Lockwood
\& Co. New York: D. Van Nostrand Company. 12mo. Pp. 458. 1,085 il lustrations. Price, $\$ 3$.
The present volume is profusely illustrated very helpful engravings, and the numbe tables is surprisingly large. The best Con the ral practice is given. The book show gineers.

## ginee

micical Mycology. The Utilization of Micro-organisms in the Arts and Vol. II. Eumycetic Fermentation Part I. London: Charles Griffin \& pincott Company. 1903. 8vo. Pp. 189. Price, $\$ 4$.
erme fistillers process for the use of brewers and chemists, pharmacists, and all interested in the industries dependent on fermentation. Th first volume dealt with Schizomycetic Fer The Utility of an Academic or Classic al Education for Young Men Who Have to Earn Their Own Living anercial Life an Investigation By R. T. Crane. Chicago. 1903. 16mo. R. T. 109.

Simple Scientific Experiments. By Aurel de Ratti. London: Dawbarn Ward, Ltd. 1903. 16mo. Pp. 69 ortuni Sul Lavoro. Mezzi Tecnici per Prevenirli. By Effren Magrini.
Milan: Ulrico Hoepli. 1903 . 16 mo . Pp. 251. Price, 75 cents.

INDEX OF INVENTIONS For which Letters Patent of the United States were Issued for the Week Ending July 28, 1903,
AND EACHEEARINGTHATDATE

| abrading material, tool for holding, M. E. McAfee <br> cid makirg sulfuric $\quad$ G Gin. |
| :---: |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |





Fence wire ratchet or tightener, Willmarth
 Fiber
Fifth.
Filter



 Flue cleaner, R. S. \& C. M. Rugles......
Fluid extracting press, . W. C. Marshali...
Flushing device, rain pipe, J. H. Doyie.
Flushing drain pipes, means for, J. H. Doyie









 Ginning apparatus, J. T. Fuiler.


 Grinding machine, P. A. Whitney..........
Grinding machine, automatic, A.
rinding machine, tool, J. S. Bancroft. Haliter, J. G. Lewis.,
Hammers
 Harvester, corn, R. B.. Robbins.


 Hinge
Hinge
Hook
Hopp
Horse






 Lamps, machine for sealing inc
McBerty \& Loveridge.......



 Liquid fuel burner, J. W. W. Ne..........
Liquid separator, centrifugai, Je Melontte.
Liquors, manufacture of fermented, J.
 Lock, Green \& Carpenter.................
Lock and lateh hum, N. W. Crandail...
Loom pottern chain, W. J. Lutton......
Loom shedding mechanis, G. Wh.
Loom shedding mechanism, C. H. Draper



 Microscope, Bausch \& Hommel............
Milk tester, G. M. Luther................
Milling and boring machine, combined. A
Moistening and den sealing device, enveiope, A










## Power'Wire?2ope

 PPONER


## Scientific American



1876-1902

## 15,000 Valuable Papers

## JUST PUBlished.

ALARGE edition of this new cata logue now ready for distribution. Thousands of new papers are listed in it, bringing it up to date. Sixty three-column pages. Copies will be mailed free to any address in the world on receipt of request. All Supplements listed in catalogue can be supplied for ten cents each

## M1SN \& CO:3

Publishers,
36I Broadway, New York


This great, thick lather is like the richest cream in its softening, healing, refreshing effect. Try it.




LEARN $\begin{gathered}\text { No other section affords such chance for } \\ \text { studd, practice and } \\ \text { big wases as }\end{gathered}$ er from Niagatady, proactice and big wages as this. Pow-
western New York. Sessions
ELECTRICITY



A Handy Book To Have
It is illustrated throughout and de-
seribes and
then




## THE OBER LATHES



 Whiffetrees, Yokes, Spokes, Porch
Spindles, Stair Baiusters
and Chair Legs and other irregular Sena for Circular $A$.

WE
\%ien
ien $\square$ DRILLING Machines Strong, simple and durable., Any moehanic can
operate them easily. Send for catalog. WILLIAMS BROS., Ithaca, $\mathbf{N}$. Y

New Evinrude Motors Automobile and Marine. Light weight
for power. 1 and 2 yllinders. Fazsy to
start. Thinee speed and reverse plane-
tary transmission gear. Write for circulars and prices. MOTOR CAR POWER
LQUIPMENT CO.,
'Tase and Ferry sts:



## Vessel charging H. Shomith Viser





Wine press,
Wre
Wre
clasm . Perotti.


 DESIGNS.




TRADE MARKS.






 40,821
408829
40,813








## stapie

LABELS.







## PRINTS.









15 IS DEVELOPED, MODELS Stamping \& Tool Co., La Crosse, wis. SPECIALLY DRAWN METAL TVEBING to

MODEL AND EXPERIMENTAL WORK. Electrical and Mechanical Instruments. smail Mach
EWARD KLEISSCHIDT, 82 W. Broadway, New Yor


ICE YACHT BUILDING.-COMPLETE



FOOT TROUBLES









PROPOSALS.


 WANTED Patent office Draughtsmen. Only thoroughly expe-
reiceat men need apply. Must show specimens ${ }^{\text {an }}$
 MATCH MACMINERY


HAVE YOU INVENTIVE GENIUS? If so there is a fortune ahead of you
THE IDEA
CO., Adress
Shelbsville, Ind.


## FOR SALE

## 

 L. Box 46\%, Canton, Ohio

## 


WHAT WE DO-HOW WE DO IT


## Metal Patterns and Models

of every deseription Highest grade of ex-
perimental work. Gated $\left.\begin{array}{c}\text { work } \\ \text { a specialt }\end{array}\right]$ THE C. E. WENZEL CO.., 313 Market St... Newark, N. J. Model Machinery and Experimental Work.




## 

APATENT GIVES you an exclusive right to your invention for a term of seventeen years. You can sell, lease, mortgage it, assign portions of it, and grant licenses to manufacture under it. Our Patent system is responsible for much of our industrial progress and our success in competing in the markets of the world. The value of a successful Patent is in no degree commensurate with the almost nominal cost of obtaining it. In order to obtain a Patent it is necessary to employ a Patent Attorney to prepare the specifications and draw the claims. This is a special branch of the legal profession which can only be conducted successfully by experts. For nearly sixty years we have acted as solicitors for thousands of clients in all parts of the world. Our vast experience enables us to prepare and prosecute Patent cases and Trade Marks at a minimum of expense. Our work is of one quality and the rates are the same to rich and poor. Our unbiased opinion freely given. We are happy to consult with you in person or by letter as to the probable patentability of your invention.

Hand Book on Patents, Trade Marks, Etc., Sent Free on Application.
MUNN @ CO., Solicitors of Patents,
361 BROADWAY, NEW YORK.


