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The Editor is always glad to receive for examination illustrated
articles on subjects of timey interest. If the photographs are articles on subjects of timely interest. If the photographs are
share, the articles hiort, and the tacts suthentce, the contrioutions
will receive special attention. Accepted articles will be paid for will receive special at
at regular space rates.

## bUILDING AMERICAN LOCOMOTIVES IN BRITISH SHOPS

A significant event that calls for more than passing notice is the securing by a British firm of a Canadian order for twenty high-class locomotives, to be built from American designs. Hitherto the competition has been between American-built and designed locomotives and locomotives which were English both in design and construction, and the result has generally proved that British locomotive builders were rarely able to promise delivery within several weeks of the date set by their American competitors, while their engines were from 20 to 30 per cent more costly. In explanation of these differences, it has been claimed by British buillers that their engines are better constructed and contain more costly materials, and that although their first cost is greater, they are more economical in operation and considerably more durable in service. The order for the Canadian locomotives was secured in competition with American firms, and as the locomotives will be of American design, an opportunity will be presented to see whether the superior economy of operation and the greater durability of English-built locomotives are due to the design or to the workmanship. Of course, it is understood that the operative results will not absolutely settle this question, as there are liable to be various elements entering into the comparison that will prevent any conclusive deductions being made; but it is certain that after the locomotives have been delivered and been operated for a number of months, we shall know a great deal more about this vexed and very interesting question than we do just now.

## NAVAL WAR-GAME BETWEEN THE UNITED STATES AND GERMANY

In view of the rather startling developments. just now occurring in South American waters, particular interest attaches to a series of articles from the pen of Mr. Fred T. Jane, which is being published in the Scientific American Supplement. The author of these papers, who is a naval writer of world-wide repute, is the originator of the Jane Naval War-Game, which is being played extensively by the officers of the navies of the world. The object of the game is to approximate, as closely as possible, the conditions which would obtain if an engagement were carried out between the ships of two contending navies. The sphere of operations in playing the game is a large board ruled into squares representing 2,000 yards on a side and smaller squares representing 100 yards, or half a cable, on a side. This magnified checkerboard is used for the actual engagements when two hostile fleets have drawn so close together that they can be contained within the board. Preparatory to the actual conflict, strategical moves are made by each side in six-hour runs, which are carefully plotted by the rival admirals on charts, the courses followed by the opponents being compared by the umpire, who is seated at a central table. When the hostile forces approach within sighting distance, the models of the ships are transferred to the large checkerboard, which is known as the "seaboard."

The ships used in the game are accurate models of the ships of the two contending nations that are in commission when war is declared, and each vesse is maneuvered by a different player who acts as her captain throughout the war. Until the engagement begins, the admirals are allowed to give any directions they please to their captains; but after fire is opened, they may transmit signals only through the umpire, and each captain has to think for himself, and carry out his orders to the best of his ability. Firing is allowed to commence at 8,000 yards, and targets representing the actual ship to be attacked at various ranges and positions, are used. Hịts are determined by an instrument known as a "striker;" and when armor is hit, penetration depends, as in actual war, on the nature of the projectile, the range, and the angle of impact. It is claimed by the naval officers
who play the game that the actual average of hits works out very closely to actual battle results.

An interesting feature of the war-game is that, in playing it, fleets may be made up, if so desired, each of which contains vessels of different navies and widely different types; or two opposing fleets may be arranged which contain opposite types of design; or, yet again, battleships may be pitted against armored cruisers Indeed, any combination desired may be made, and valuable lessons learned as to the relative efficiency of different types and the degree to which they are likely to attain the results which were aimed at when they were designed.
Just now a very interesting "war" is being fought out by the Portsmouth (England) Naval War-Game Society between the navies of the United States and Germany. The account of the various battles of this war, illustrated with diagrams representing the positions of the ships in the various stages of the battle referred to above, is being contributed by Mr. Jane to the Scientific American, with exclusive rights in this country and in Great Britain. The first of these most interesting papers was given in the last issue of the Supplement, and they will appear in successive issues until the war is over.
Directly war broke out, both sides put all available ships in commission. As a rule, this affected the coast defense squadrons (both far removed from the scene of war) and the commerce-attack cruisers which wers destined to have an early meeting. The United States Mediterranean squadron was cabled to proceed to the Far East. The South Atlantic squadron put to sea in an endeavor to bring on an action with the Germans in those waters; while the Home fleet cruised up and down the coast awaiting developments. On the German side the first Home squadron went to Gibraltar at full speed, which it reached seven days after the breaking out of war; but by this time the United States Mediterranean fleet was well down the Red Sea. Both sides adopted somewhat similar dispositions for their cruisers. That is to say, there was but little inclination to speed them, their efforts being directed rather to hunting for hostile cruisers than to attempting action against commerce.
In the current issue of the Supplement is described a great battle of the hostile fleets which took place in mid-Atlantic, the American fleet consisting of the flagship "Olympia," the commerce destroyers "Columbia" and "Minneapolis," and the cruisers "Raleigh," "Cincinnati," "Detroit," "Marblehead" and "Mont gomery." The German fleet was made up of the flag ship "Prinz Heinrich," the "Victoria Luise," "Gefion," "A.mazone," "Thetis" and "Ariadne." The result as worked out in the game was the defeat of the American fleet, due mainly to the lack of under-water tor pedo-tubes, the "Olympia" being torpedoed and captured; the "Columbia," "Cincinnati," "Marblehead" and "Montgomery" sunk by torpedoes; the "Detroit" rendered unmanageable and captured; while the "Minneapolis" and the "Raleigh" escaped. On the German side the damages were that the flagship "Prinz Heinrich" was sunk by torpedo fire; the "Victoria Luise" badly injured by torpedoes; the "Thetis" badly raked by gun fire and scuttled by the Germans; while the "Gefion," "Amazone" and "Ariadne" were cut up by gun fire, several of their guns being put out of action. In the following issue will be a descrip tion of an indecisive battle in the Far East, where the Germans had concentrated with designs on one of the outlying islands of the Philippine group.

## THE NEW RAILROAD AND TROLLEY TUNNELS ENTERING NEW YORK.

In spite of the strenuous effort made by a certain section of the Board of Aldermen to defeat the Pennsylvania Railroad tunnel grant, the clearly expressed will of the people and the undoubted advantages to be derived from the Pennsylvania Railroad's proposal have carried this important measure through. New York city can now rest assured that before many years have elapsed, it will be in possession of a terminal station that will be commensurate with its needs and in keeping with its importance as the metropolis of the western hemisphere. It is certainly a curious anomaly that for so many years a city of the size of New York should have contained within it only one terminal station. The explanation is to be found in the peculiar geographical features of the site upon which the city has grown up. Surrounded, as it is, on three sides by the broad waters of the Hudson and East Rivers, direct communication by railroad was only possible, at least in the earlier years of railroad construction, from the north; and it was inevitable that the first railroads to enter New. York city should come in by way of the Harlem River. The East River it is true, did not present the insuperable obstacle to a railroad bridge that seemed to exist in the Hud son River to the west; but in earlier years the comparative unimportance of the Long Island Railroad precluded any serious consideration of an East River cluded any serious consideration of an East River
railroad bridge, while the travel from the New Eng-
land States by way of the New Haven Railroad obtained entry to Manhattan Island over the tracks of the New York Central Road. With the exception of the systems that use the Forty-second Street terminal, however, New York city has been practically cut off, as far as direct railroad communication is concerned, from the majority of the great railroad systems of the United States; for in spite of the fact that an excellent ferry service had grown up across the Hudson River, it is a fact that the majority of the trunk railroads that serve New York city have their terminals in another city and another State.
Within a few years' time all this will have been changed. The most progressive railroad system in America will have erected in the heart of Manhattan Island the largest railroad station in the world; the problem of railroad bridges across the Hudson and East Rivers will have been solved by the construction of a series of main-line tunnels beneath. Manhattan Island, giving a direct trunk line service between New York city and the whole of the United States, and a direct suburban service to the vast residential districts lying to the east and west of New York. The tracks will be carried in two separate 18 -foot, tube tunnels extending below Thirty-first and Thirty-second Streets until they reach Seventh Avenue, where the easterly façade of the central station will be located. Here a third track, to extend below Thirty-third Street, will be added, and the three tracks will continue across Manhattan Island under the three streets named, converging below the East River to unite in a single tunnel as they enter Long Island. The great central station with its underground yard will cover more than four large city blocks, including all the space between Tenth and Eighth Avenues and Thirty-first and Thirty-second Streets and between Eighth and Seventh Avenues and Thirty-first and Thirty-third Streets. Altogether there will be in the station 25 parallel tracks, access to which will be gained by a broad causeway, which will be approached from street surface by easy grades at either end of it. The causeway will extend entirely across and above the tracks, with easy stairways leading to the platforms. What might be called the superstructure of the station will contain the waiting rooms, baggage rooms, and general offices of the company, and its architectural features and great size are such that it will constitute one of the most imposing buildings in the city. The construction of this great engineering work, which is to cost, all told, some $\$ 50,000,000$, will be one of the most interesting works of its kind ever carried on. It will give employment to a vast army of laborers; and in this and other respects will prove of undoubted benefit to the city, even before the general public begins to appreciate the great saving of time and trouble, which will be realized from the very day that the station is open for service

Concurrently with the granting of the Pennsylvania Railroad franchise, the Board of Aldermen granted a second tunnel franchise, permitting the New York and Jersey Railroad Company to construct a large ter minal passenger station on the New York side of the North River at the foot of Christopher Street. The New York and Jersey Railroad Company was organized under the laws of the State of New York to complete the tunnel begun some years ago by the Hudson Tun nel Railway Company. At the present time more than 4,000 feet of this tunnel have been constructed from the New Jersey side, and a gap of only about 1,400 feet remains between the completed end of the tunnel and the New York shore. Active work on the tunnel has been in progress for some months under the supervision of the chief engineer, Charles M. Jacobs, who is also chief engineer for the Pennsylvania Railroad tunnel. The New York terminal station will be in the block bounded by Christopher, Greenwich and West Tenth Streets. The completed section of the tunnel begins in the yards of the Delaware, Lackawanna \& Western Railroad, and the Jersey terminus of the tunnel is close to the Erie Railroad's terminus. Probably these circumstances have given rise to the rumor-denied by the railroad companies themselves, but generally accepted by the press and the publicthat the Erie and the Delaware, Lackawanna \& Western Railroads have an understanding with the New York and Jersey Railroad Company, by which they will be enabled to run their cars through to the New York terminus. If this rumor proves to be true, the closing days of the year 1902 will have witnessed the inauguration of the most important scheme for the betterment of transportation to and from New York city in the history of the metropolis.

During August, Scotch shipbuilders launched 22 vessels, of about 46,882 tons gross, as compared with 19 vessels, of 32,022 tons gross, in July, and 23 vessels of 55,080 tons gross. in August last year. In the eight months Scotch builders have launched 198 vessels, of 338,708 tons gross, as compared with 185 vessels, of 354,826 tons gross, in the corresponding period of last year, and 321,360 tons gross in 1900.
the army signal corps.
The efficiency of the Signal Corps men in transmit ting messages along the coast during the sham war between the Army and Navy calls special attention to the development of a branch of our Army equipment which has rarely received all the attention it deserves. It was in the American armies during the war between the North and South that the telegraph was first practically applied under war conditions, and some of the experiences gained at that time have been of inestimable advantage in developing a system of telegraphic communications that would be ready for instant use. When the Spanish war broke out the ability displayed by the Signal Corps in covering the whole coast with a system of communication, which would have made it difficult for any hostile fleet to approach without detection, was remarkably grati fying to all those interested in this feature of warfare.
The technical corps of an army is always propor tionately, small, and the pay for expert electricians has never been high enough in our Army to attract the most efficient men; but through the self-sacrificing endeavor of a few men the service has been enabled to accomplish much in recent years. Unfortunately, Congress has never fally appreciated the importance of the Signal Corps, which has full charge of constructing, repairing and operating military lines, and the funds grudgingly granted for this purpose have been totally inadequate to the actual needs.
The Signal Corps of the Army divides the system of covering the country with telegraphic lines into three divisions. These are the permanent, the semi permanent, and the flying lines. The first consists of the established commercial telegraph and cable lines which the Army would use in the event of a war, and even take full possession of in an extreme emergency. The semi-permanent lines are those which have a number of stations along the coast equipped with all the necessary apparatus for communicating with other signal stations either by telegraph lines or by wireless telegraphy. The coast is divided up into sections with stations established at convenient points, which in times of peace are practically abandoned except for local watchmen whose business it is to look after the stored apparatus. Several of these stations have been equipped since the war with Spain with all the neces sary implements for immediate and practical work.
The third division of the signal system is in some respects the most important. The field or flying telegraph lines must be erected in the very field of oper ations and often in the face of the enemy's fire. The signal men who operate these must be the bravest and most efficient. The extreme outposts of the Army must be connected with headquarters by some system of signaling. The Signal Corps division in charge of this must devise some means of establishing such communication in an emergency either by laying wires, erecting temporary wireless telegraph stations, or by signaling with flags or other flying objects. In order to accomplish this quickly in the face of the approaching enemy wires must sometimes be laid on the ground or stretched across marshes and creeks and small rivers.
In all field operations the apparatus employed must be of great mechanical strength and accuracy and comparatively simple and light in weight. The field telephone has been found to be of the utmost value in this branch of the service, for messages can be communicated quicker by means of it than by telegraph, while the telephone will often work over hastily constructed wires where telegraphic messages would fail.
The modern flying telegraph and telephone wires can be constructed under ordinary conditions at the rate of one to three miles an hour. The truck $u_{\sim} \approx \mathrm{d}$ for the purpose has a field searchlight which throws a strong path of light behind or ahead to enable the workmen to see their way on the darkest nights. All complete this truck weighs but 5,300 pounds, and car ries sufficient fuel and water for two hours of steady work. A team of strong horses can drag it over an ordinary country; but in the event of the enemy approaching close to the lines, four horses would be assigned to the task to avoid any delay in crossing rough fields and marshes. Besides carrying oil for fuel and water for boiler purposes, the truck has a
complete equipment of telephone and telegraph instrucomplete equipment of te
ments, and a cable reel.
The flying field telegraph and telephone train consists of three sections, and the field searchlight trucks. Each section carries all the material and apparatus necessary to construct from fifteen to seventeen miles of line. There is the wire wagon, the lance truck, and the searchlight and generator truck. The second truck is loaded with four or five hundred lances of well-seasoned cypress or spruce, each a trifle over fourteen feet in length, crowbars, tools, rubber insulators, and similar articles. A preliminary surveying party precedes the lance truck, and pins are stuck in the ground by the surveyors to mark the places for the lances. A working party with crowbars follow next, and they
make a hole two or three feet deep in the soil at each pin mark. The lance truck comes immediately in their wake, placing the poles near the holes made with the crowbars, and attaching the insulators on the upper ends.
The wire wagon with its load of wire appears on the field at this juncture, and the workmen slip the wire into the slot insulators and raise the poles to an upright position. The battery wagon then follows equipped with a number of cells to operate the lines, and with a supply of the various types of field telephone and telegraph apparatus. If the line is to be a permanent one more care is exercised in making the work of a substantial nature, and sometimes a second working division follows to improve and amplify the work of the first flying division. Operating stations are established at certain points, and skilled operators are in constant communication with the first end of the newly-laid line, which may in a short time be at tacked and destroyed by the approaching enemy. Consequently as fast as the line is laid communication is established and the head division knows exactly what it taking place at the other end and all along the line. The constructing of such a flying. line is one of the most interesting and dangerous clässes of work that mechanics and electricians can undertake in war time. The enemy is equally alert to the value of such established communication, and scouting parties are sent out ahead to destroy the lines. Often the telegraph operators and electricians must be prepared to defend themselves and their work. Consequently the army electrician and operator is a fighter as well as a mechanical expert. He must enlist as a soldier and become proficient in the use of small arms and military drills and tactics. Where the conditions are peculiarly dangerous, a squad of soldiers follows in the rear of the Signal Corps men to protect them from an attack by the advancing enemy, and the electricians often work away at their appointed task while skirmishing battles are going on all around them. They only drop their tools to take a hand in the conflict when matters get a trifle too warm for the soldiers, and their protecting escort appears to be retreating before an overwhelming number of the enemy.
During our campaign in the Philippine Islands the field telegraph and telephone workmen performed excellent work along the line described, and as fast as the Army invaded new territory, following after the fleeing enemy, the electricians strung their wires over the ground or attached them to trees or insulated lances. They had difficult problems to solve in many parts of the country, for the land alternated between low marshy meadows, thick tropical jungles and rough mountainous country. But through all kinds of scenery and climate the Signal Corps men persistently pushed their way, keeping the rear of the advancing army in touch with headquarters. With the exception of only a few picked bodies of men who went in search of Aguinaldo, the advancing columns never once got far out of touch with the main division, so efficient were the flying telegraph corps of men in establishing lines of communication.
G. E. W.

## TO OUR SUBSCRIBERS.

This is the last issue of the -year-the fifty-seventh of the Scientific American's life. Since the subscription of many a subscriber expires with the present number, it will not be amiss to call attention to the fact that the sending of the paper will be discontinued if the subscription be not renewed. In order to avoid any interruption in the receipt of the paper, subscriptions should be renewed before the publication of the next issue. To those who are not familiar with the Supplement a word may not be out of place.
The Supplement contains articles too long for inserThe Supplement contains articles too long for insertion in the Scientific American, as well as translations from foreign periodicals, the information contained in which would otherwise be inaccessible. By taking the Scientific American and Supplement the subscriber receives the benefit of a reduction in the subscription price.

## EUROPEAN SALE OF pUPIN'S TELEPHONE PATENTS.

It is said that Prof. Michael Pupin has sold the European patent rights of his invention for the transmission of telephone messages over long cables to the firm of Siemens \& Halske of Berlin. Whether any reliance is to be placed upon the report that he received a half million dollars from the firm for the exclusive European rights cannot be ascertained. No doubt the patents were bought for a large sum. Pupin's system has been exhaustively described in the columns of the Scientific American. The repor made to the firm by its engineer states:
"The experimental tests demonstrate that the insertion of inductance coils into long distance telephonic conductors, in accordance with Pupin's invention, en ables us to obtain in practice the enormous effects required, and that long distance telephony actually
encers into a new area of development. The problem of transatlantic telephony has become through this invention a possibility, even if the cost of a suitable submarine cable might still be too high and the technical difficulties accompanying the manufacture and laying of a submarine cable with coils in great submarine depths might be considered as exceptionally serious.
"The manufacture and laying of Pupin's cables in the less considerable depths of the Mediterranean, the North Sea and the Baltic offer no difficulty whatever, so that there is nothing in the way of establishing direct telephonic communication between Ber-lin-London, Berlin-Copenhagen-Stockholm, etc."

## SCIENCE NOTES

Some two years ago, while tending the roots of the vines in a vineyard at Attenburg, Lower Austria, a gardener unearthed the lower jaws and upper molars of a gigantic animal, presumably a rhinoceros, which were taken to the high school at Vienna for further investigation. Prof. Toula closely examined the relics, and recognized from the structure of the teeth that the remains were not those of the ordinary wooly rhinoceros. He immediately repaired to the vineyard, where he continued excavations at the point where the skull was disinterred, and discovered practically the whole of the skeleton of this interesting animal, which has now been mounted. Although a portion of the skull is missing, there is sufficient to show that the beast was of the two-horned species found in Sumatra. The breccia where the skeleton was found is of the Pleistocene age. It also contained the remains of a goat.

Prof. A. L. Rotch, of the Blue Hill Meteorological Observatory, intends to explore the upper regions of the air above the equator by means of kites and balloons sent up from ocean steamers. In this manner Prof. Rotch hopes to study the overlẏing and antitrade winds and to make a map of their course. It is only on the peak of Teneriffe that the anti-trade winds can be observed the whole year. Their mean lower limit is at the height of 9,000 feet, and their height is greater in summer than in winter. In October this altitude sinks to 6,000 feet. We know that the antitrade exists over the trades, at least in the North Atlantic and at the Sandwich Islands, but no one has found this upper current in Central America or in Ecuador, while the smoke of the highest volcanoes around Quito constantly indicates a strong wind from the east. It remains to be seen whether kites or balloons sent up from ocean-going steamers will add something to our very limited knowledge of the antitrades.
At the recent annual congress of the Swiss Society of Natural Sciences, held at Berne, a new and interesting theory as to the origin of the appearance of the higher atmosphere, which is popularly styled as the "blue sky," was advanced by M. Spring, a well-known scientist of Liege. Hitherto the azure tint has been supposed to be due to the refraction of light upon minute corpuscles disseminated in the air. M. Spring, however, has conceived a new explanation of the phenomenon. He has carried out à number of experiments with luminous rays under almost all conceivable conditions, injecting them into agitated solutions, and into a glass tube, containing pseude solutions such as chloride of aluminium of absolute limpidity; but although he could obtain red, yellow, violet, etc., under no circumstances could he obtain blue, until by the use of electricity he secured a perfectly pure atmosphere in which blue was clearly discernible. M. Spring therefore concludes that the blue of the sky is purely electrical in origin, and is an essential quality of the air.
Mr. Oscar Neumann, the well-known explorer, has delivered a lecture before the Royal Geographical Society of Great Britain dealing with his journey from the Somali coast to the Soudan through southern Abyssinia. He was accompanied on the expedition by Baron Von Erlanger and Dr. Ellenbeck. The journey was of great scientific value. The party discovered several fossils of Upper Jurassic strata (north of the Wabi), and still more that of cretaceous strata in the Gillet Mountàins. They found that the belt of country from Abulkasim and Abu Nas to the Blue Nile, and the headstreams of the Sobat, consists for the most part of tertiary volcanic rocks, the date of the formation of the rift valley -formerly occupied in its northern parts by a great lake basin, as is shown by mollusks found on the Suhsuk River-belonging also probably to the tertiary period. Between Zeila and Addis Abbeba. Dr. Ellenbeck made a collection of some 2,500 botanic specimens, and after separating from the rest of the party Mr. Neumann obtained some 200 plants. The zoological collections are the largest that have ever come to Europe from Africa at one time. Mr. Neumann's collection includes 1,000 specimens of mammals, 1,300 of birds, 30,000 of insects, 2,000 mollusca, besides reptiles, fishes, etc. Twelve new mammals and ten birds were discovered.

Care of Automobile Tires.
Some automobilists complain of continual ill luck with tires, while their friends, using the same makes, will have practically no trouble. The apparent discrepancy is not due to any difference in the quality of the tires, but to the amount of care which they receive The average motor car driver or mechanic will too often attend to every part of the vehicle but the tires. These he will neglect to keep thoroughly inflated, and perfectly clean, so that mud gets in between the tire and the rim and dries there. This rusts the rim and crowds the tire, while if not kept inflated the tire becomes rim worn and the rim is injured by striking stones and other obstructions. An official of one of the tire manufacturing companies is responsible for the statement that if several wellknown automobilists should purchase tires of the same make for identical vehicles, he could foretell
almost exactly how long each set would last, on ac count of his knowledge of the care which the respective cars would receive.-N. Y. Times.

## A GERMAN AMBULANCE TRAIN

Although it is impossible altogether to prevent rail way accidents, it seems at least that something can be done to relieve the sufferings of those who have been injured. Both in America and in Germany, ambulance trains are now in use, which are kept ever ready to be sent out for the purpose of affording speedy relief to the maimed.

The ambulance train of which we present illustrations may well be considered a typical example of what has been done abroad. The train, so far as its narrow limits permit, is as admirably equipped as any modern hospital; its operating-room is fitted up with an operating table, with all the necessary appliances of antiseptic surgery. The ward of this hospital on wheels has eight removable beds, which can be used as litters
tanks are filled, and the railroad surgeons-who live in the vicinity of the stations-are called by telephone.

Even the fast limited trains must give way to the surgeons, and are sidetracked in order that the am bulance may speed to the scene of the accident

The admirable system which has been devised ren-


## a GERMAN AMBULANCE TRAIN

ders it possible for the surgeons to reach the injured within half an hour after they have been informed of the accident.

An interesting project for the purpose of facilitat ing and developing communication between England and the Continent of Europe is in contemplation. The scheme is to substitute a service of ferries, such as are used in Denmark, in lieu of the present steamboat service between Dover and Calais. The distance from the former to the latter port is 21 miles; and although the form is the latter port is miles and the sea is at times very rough, owing to the meetin f the waters of the North Sea and the English Chan nel, it is not more so than the Danish waters where the ferries ply, notably between Malmö and Copenhagen, a distance of 16 miles. A commission, com posed of English and French engineers, has been investigating the Danish systems and their ferries, and it is stated that one of the Danish boats is to be loaned for the purpose of experiment between Dover and
success in Denmark, so much so, that twenty ferry steamers are now in operation. The vessels are about 300 feet long-approximately the same size as the new turbine steamers now under construction for the DoverCalais route-and are very similar in design to the ordinary screw steamer except so far as concerns the internal arrangements, where provision is made for the accommoda tion of a complete train of railroad cars. There are two new boats in course of construction for the Danish ferry service, which are to have a speed of 18 knots per hour, so that they compare very fa vorably on this point with the orthodox steamships. If the ex periment with the Danish ferry steamers prove successful be tween Dover and Calais, the ferry steamers for this route will in all probability be equipped with steam turbines.

So much is said nowadays on both sides of the Atlantic about the decadence of British shipping that the recent re turns for 1901 issued by the British Board of Trade are interesting reading. According to this government return, British shipping trade with this country last year aggregated $14,426,108$ tons, of which $12,626,874$ tons were British bottoms and only 479,46 tons American. The whole foreign trade of the United States was represented by a tonnage of $49,680,318$, ot which 54.4 per cent was British and only 16.1 per cent United States. British shipping on the register was $9,608,420$ tons, while the tonnage of this country registered for over-sea trade was 889,129 , but there was in addition, $4,635,089$ tons employed upon the rivers, lakes and coasts. The British advantage was stil greater if steam tonnage only be considered, $7,617,793$ tons for Great Britain, against $2,920,953$ tons for the United States. Moreover, the United Kingdom added 773,017 tons to the register, while the United States added only 483,489 tons. The American increase how ever, has doubled during the past four years. Further


INTERIOR OF HOSPITAL CAR.


OPERATING TABLE.
f need be. Reclining-chairs complete the furniture of the ward.

Every German railroad line has a certain number of these ambulance trains, the road being divided into sections and a train assigned to each. Trains are always sidetracked at a station, ready to be sent out. As soon as news of an accident is received, the water

Calais, to determine if a similar scheme is feasible at this point. The object of such a system would be to run the trains on and off the ferries at the landing stage onto the railroad tracks, thus dispensing with the necessity of embarking and disembarking, by which means great economy in time and trouble would be effected. This system of ferrying has proved a great
more, Great Britain built 207,452 tons for foreigners the United States built only 14,567 tons.

The new power plant on the American side of the Saulte Ste. Marie is rapidly progressing. It will be much larger in every particular than the plant on the Canadian side.

MACHINE FOR REMOVING AND DISPOSING OF SNOW.
While the problem of expeditiously removing snow from our city streets without seriously interfering with traffic is apparent to all, we venture to state that few people realize the seriousness of another problem which confronts the Street-cleaning Department, namely, the disposal of snow thus accumulated. m fall of but a few inches amounts to an astonishing figure when multiplied by the street area of a large city, and the snow gathered must often be carted immense distances before a dumping ground of sufficient capacity can be reached.
An improved method of surmounting these difficulties is afforded by the machine illustrated herewith, which is designed to scrape up the snow from the pavement and at the same time recluce it to water which flows off into the sewers To this end the machine comprises a furnace or heater of peculiar shape mounted to swing between the side rails of the frame. The forward portion of this heater is inclined downward and terminates in a shoe or scraper adapted to scrape up the snow as the shoe is drawn along. The shoe may be raised, when desired to prevent it from engaging with the ground, by means of a lever adjacent to the driver's seat and having suitable connection with the forward end of the furnace The smokestacks shown communicate with the for ward end of the furnace
and a forced draft is provided by means of blowers having pipes leading to the ashpit. The snow scraped up onto the shoe is carried along the inclined sur face of the furnace by an endless conveyer, and coming thus in contact with the heated surface is immediately melted. The endless conveyers and blow ers are operated by chain and sprocket connections with the rear wheels of the machine. Above the con veyer is a coal bin from which a chute leads rear ward and is inclined downward, so that the coal may pass to the rear platform when the fireman opens the gate at the end of the shoe. Mr. Jacob Mandrey of Wakefield, N. Y., is the inventor of this machine

## ELECTRO-MAGNETIC ROTATIONS <br> by howard b. dalley

There is nothing that so adds to the fascination of the study of physical science as an easily tried experiment. Those presented here, illustrating some of the rotational features of electro-magnetism, besides being of great historic interest, are of special value as aids in elementary study in that department of electro-dynamics dealing with the singuiar natural tendency of electric currents to move across the lines of force of a magnetic field. In 1821 in a series of brilliant experiments in which the illustrious Fara day showed the rotation of a current-bearing conductor round a magnetic pole, with its antithesis, the movement of a magnet round an electrical current, occurred the first utilization of this curious physical principle for the accomplishment of rotary mechanical motion; and in the beautifully ingenious forms of illustrative apparatus employed by him are to be recog. nized the earliest true examples of electric motors known-the embryonic prototypes of that most valuable and indispensable of mechanical appliances, the perfected modern motor, whose presen ${ }^{\text {i }}$ universal adaptation to the countless uses of the mechanic arts testifies to the immense importance of this great contribution to electrical science. The first figure shows a sim-

ig. 1.-SIMPLE ELECTROMAGNETIC ROTATOR.


## MACHINE FOR MELTING AND REMOVING SNOW.

round steel eight inches high are wired into electrical communication at their lower ends, and placed within a tall glass tumbler, the magnet upright in the center, and the carbon against the side of the glass, both being fixed in position with paraffine melted and poured into a depth sufficient to entirely cover


Fig 4.-ROTATION OF CURRENT-BEARING CONDUCTORS AROUND A MAGNETIC POLE
all the metallic connection. To give the magnet a firm anchorage in the wax, a piece of sheet metal about the size of an old-fashioned penny is drilled through its middle and forced onto the magnet's
ple method of demonstrating the phenomenon of current rotation round a magnetic pole. The apparatus is constructed from easily procurable materials, and has the advantage of comprising within ilself the voltaic combination for producing the necessary electric current. A plate of carbon from an old dry battery, and a permanent bar magnet of quarter-inch
lower end and soldered fast. To insure the perfect flow of the wax about the bases of carbon and magnet the operation of pouring should be done with the tumbler standing in a bath of hot water. A strip of sheet zinc one-fourth of an inch wide, shaped like an inverted $U$, with its two parallel legs about elevensixteenths of an inch apart has soldered in the middle of its bend a stiff sewing needle, its point extending downward about threefourths of an inch and turning freely in a small indentation made in the end of the magnet before tempering. To insure good electrical contact here the needle sets in a small mercury cup formed with a short piece of rubber tubing on the magnet's upper end, care being taken to have the latter and the pivot point bright and clean. Bichromate battery fluid is now poured into the tumbler until its surface reaches a little more than midway between the magnet's two poles, immersing the ends of the zinc to a depth of about an inch, the fluid being prevented from touching the magnet by a covering of snugly fitting rubber tubing extending well down into the wax. It is evident that the arrangement forms a galvanic cell with a part of its closed circuit (the zinc) freely movable. As the poised strip with its current is well within the influence of the magnet's upper pole, it sets up a upper pole, it sets up a
vigorous rotation about it in a direction depending upon which pole is uppermost. By using a larger containing vessel and two magnets with opposite poles above the fiuid, both right and left handed rotations can be shown at once. After some hours running the ends of the zinc will have been eaten off by the acid; if, then, the instrument be desired for further use, new ends having some length so that they can be pushed down as they waste away may be bound on with small rubber bands.
To one having knowledge of the general significance of the term "Lines of Force," and of the methods of demonstrating their existence and action, the rationale of this class of phenomena is not difficult. In the diagram, $A$ (Fig. 4), we may regard $m$ and $w$ as indicating respectively transverse sections of a bar magnet near one of its poles, and of a conducting wire with axis parallel with that of the magnet, the radial-arrow-directed lines representing the normal symmetrical arrangement of the lines of force in the magnetic field, when uninfluenced by the existence of any current in $w$. If, however, we start a flow of electricity through $w$, the conductor becomes the center of a system of lines of its own, which, however, unlike those of the magnet, arrange themselves in concentric circles surrounding the conductor throughout its whole length, these having
either a right or lefthanded directional sense, according as the current passe up or down in the passes up or down in the wire. They are shown
right-handed in $B$ which represents in a general way the distorted condition of the field which their presence induces. In obedience to Faraday's well-known laws of elec-tro-dynamic action by which lines running in like directions mutually repel, while those having contrary directional paths attract, and where near enough together tend to merge into one another we find the magnet's lines at the left of $w$ bending away and avoiding the wire, because of the sim ilar direction of its own circtlar lines on that side, as shown by the arrow points. At the right


Fig. 2.-REVERSIBLE ROTATOR.


Fig. 3.-ELECTRIC ROTATOR WITH
however, the two systems of lines are running in opposite directions, resulting in mutual attraction, with the coalescence of those of the two sets of lines lying nearest together. Since the magnet's displaced lines are endowed with a sort of elastic tendency to restore themselves to their normal position, those at the left must tend to push, and those at the right to pull the conductor round in the direction of $a$. On reversing the magnet's poles rotation to the left occurs. The reason is easily understood when we remember that lines of force emerging from one pole of a straight magnet, after a curved passage through surrounding space, re-enter the magnet at its opposite end; hence, if we would indicate $m$ with poles re versed, the arrow-heads on its lines should all point inward, giving a condition exactly the opposite of that illustrated, $w$ being now driven to the left. Or again, left-handed rotation ensues on simply reversing the current in $w$ (which would be indicated by reversed arrow-heads on the circles), thus again reversing the directional relation between the two systems of lines. To Dr. Silvanus P. Thompson we are indebted for some striking experimental verifications of the established theories of these phenomena, his beautiful graphic demonstrations obtained by the iron filings method of electro-dynamic observation being of great educational value.*

A neat rotator, convenient for permanent laboratory or lecture table use, is shown in Fig. 2. In this instrument a round magnet of three-eighths-inch steel, eight inches high, carrying at its middle a metallic mercury cup, supports a revolving rect angularly shaped brass wire frame which turns on a mercury-surrounded needle point as in the preceding experiment, the needle being steadied at its upper end in a bearing in the extremity of a horizontal arm at the top of a suitable supporting standard. The open lower end of the frame terminates in two fine points that just graze the surface of the mercury in the lower cup. To prevent the mercury from touching the cup or that part of the magnet within it, the latter ar covered thickly with shellac or paraffine. By a wire passing through a small vulcanite bushing in the side of the cup, the mercury is electrically connected with one of the binding posts on the base, the othe post being wired directly to the base of the magnet By changing in the posts the wires from the single cell of dry battery which runs the apparatus the effect of current reversals can be conveniently studied
The rotation of a magnetic pole round an electri current is easily exhibited with the simple arrange ment illustrated in Fig. 3. A pair of arc light car bons nine inches long fixed in paraffine within an ordinary tumbler are joined at their tops with a copper wire from which hangs by a hooked conducting rod a short piece of round Leclanché battery zinc, threeeighths of an inch in diameter. A four-inch length of fine knitting needle strongly magnetized has upon it a little nearer one end than the other a cylindrical cork float half an inch in diameter, its length made as short as is consistent with an ability to support the needle with its upper end about seven-eighths of an inch above the bichromate solution which fills the glass. The zinc, which should not be over an inch in length, should be brought as near as possible to the surface of the liquid without touching the lower end of the cork when the latter and the zinc hanger ar in contact, the important object being to get as much vertical distance as possible between the lower end of zinc and magnets. The zinc hanger, down to where it joins the zinc, and the needle with its floa are protected from chemical action by being dipped for an instant in melted beeswax. When placed in the tumbler near the central wire the magnet is ttracted to it and swims round it continuously in a direction determined by the polarity of the magnet's upper end. Two needles oppositely magnetized ca hus be used to show right and left-hand rotations As the cork must roll against the wire in its orbital movement, it should be made as smooth and truly cylindrical as possible.

The Scientific American in a Kipling Story.
There is nothing so inspiring to an American abroad, particularly if he be living in some neglected corner of the earth, as the sight of a fellow country man, or even some American-made article bringing with it vivid recollections of the dear old country and the former happy days. Such a scene is cleverly pre sented by Rudyard Kipling in "The Captive," whic appeared in a recent number of Collier's Weekly. In this story we are gratified to find that the object which brings cheer to the heart of a lonely and unfortunate American is a copy of the Scientific Ameri can. The character represented is an inventor who in order to exhibit and test his new patent automatic field gun, has taken part in the Boer war. Unluckily being on the losing side, he is taken captive by the

* For an interesting review of Dr Thompon's experiments with
numerous photogranhic illustrations of iron filings "autograhs " of the numerous photogranhic illustrations of iron filings aatogranhs of
linee of crice, showing their behavior under a great variety of condition
the reader is referred to SciENTIFIC AMERICAN SUPLEMENT No. 161.

British, and is found by a visitor in one of the prison camps. Uncommunicative at first, the American immediately breaks his reserve upon hearing the rattle of a newspaper wrapper. His excitement grows when he observes the New. York postmark and sees that it is the-"Yes! The Scientific American. Oh, it's good! Can I keep it? I thank you, I thank you." Fiction though this be, the fact of the matter is that the Scientific American brings cheer to American hearts in every quarter of the globe, keeping our countrymen, the world over, in touch with the advances in practical science for which America is justly famous.

## Foot and Mouth Disease.

by r. l. adams.
The disease which has broken out in Massachusetts, especially in the vicinity of Boston, known as the foot and mouth disease (Epizootic Aphtha), is not new to this country. Thirty years ago it caused considerable havoc in Massachusetts, New York, and Connecticut, as well as in Canada. It was finally suppressed and exterminated, at a cost of $\$ 3,000$, and until a few weeks ago not a single case had been reported in the United States since.

The germs which spread the disease in this last case-first found in Brighton Stock Yards, Brighton Mass., a few weeks since-may have been brought over from Scotland fens, or some districts of France or from some foreign country where the disease is prevalent, on some traveler's clothes who had visited one of these places and inspected the live stock, or on the straw or hay packed around articles imported from them. The second herd found with the disease was in Dedham, Mass., and the herd here had. contracted.the disease from a cow bought at an auction in Concord. The cow proved to be lame, and so it was sent back, but too late to prevent the intro duction of the disease and its spreading to the herd. From these places the disease spread rapidly to other places, and there is danger of its spreading still further.
The disease is propagated by germs and is highly contagious. Persons can carry the germs on their clothing or shoes, dogs can transport them, and they can be taken into the systems of a healthy herd which passes over the same road that a sick animal passed over a few hours previous. Cattle are not the only animals subject to it, for it is contracted by sheep, swine, horses, poultry, and sometimes by man. In the latter it comes from drinking the milk or eat ing the flesh of infected animals, and sometime by coming in contact with the sores; for instance the hands coming in contact with the sores on the teats, while milking. The disease has the nature o an eruptive fever, which is easily recognized by the symptoms, consisting of a higher temperature in the mouth, bleeding teats, an erect coat, loss of appetite and the secretion of "ropy" saliva. Little blisters, about one-half inch in diameter, form in the mouth and various other parts of the body, as on the teats The animal drivels, and in walking around treads on this saliva, in which the virus obtained foothold when the blisters broke, and gets the sores in his hoofs. The irritation caused by the sores causes the animal to lie down, so that he gets the sores on vari ous other parts of his body. In two or three days the blisters grow ripe, break, and discharge their contents. If a number of these occur in one place, it makes a raw spot and is very irritating. The disease runs its course in ten or fifteen days, and the animal gets well in the majority of cases, although it some times proves fatal.

As the germs are carried only on solid matter, no persons are allowed near infected places; and if caught are liable to arrest. Fifty thousand dollärs has been appropriated to exterminate the disease and with such competent men as we have in charge it will probably be stamped out in a few weeks. Iso lated herds will probably be bought and killed, while communities infected with it will be quarantined and traffic stopped. At present Portland is the only ex porting place in New England doing business, for Maine and Connecticut are the only States in New England free from the disease.

With the breaking of a bottle of champagne over the shore end, the landing of the Pacific cable was cele brated on December 14. The landing and splicing of the cable which is to connect the mainland with Honolulu was effected without accident, and was wit nessed by about 40,000 persons. The work of hauling in the cable was done so expeditiously that the offi cials arrived on the beach only two minutes befor the cable. When the splicing was completed late in the afternoon, horses were hitched to the end, and the cable was hauled through a conduit to the cable station. At the same time a steamer put orrt to sea ive miles, and anchored the cable with ballonn buoys the end was then taken up by a cable steamer an taken aboard. The splicing to the main body was completed during the night.

## (raxiexphondente.

## How to Waterproof Boots at Home

To the Editor of the Scientific American. paper who are like myselif obliged to do outdoor work during all seasons of the year, and particularly during the winter, when footwear, absolutely waterproof, is of the greatest importance to ward off colds, etc., I have for the last five years used successfully a dressing for leather boots and shoes, composed of oil and India rubber, keeping out moisture and uninjurious to the leather applied, leaving same soft. and pliable. To prepare same, heat in an iron vessel either fish oil, castor oil, or even tallow to about 250 deg. F., then add, cut into small pieces, vulcanized or raw India rubber, about 1-5 of the weight of the oil, gradually stirring the same with a wooden spatula until the rubber is completely dissolved in the oil; lastly, add to give it color a small amount of printer's ink. Pour into a suitable vessel and let cool. One or two applications of this are sufficient to thoroughly waterproof a pair of boots or shoes for a season. Boots or shoes thus dressed will take common shoe blacking with the greatest facility.

Charles F. Miller.
Kansas City, Mo., November 5, 1902.

## The Keosauqua, Iova, water Power

the Editor of the Scientific American:
In the revival of the use of water power, which is now used almost exclusively where it can be procured for the manufacture of electricity for commercial purposes, all available water power should be located. There is an undeveloped water power of no mean importance at Keosauqua, Van Buren County, Iowa, forty-five miles above Keokuk at the great bend in the Des Moines River, which at that point is seven hundred feet wide, and in the lowest stage of water at the rapids is five hundred feẹt wide, with an average depth of sixteen inches, and at the time of extreme high water the river rises only eighteen feet above low-water mark. It is twelve miles around the bend, and the natural fall is thirty feet. The water power can be developed by building a ten-foot dam across the river at the be ginning of the bend, and cutting a canal across the bend for a distance of a little less than two miles, the deepest cutting of which would be sixty-five feet, and the average cutting. would be thirty-five feet for the entire distance, which would give a fall of forty feet.
This water power has been surveyed by competent engineers, and would have been developed before this, but for local causes, which are now entirely removed. The natural conditions are favorable for the use of water power, and there is plenty of stone of a su perior quality
There is no question but what the entire power can be utilized as soon as developed, as there are a number of manufacturing concerns who are now using steam. Besides, the people of Iowa are just beginning to build interurban electric railway lines, and can use this power by transmission.

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W. A. Duckworth
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Keosauqua, Iowa, October 18, 1902.

## The Use of Eyeglasses in schoolroom

To the Editor of the Scientific American
If one is familiar with the work of school children. stenographers, bookkeepers and copyists, he cannot fail to notice that a large proportion of these are wearing glasses before their time. Excessive use of eyes in ill-lighted rooms or in artificial light, is partly responsibie for this, but another cause seems to be generally overlooked, namely, the horizontal position of the books and papers they use. In such position nothing is in focus, and there is a constant strain of the eyes, in the oblique view they get of printed or written page.
The remedy is simple and obvious. Books and papers should be supported in front of the user. Mu sicians understand this, and support their music on a music rack to the relief of the eyes and shoulders When others adopt this plan, oculists will still have enough to tax their best skill and effort, but many will defer the use of glasses to mature age.

Joseph Dana Bartlett
Burlington, Vt.

## Marconi Cape Cod Towers.

On the bluff back of Cape Cod, four 250 -foot tower have been built for Marconi. The work of construc tion has been going on for about ten months. The arrival of Marconi at Cape Cod will doubtless mark the beginning of noteworthy experiments. The action of the Italian government in sending the "Carlo Alberto" to Venezuela places Marconi in a most awkward position. He had intended to carry on off-shore experi ments in the ship. Now he must abandon work for the time being at least.

## THOMAS ALVA EDISON

With the commercial introduction of a radically new type of storage battery, public attention is again drawn to the man who has done more than any other in our time to apply electricity to the needs of every-day life There is not an electrical instrument, or an electrica process now in use, but bears the mark of some great change wrought by the most ingenious of Americans.

Some brief account of Thomas A. Edison, as an in ventor and as a man, may not be without interest to the readers of a journal, many of whom are them selves inventors. To those who believe that Edison's work is the product of an inspiration given by natur to but few, the story of the manner in which he achieves success will seem shockingly unromantic. In the genius who works by inspiration Edison has no great faith. "Genius is two per cent inspiration anc ninety-eight per cent perspiration," is the incisive, epigrammatic answer he once gave to a man who though that a genius worked only when the spirit moved him. Yet it must not be supposed that Edison is deficient in imagination. Every great inventor must have some thing of the poet in him; for without a most lively fancy, he could never see the possibilities of his own creation

If the limits of this article permitted a discussion of Edison's numerous inventions, the characteristic of commercial utility would be found common to them all. Not being given to scientific rhapsodies, Edison does not concern himself with what may be of service a century hence; he confines himself rigorously to the needs of the present

Knowing full well that he is probably not the first who has set for himself the task in the performance o which he is engaged, he reads all that is pertinent to his subject in the vast library which forms an important adjunct of his laboratory. Not content .with the information gathered from his own shelves, his literary agent is ordered to send him more. If one were to examine a certain revolving bookcase in Edison's study at home, one could foretell what electrical problem is soon to be solved in the Orange laboratory or in that case are always contained the volume which interest him most at the time
After a thorough review of his subject, Edison be gins laboratory work-an expert keenıy alive to the failures of his predecessors, careful to avoid useless repetitions of old experiments. It is now that the two per cent inspiration gained by exhaustive reading, and the ninety-eight per cent perspiration which he is ready to expend, are applied. Experiments are made; not a few, but hundreds and even thousands. Mode after model is built. Failure upon failure is met with until further effort seems hopeless. Undismayed, Edison performs more experiments, builds more models. Failure spurs him on. At last an experiment is per formed or a model made which gives faint encourage ment. So far from being elated, he regards the promis ng result with great suspicion. The failures have been oo many; the apparent success after all may be due to an accidental combination of circumstances that may never occur again. Only after the partial triumph has been confirmed by many trials does complete assurance come
If ever an Edison invention was a product of infinite pains and unflagging pertinacity, it was the electric incandescent lamp. He had read all that could be read of the labors of others to provide a more efficient light He knew of Starr's work in England and of Draper's n New York with the platinum wire. He had studie what Despretz had done with sticks of incandescen arbon contained in a glass globe exhausted of air and filled with nitrogen. He knew all that was worth knowing of illumination by means of incandescent carbon inclosed in a vacuum. Then he set his wits at work to find out why everyone had failed. Early in the spring of 1877 he began to experiment. First he thought that a carbon filament might be made out of cotton thread. Five hours were spent in carbonizing a thread. The frail black filament obtained crumbled at the touch. Attempt after attempt proved hopeless. At last a carbonized thread was rescued intact from the furnace; and that, as bad luck would have it, broke in the mounting. For days no further progress was made. He locked himself and his assistants in his laboratory, vowing that neither he nor they should open its doors until he had produced an operative in candescent lamp. After repeated mishaps and in cessant testing, a lamp was completed which burned for days before its light expired. . Then, and not until then, did he and his laboratory assistants rest. Every imaginable substance was now tried in the effort to devise a perfect filament-iridium, platinum and all the metals, threads rubbed with coal tar, plumbago, South American fibers, monkey;bast fiber, Manila hemp, wouth American bast, whitewood, palm leat, paper of all kinds, jute, cardboard, bamboo, and a hust of other substances. After thousands of tissues and threads had been tried, it was finally determined that egetable fibers produced the best filaments.
He had now to determine what vegetable fiber best
suited his purpose. A man was dispatched to China and Japan with orders to test the native bamboos. An other explored the Amazon for fibers, suffering untold hardships and tasting no meat for a hundred and sixteen days. A third was sent around the world, with instructions to search Ceylon in particular, from the north to the south and from the east to the west. The whole globe was scoured. Finally the explorers brought back some eighty varieties of bamboo and three thousand specimens of vegetable fibers. Of all these, only three or four were found available.
Trial after trial was made to determine what shape of bulb should be adopted; what particular quality of glass should be used; what was the most effective way of exhausting the air, and what was the simplest method of sealing the bulb. And even after these tasks had been performed, it was necessary to devise a means of generating a current of the proper character.

In all this there is no guesising, no trusting to luck. Edison knows exactly what he wishes to accomplish, and how his end is to be attained. Absolute certainty of purpose and of method saves him from frittering away his time in useless experimentation. Chance has given perhaps an occasional idea, but it has not light ened his work. A device, whose invention he himself has attributed to accident, is the phonograph. He had taken out a patent on a telegraph repeater, in which a chisel-shaped stylus indented a sheet of paper curled around a cylinder. These indented marks were to be used in retransmitting the recorded message. "While singing into the mouthpiece of a telephone, the vibra tions of the voice sent the fine metal point. into my fin ger," he tells us. "That set me to thinking. If I could record the movements of the point and send it over the same surface afterward, I saw no reason why the thing would not talk. I tried the experiment first on a strip of telegraph paper. I shouted 'Hello! hello!' into the mouthpiece, ran the paper back over the steel point and heard a faint 'Hello! hello!' in return." Then he decided to make a talking-machine. The men in the laboratory laughed at him. In the end he prove that he was right.
When the first operative phonograph was completed, Edison packed up his instrument and came to the office of the Scientific American. Without ceremony he placed the machine on the Editor's desk and turned the crank. The machine introduced itself. "Good morn ing," it said. "How do you do? How do you like the phonograph?" And thus it happened that the Editors of the Scientific American constituted the first public audience that ever listened to the phonograph
The story of the incandescent lamp is repeated in Edison's invention of a method of electro-magneti cally concentrating ores. The system has been so full described in these columns that a detailed description is hardly necessary
About the latter part of 1897 Edison devoted his ex clusive attention to the invention of a new storag battery, on which problem he had been engaged for some five years. For over a year he worked harde than a day laborer. He was at his laboratory at half past seven in the morning. His luncheon was sent to him. In the evening he left for dinner, but returned at eight. At half-past eleven at night his carriage called for him; but often the coachman had to wait for three or four hours until the inventor came out of his laboratory. Yet despite all this labor, no apparent progress was made for months.
When vacation time comes, and with it a chance to eave his laboratory, Edison plays just as he works, with his whole heart and soul. He will hear nothing of business. Science is thrown to the winds. Letter sent to him from the works are utterly disregarded Only a telegram of the most imperative nature wil command his attention. And so it is with the little relaxation which he permits himself during his work His hours of rest are few; yet his short sleep is sounder and more refreshing than that of many whose enterprises are of less pith and moment.
Of Edison's personality much might be written When you meet him for the first time, you feel im mediately at your ease-he is so unaffected and cordial Then, if you are a newspaper man, you begin to study him out of the tail-of your eye. He is neither tall nor hort, stout nor thin. His white hair makes him seem older than he really is; he is only fifty-six. His face is clean shaven--the mouth firm, the chin strong. In his dress he is careless to a degree. If you are for tunate enough to have him pilot you through his labo atory, you will find it no easy matter to keep up with his quick step. He is nervously active; everything he does is done quickly, yet not hastily. He explains things tersely and clearly. You talk to him; you notice that he is somewhat deaf, and you wonder wh his man of all men, should not resort to some inven tion that will enable him to hear better. But he looks pon his deafness not as a misfortune. Eminent secialists have told him that he can be cured; but he has assured them that he prefers not to be treated arguing shrewdly that if he could hear the noises
which have been so long muffled, he might find it more difficult to concentrate his mind on his work.
Some day a patient Boswell will lovingly intersperse in the chronicle of Edison's life-work many a tale of his delicate sense of humor. If there is one thing that Edison loves, it is a rollicking story. Many a black hour in the laboratory has been brightened for his assistants by his keen wit and sparkling repartee. Ocsionally the outer world hears his scientific opinion expressed in some playful sarcasm. When asked once by a New York State official what was the best method of electrocuting murderers, he gave vent to his deeprooted opposition to capital punishment in the bantering retort, "Hire out your criminals as linemen to the New York electric lighting companies." Then he began an exhaustive investigation which finally revealed the quickest and most painless method of electrocution. Every man in the laboratory who hears a good joke or a clever remark feels it his duty to repeat it to the "Old Man," as Edison is affectionately called in the shops.

His laboratory and his plant are not so much a place of business as a school of scientific invention, of which he is the master. Indeed, he has ideas of business which a Wall Street man might charitably call eccentric. Nowadays his business affairs are conducted by able men. But in the days when he built his first plant at Newark, and when the actual work of keeping accounts devolved partly on him, he conducted his financial affairs in a picturesque, nonchalant way. "I kept only pay-roll accounts, no others," he assures us; "received the bills, and generally gave notes in payment. The first intimation that a note was due was the protest, after which I had to hustle around and raise the money. This saved the humbuggery of bookkeeping, which I never understood. The arrangement, besides, possessed the advantage of being cheaper, as the protest fees were only one dollar and a half. Notwithstanding this extraordinary method of doing business, everyone was willing to accept the notes and my credit was good." The hours of work were just as erratic. "We had no fixed hours, but the men, so far from objecting to the irregularity, often begged to return and complete certain experiments, upon which they knew my heart was especially set.'
Like all successful men, Edison has his enemies. He has been accused of appropriating the work of others as his own. There is a rumor abroad that he employs a number of brilliant young men, whom he pays handsomely to work out his ideas, and that it is they who really ought to be credited with the invention of many devices that bear his name. That he is dependent to a certain extent upon the help of assistants is undoubtedly true. Nature has given him but a single pair of hands and a single head. In his laboratory the help which he receives consists largely in the per formance of tasks too multifarious for a single man. Something more than a bare idea to work with is given to each man in the laboratory. He is told exactly how the result desired is to be attained. In other words, the men in the laboratory are intelligent human tools in Edison's hands. To him alone is due the inven tion of the many contrivances with which his name will ever be associated.

## The Current Supplement

The current Supplement, No. 1408, opens with a description of some electric freight locomotives. By far the most important article in the number is the first of a series of installments by the English corres pondent of the Scientific American on water-tube boilers. The French revolutionists provided the world with a decimal system of weights and measures but they were not farsighted enough to provide a decimal system of time. The problem of extending the decimal system to the measurement of time has been taken up by M. De Sarrauton who has deviser a most ingenious decimal registering chronograph described in the current Supplement. Mr. E. H. Fos ter tells much that is of value on superheated steam The Ionic volute has for centuries been an æsthetic mystery to architects. How it was formed has never been quite discovered. F. C. Penrose gives some information on the origin and construction of the volute. Some types of French electrical elevators are described in an article that will be found of interest to engineers familiar only with American practice. An other electrical article of some importance is Mr. G. Paul's study of surface contact systems. "Modern Methods of Underground Wire Rope Haulage" forms the subject of an entertaining article.

It has been unofficially stated that at the approach ing automobile show, to be held next month (Janu ary), the storage battery of Thomas A. Edison will be shown in its completed form, and it will be an nounced that the device is ready to be placed on the market commercially. Three machines equipped with these batteries have been in daily operation on the oads of New Jersey, around the Edison works, for some time and one has done a century every day.

## spectral photography.

Probably the oldest method of taking a spectral pho tograph is to expose the plate for a brief period, in the camera, with a skeleton, or person in ghostly apparel, some hideous monster, or even a large bunch of flowers as a subject, afterward using the same plate again in the camera, upon the subject to be taken, with the spectral images, and then developing the whole plate at one operation
Another method of producing spectral photographs is to make a very thin positive image on glass, of the same size as the plate to be used in producing th spectral photograph, then placing the plate in the holder, as usual, with the weak positive superposed, and making the exposure through the positive, thereby giving on the negative plate, along with the person, ghostly image of any prearranged subject. This is a very good way of producing a ghost picture; but it is li able to detection if the same weak positive is used the second time.

Another method of producing such images is to pain in outline on the background the figure desired, by using a solution of quinine sulphate. The image when dry is invisible to the eye, but is capable of producing an image on a sensitive plate

In some recent experiments still another method of producing spectral pictures was discovered. This method, together with a specimen, is illustrated in the accompanying engravings. It consists in supporting a mirror in front of the photographic lens, which is smaller in diameter than the lens, so as to cause an image of an object, at one side of and at right-angles to the axis of the lens, to be reflected into the camera and produce an image simultaneously with the imag of a person or object, the same being formed by the marginal rays, which pass to the photographic lens around the edges of the mirror. The mirror being entirely out of focus does not appear on the photo graphic plate. By this very simple contrivance com bined images of various objects may be made upon the same plate.
The amount of light reflected into the camera by the mirror is regulated by the distance of the latte from the lens, and the marginal rays which enter th lens may be regulated by the diaphragm. The ap paratus required for this experiment is very simple indeed. It consists simply of an apertured plate, slipped over the lens, and clamped between the lens and the collar. This plate is bent at right angles, and the horizontal arm is slotted. In the slot is placed a screw, having a shoulder which is clamped against the plate by a milled nut. The head of the screw is slotted, and provided with a clamping screw, for holding a downwardly project. ing wire, to which is attached a small mirror by means of beeswax. The wire should be provided with a coat of dead black varnish, to prevent it showing on the plate. The mirror should be varied in size to suit the lens to which it is applied. In the present case it consists of a silvered microscope slide-cover $5 / 8$ inch in diameter, and about $1-200$ of an inch thick. Thin glass is used for this purpose to avoid the forming of a double image of the specter. The simplest way to silver the slide cover is to scrape the amalgam from a small piece of lookingglass, leaving a disk the size of the glass to be silvered. By placing a minute drop of mercury on the disk and allowing it to remain a few min utes the disk may be slid from the piece of look ing glass to the thin cover glass. If the transfer is successful it is allowed to remain for a few hours and then varnished with shellac varnish. If too much mercury has been used, the surplus can be taken up by means of a thin piece of tinfoil applied to the back of the mirror, which is allowed to remain
By a little practice in the adjustment of the mirror and shutter, the proportionate amount of light for the specter and for the subject may be regu lated. The object representing the specter is mounted on black cloth, preferably black velvet so that no other object than the specter will be represented by reflection
A screen may be placed between the sitter and the specter, so that the delusion may be made complete. By folding the screen over the specter when it is not in use, the litter will be con cealed, so that by careful manipulation, the trick will not be discovered by the sitter.

To Separate Adhered Postage Stamps Without Destroying the Paste.-It is often desired to sepa rate postage stamps that are stuck together with out destroying the paste, so that they can be used without another application of paste. This can be done by dipping the stamps in water for a few se onds (not as long as is usually done), shaking off the excess of water, and heating with a match as much as possible without burning. The heat expands the water between the stamps and separates them. so that they can be easily pulled apart and are ready for use.-W. L. S.

THE NEW ARMORED CRUISERS "TENNESSEE" AND WASHINGTON.'
The two new armored cruisers, the "Tennessee" and "Washington," which are to be built by contract, will have a speed of 22 knots, the same as for the "Maryland" and "St. Louis" classes of armored cruisers now building, and one knot in excess of the designed speed of the earlier armored cruisers, the "New York"


Fig. 1.-MIRROR FOR PRODUCING SPECTRAL IMAGES.
and "Brooklyn." Although they will be slower than many foreign modern cruisers, the "Tennessee" and "Washington" excel in battery power and protection any armored cruiser built, building, or designed, and they are the equal of many of the battleships of the world. With the high protection and battery, it may be asked in what respect these vessels differ from a battleship. It may be stated that they bear the same relation to the battleships as the cavalry does to th infantry in the army. With four knots greater speed than the vessels of the "Connecticut" class of battle ships, they are able to move more quickly from poin


Fig 2.-ARRANGEMENT OF SPECTER, MIRROR AND SUBJECT.
to point, and with their excess of speed over the battleship, they are able to give battle or run away from the enemy's battleship as they please; and with their powerful offensive and defensive qualities, they are able, in case of necessity, to put up a stiff fight with the finest battleship afloat. As compared with the "Maryland" class of armored cruisers now building, there is increased protection to the gun positions by the installation of splinter bulkheads, greater isola tion of the 6 -inch gun positions being thus secured. Of the twenty-two 3 -inch guns which are carried, only six are without full protection, and even these ar


Fig. 3.-A GHOST STORY.
placed in casemates forward and aft on the gun deck and protected in front by two inches of nickel steel. The battery power has also been greatly increased by the substitution of four 10 -inch guns on the new vessels in place of four 8 -inch guns on the "Maryland" class, the relative perforating power of the 10 and 8 . inch guns through Krupp armor by cap projectiles at 3,000 yards being in the ratio of 15 to 10.3 . The number of 6 -inch guns has also been increased from fourteen on the "Maryland" class to sixteen on the "Tennessee" class.

The general features and dimensions of these vessels are as follows:
Length on load waterline....... .................... 502 feet Breadth, extreme, at load waterline..
$\qquad$ 502 feet
72 feet $101 / 3$ inches Displacement ou trial, not more tha 14,500 tons
$\quad 25$ feet Maximum displacement, full load conditon, with coal bunkers full, full supply of stores, ammunition on board, and water in boilers........... 15,950 ton Mean draft at maximum load.. Coal carried on trial.. 27 feet Total coal bunker capc... Steaming radius at 10 knots per hour .... Eteaming radius at full speed. about 2,000 ton Appropriated for hull and machinery
about 2,000 tons 6,50u knots 3,100 knots 34.659,000

The trial of the vessels will be conducted on the normal displacement of 14,500 tons given above, and a draft of about 25 feet, the vessel being supposed to carry, in this condition, the normal supply of coal given above, and two-thirds supply of ammunition and general stores. The hull is to be of steel, with the usual cellular subdivisioning of the double bottoms and the hull spaces.

The freeboard of these vessels at the line of the main deck is about 18 feet amidships, 24 feet forward, and 21 feet 6 inches aft; and, of course, increased in wake of the superstructure, which extends to the upper deck.
The hull is protected by a 5 -inch belt of armor extending from 5 feet below the normal waterline to the upper deck in wake of 6 -inch guns; this armor extending completely to the bow and stern near the water line to form a waterline belt, being reduced in thickness at the ends to 3 inches. Extending from the gun deck to the protective deck are bulkheads of 5 -inch armor which form the forward and after limits of the belt armor. Between the gun and berth decks are similar bulkheads located in wake of the 10 -inch barbettes which are fitted on the gun deck and form the forward and after limits of the side armor between the main and gun decks. Above the gun deck in wake of the 3 -inch battery, 2 -inch nickel steel is fitted. The 6 -inch guns on the gun deck are isolated by splinter bulkheads of $11 / 2$ inch nickel steel, extending continuously across the ship, and 2 -inch nickel steel extending fore and aft.
The 10 -inch turrets are protected by 9 inches of armor on the sloping face, 7 inches of armor on the sides, 5 inches in the rear, and with top plates of $21 / 2$-inch nickel steel. The barbette armor is 7 inches thick in front, reduced to a thickness of 4 inches at the back and below the gun deck, where protected by the belt and casemate armor. The protective deck, which extends from bow to stern, will be $11 / 2$ inches thick on the flat over the engine and boiler spaces, 4 inches thick on the slopes at the side, extending down to the bottom of the belt armor, 3 inches on the slope forward and aft. A cofferdam 30 inches thick will be worked from end to end of the vessel between the protective and berth decks.

The armament will be as follows: Main battery: Four 10 -inch breech-loading rifles, sixteen 6 -inch breech-loading rifles. Secondary battery: Twenty three 3 -inch rapid-fire guns, twelve 3 -pounder semiautomatic guns, two 1-pounder automatic guns, two 1-pounder rapid-fire guns, two 3 -inch field pieces, two
machine guns of 0.30 caliber, six automatic guns of 0.30 caliber.
The 10 -inch guns will be mounted in two elliptical, balanced turrets protected by armor as described above, and they will be under complete electrical control, as will also be their hoists and their loading and training mechanism. The 6 inch guns will be mounted four in independent armored casemates on the main deck, the remain der in broadside on the gun deck, all on pedestal mounts, the back and side plates of the casemates on main deck being of 2 -inch nickel steel. At each end of the vessel four of the 6 -inch guns can be trained directly ahead or directly astern respect ively, so that it is possible to obtain a direct ahead fire with the main battery of two 10 -inch and four 6 -inch guns, and the same number at the stern. The 3 -inch guns will be mounted as fol lows: Six in sponsons on the gun deck, six in broadside on the gun deck, and ten in broadside on the main deck. The 3 -pounders and smaller guns are mounted on the upper deck, bridges, in th tops.
The ammunition and shell rooms are so ar ranged that about one-half the total supply of am

unition will be carried at each end of the ship. With the increase in battery, special care has been required in developing these designs to secure an adequate rate of supply of ammunition from the magazines to the guns. For handling 6 -inch and 3 -inch ammunition, the ships have been provided with a central passage extending completely from the forward to the after magazines, and four side passages at each end to ex tend a sufficient distance forward and aft to provide for handling the ammunition within the armor protection, on the decks above. All of these passages are at the level of the upper platform deck, and such quan tity of both 6 -inch and 3 -inch ammunition is stowed a this level as would probably be required in any action. The remaining aminunition is stowed where it can readily be whipped up by hand when time is available from the lower to the upper platform.
For handling ammunition along the central passage, there will be ammunition conveyors, which are noth ing more than traveling platforms, onto which ammunition can be loaded at one end and delivered abreast the various ammunition hoists at differen points in its travel. Provision has been made by means of power hoists, to handle the 6 -inch, 3inch, and 3 -pounder ammunition at the rate of seve pieces per minute. In addition to the power supply, there has been provided sufficient means for a sup plementary supply of ammunition by hand, to inter fere as little as possible with the power handling so that, with the combined means of supply, it will be possible to supply ammunition to all of the gun at a rate equal to that at which they can be fired The full complement of the vessels, as flagships, will consist of: One flag officer, one commanding officer, chief of staff, 19 wardroom officers, 12 junior officers, 10 warrant officers, 814 men
The masts will be fitted for the installation of wire ess telegraphy.
The propelling engines will be of the vertical, twin screw, four-cylinder, triple-expansion type, of a com bined indicated horse power of 23,000 . The steam pressure will be 250 pounds, and the stroke 4 feet
The engines will be located in two separate water tight compartments. Steam, at a working pressure of 250 pounds, will be supplied by sixteen boilers of the straight watertube type, placed in eight water tight compartments, having combined grate surface of at least 1,590 square feet, and heating surface of at least 68,000 square feet.

## LEADING TYPES OF 1902 FRENCH LIGHT-WEIGH

 AUTOMOBILESby the paris correspondent of the scientific american. ight-weight cars that have become of the Frenc year, may be of interest to many of our readers. We have given considerable space to the description of the Renault car, as this deserves special mention, since it won the Paris-Vienna race last summer, thus proving the enduring qualities of a light-weight machine in hard and rapid road test, and demonstrating that its staying powers equaled, if not surpassed, that of the heavy, locomotive-like car, that had heretofore been so prominent in France.
This machine has been designed especially to se cure lightness and simplicity in the mechanism, com bined with a sufficient motive power. Its design has been carefully studied, and it is no doubt due to this act that it has proved so successsful. The general ar angement of the parts will be noticed in the plan view of the frame, and in the different photographs The motor, which is mounted in front, is, however, larger than the one shown; it is of the upright 4 cylinder type, and has been newly designed. The c.vlinders are mounted in pairs, as usual, upon a long aluminium crank case. The motor develops 24 hors power, and weighs 286 pounds, including the flywhee and friction clutch. The inlet and exhaust valves are superposed; the former are automatic, while the latter are operated from a cam-shaft. The front view shows the relative position of the motor and the water cooling system. A large water-jacket surrounds the motor cylinders and valve chambers, and is closed at the top, tor each pair of cylinders, by an aluminium cap which receives the water-tube. The water tank is of small dimensions, and is placed above and behind the motor. The radiating tubes are placed on each side and partly inclose the motor. The water circulation is carried out on the thermo-siphon principle, which is coming into use in France. The water circulates by gravity alone, the heated water coming from the top of the motor rising to the upper reservoir, from which it descends again through the cool ing tubes, and enters the motor at the lower part. In this way the use of a water-pump is not necessary. The carbureter is of the float-feed atomizer type The admission of gas is regulated by a governor on the motor, and also by a pedal adapted for the purpose, whose position may be fixed by a thumi-nut placed just below the steering wheel. During stops or long descents, the motor speed may thus be reduced to
less than 400 or 500 revolutions per minute or the motor may be stopped. The quantity of air entering the carbureter is also regulated, according to the speed of the motor, by a small handle placed beside that of the ignition shifting one. The method of elec tric ignition deserves mention, as the new system de signed by M. Carpenter is employed. The spark-break is made much more quickly than usual. The tremble of the induction coil, instead of breaking contact di rectly, when it is attracted, does not do so until nearly at the end of its movement, when at the maximum speed; at this point it strikes against an auxiliar contact spring, making a very quick break. The r sulting spark is much better, and the motor can be run at a higher speed
The friction clutch and transmitting mechanism are shown in the diagrams. The friction clutch and fly wheel are mounted together. Inside the flywheel, $V$ is a cone-socket upon which is applied the conical piece, $U$, of aluminium. The two cones are normally pressed together by a spring, $X$, and are separated by the rod, $Q$, which is operated by the pedal, $l$. A double set of ball-bearing collars are used to take up the thrust.
From the friction clutch the main transmission shaft passes first through the speed-changing box, and thence to the differential. This shaft is divided into two parts, one a square portion which carries the sliding set, $A E$, comprising the two gears, and one of the jaws of a clutch (seen between $E$ and $D$ ). The second part, carrying the other jaw of the clutch passes out of the gear box and through a double-jointed transmission rod to the differential, where it carries a bevel driving gear. The main shaft, made thus in two portions, may be operated as a whole when the clutch is in contact; or, by separating the jaws of the latter, the first part may be made to operate the sec ond at different speeds by using the intermediate gear set below. The lower shaft carries a set of gears, $B G C$, for the two speeds and reverse. The trans mission can be made either through $A B C D$ for the first speed, $E G C D$ for the second, or by direct coup ling through the jaw clutch for maximum speed, by sliding the upper gear-set back and forth. The method of throwing the gears into contact is a special feature of the Renault machines. The lower shaft, $B G C$, rotates in a pair of eccentric bearings; it is not shifted to the right or left but can take a to and fro movement so as to approach the upper set. In this way the teeth do not engage in the ordinary way by a side movement but strike each other face to face over their entire sur face. The gears are first thrown opposite each other, then one set is applied to the other progressively, so that the teeth of one mesh with those of the other In this way there is much less shock than usual in he speed changing, and the meshing of the gears is effected easily. Two movements are therefore neces sary to change gears-one the shifting of the set, $A E$ and the second a forward and back movement of $B G C$ This is accomplished in a very simple and effective manner by a single movement of the lever. An upper haft, $P$, operated from the driver's lever, carries screw thread, $F$, which works in the collar of the gear shifting fork, $F$. When the shaft is rotated, the screw moves the fork back and forth to shift the gears. To bring up the lower set, $B G C$, the same shaft carries a cam, $H$, on the right, which operates a rack. The latter engages with the bearing of the lower shaft which is mounted so as to take a rotary movement The shaft is mounted eccentrically in this bearing and when the latter is rotated, the shaft is elevated or depressed, throwing the gears in or out of contact. A similar rack is used on the left side. The relative position of the fork and the cam is such that the two operations succeed each other properly; thus upon turning the shaft, $P$, the speed-changing takes place as follows: First, $B G C$ is lowered; next the set, $A E$ s displaced laterally; then $B G C$ is raised, throwing the proper gears into mesh. The reverse is obtained as usual by a supplementary gear, $S$, mounted on separate shaft and engaging with $A$. Upon shifting to the extreme left, $A$ drives $B$ through the gear $S$, giv ing the reverse movement. The transmission is made direct through the clutch for t.ee maximum peed. This system of direct transmission, which is oming into use, is a decided advantage, especially fo the racing machines in which the high speed is nearly always engaged, as the use of gearing is dispensed with.
The maneuver of the upper shaft is obtained by a toothed sector, $L$, fixed on the shaft, $K$, at the ex tremity of which is the speed-changing lever, $J$. The sector engages with a small pinion, $M$, and turns it rapidly. On the same shaft with $M$ is carried a bevel gear of larger diameter, which drives a small pinion . the latter being mounted at the extremity of th shaft, $P$. By this arrangement of double gears, a displacement, even slight, of the main lever, produces rapid rotation of the shaft, $P$. The lever, in passing rom one notch to the other, turns the shaft rapidly enough to allow of the three movements above men
tioned. The gears which operate the shaft, $P$, are inclosed in a separate case of special form, mounted close to the speed-changing box, as will be noticed.

The main transmission rod carries a joint at the end of the speed-changing box and a second at thc differential, affording a flexible transmission. The position of the joints is calculated so that when the machine is loaded the rod takes a horizontal position. The differential case is of steel, and has fixed to it two steel tubes, through which pass the main axles of the wheels. The side thrust of the axles is taken up by a ball-bearing collar mounted at each side of the differential case; these collars can be regulated from the outside by screw-rings. At the ends of the tubes are mounted the journals of the main axles, which are also provided with thrust bearings.

The Peugeot racing car, which has been quite successful in this year's events, differs considerably from the preceding. One novel feature is the use of a watercooling device somewhat similar to that employed on the Mercedes cars. It is the first machine of any note in which such a system is used in France. The radiator is mounted in front of the motor, as will be observed; it is made up of a great number of short copper tubes around which the water circulates, its construction giv ing it a honeycomb appearance. The water is circulated by a centrifugal pump of large output, driven from the flywheel by friction, and sending the water from the motor to the radiator, where it is quickly cooled. In the rear of the radiator is a ventilating fan driven by the motor. This fan draws a current of air through it independently of the speed of the car. The cooling being thus aided by the fan, a much smaller quantity of water can be used, and in fact the 4 gal lons which are contained in the water-jackets and piping system, are sufficient for the cooling without the use of a separate reservoir. In this way a considerable gain in weight is secured. The exhaust pipe has been made especially large, with a good-sized muffler quite near the motor, designed to reduce the bask pres sure to a minimum.

The friction clutch is similar to that used in the Renault car. Chain transmission is employed to drive the rear wheels. The speed-changing mechanism and differential are mounted together in a large, flat, aluminium box, leaving only the ends of the axles for the driving sprockets projecting on each side. The speed-changing device gives three speeds and a It is operated by a single lever placed at the side of the driver's seat. The movement is transmitted to a ver tical shaft, which operates a fork used to shift the gears. These are of the ordinary sliding type, but are arranged, like those of the Renault, to drive direct on the fast speed. On this speed, the motor shaft is direciconnected with the bevel gear that drives the differen tial of the countershaft, so that the only loss in trans mitting power is in the one set of bevel gears and the sprocket-and-chain drive employed from the counter shaft to the rear wheels. The reverse is obtained by an intermediate pinion.
The Decauville light-weight car is another of the leading types. It is here shown with a four-seated carriage body; when used as a racer the rear seats are removed. The motor, $M$, mounted behind the radi ator, has two cylinders of 4.4 -inch diameter and the same stroke, giving 10 horse power at a speed of 1,000 revolutions per minute. A characteristic feature is the mounting together of the motor and speed-changing box, so as to form a solid piece. This secures a rigid transmission, which is independent of the movements of the frame, and avoids jamming of the bearings. The iriction clutch is mounted between the motor and the speed-changing box. The latter has three speeds and a reverse, and is similar in principle to the others. Many of the new machines are adopting the method of direct connection between the motor and differential at full speed, also the double-jointed rod transmission. Here, however, the rod is short and passes obliquely to the differential. A- novel feature of the Decauville machine is the use of the small dynamo, which keeps the ignition accumulators always charged by means of a set of automatic switches. In this way the mishaps due to the exhaustion of the battery are avoided. The radiator is fed by a centrifugal pump, driven by the motor.
A light-weight car which has been especially promin ent this year is the Darracq. When built as a highspeed racing car, as shown in the photograph, it has a 4 -cylinder motor giving 20 horse power. The views of the frame show the same machine with a 2 -cylinder motor of 12 horse power, which runs at 1,200 revolutions per minute. The arrangement of the mechanism resembles closely that of the preceding type. Behind the motor is the friction clutch, then comes a speed changing box which has also the interlocking system for full speed. The shaft turns in ball-bearings. The differential carries at each end a steel tube which incloses the rear axles. Ball-bearings are used to take up the thrust of the axles. A jointed-rod transmission is also used from the speed-changing box to the differential.


Renault Speed-Changing Gear.


The Car in which Renault won the Paris Vienna Race.


Chassis of the Peugeot Car.


Renault Light-Weight Car With Body Removed.

Latest Peugeot Model.


RECENTLY Patented inventions.

## gricultural Implements.

 SUGAR-CANE-TRASH GATHERER, CU TER AND SPREADER.-H. B. GRAY, John stone River, Queensland, Australia. This inven-tion provides an improved device adapted to be tion provides an improved device adapted to be
moved over the harvest sugar-cane fields to ick up all the sugar-cane trash such as leaves, tops and the like left by the cane
cutters on the field. The machine cuts the picked-up trash into small pieces and spread the latter evenly over the ground to perm f conveniently plowing the same under.
CUltivator.-J. o. Lawrence, Mont ello, Iowa. Mr. Lawrence's invention relat to improvements in cultivators of the disk
type. The purpose of the invention is to protype. The purpose of the invention is to pro
vide a light, durable, economic and simple device, adapted to hoe and thin out any drille device, adapted to hoe and thin out any driled ow a planter of the same width AGRICULTURAL TOOL-D.
York. The invention relates particularly mprovements in devices for digging and breaking up the ground and the object is to provide ally operated to break up and finely pulverize the ground with comparatively little exertion
on the part of the operator as compared with spreading in the ordinary manner
STACKER.-G. W. Worley, Goldfield, Iowa. mechanism for carrying off the straw and he same at any desired adjacent point is provided in this invention. An important feature of the machine is the rake which is mounted in a revoluble drum. The rake is thrown outward by centrifugal rorce, and a guide ring rically to the axis of the drum, controls the outward movement of the rake.

## Electrical Devices.

LIGHTNING-ARRESTER.-J. E. Cordovez Panama, Colombia. An improved lightning arrester has been invented by Mr. Cordovez. The
device belongs more particularly to that typ device belongs more particularly to that type
in which a magnet by attracting an arma ture produces a ground connection, so as to direct the flow of lightning or of any un
desirable charge of electricity to the earth. HOT-WIRE ELECTRIC METER.-R. S ention relates to meter for making rical measurements of various kinds and capable of use as a volt-meter, differential volt-
meter, ammeter, etc., according to the materials used in its construction and the proportion of the parts. It is also capable of
use with both alternating and direct currents. in wheth carrent RECTIFIER
FOR SINGLE OR POLY
OLTERNATING CURRENTS.-A Hodon, 97 Rue St. Lazare, Paris, France. This Nodon, 97 Rue St. Lazare, Paris, France. This
rectifier mainly consists of an electrolyte formed of a saturated solution of bibasic phosphate of ammonia employed either by itself or
in the presence of a phosphate of any one of in the presence of a phosphate of any one of
the following metals or oxides: alumina, iron, copper, lime, or magnesia, in which solution are dipped two electrodes, one of which is made of an alloy of aluminium and zinc in the proportion of 5 per cent of zinc, while the other electrode is constructed of iron, steel, or cast-iron,
or of a combination of iron with carbon, silicon, tungsten, molybdenum and tantalum.

## Engineering Improvements.

PUMPING-ENGINE.-F. L. Orr, Thurman owa. Improvements are provided by this inoperating under an explosive and a vacuum energy created by the combustion of the explosive mixture, and in which, after being
started, the operation will continue so long as the working agent is fed thereto. The present invention primarily seeks to provide a pump of the character stated which will have a sim in which the operation can be conveniently controlled
ROTARY STEAM-MOTOR.-H. Roeske, Philadelphia, Pa. This motor belongs to that ngines" in which jets or sheets of stea escaping from one surface are allowed to impinge upon another surface to produce either direct or reactionary rotary movement in one
the two surfaces. In the present invention he steam issues from a rotary moving surimpart a reactionary rotary movement to the surface carrying the steam passageways. A
number of important details of construction number of important details of
are comprised in this invention.
Ram.-C. C. Wentwortif, Roanoke, Va. The ram comprises an automatic air supply for the air dome, consisting of a standpipe having its lower end in open communication with the
drive pipe and its upper end opening into the air dome, the standpipe having an inwardly opening air valve inturmediate its length. nozzle above the air valve prevents too rapid flow of the air which will not have time to get away before another stroke. Therefore
the action of the water in a vertical pipe and the action of the valve just below the nozzles will not be impeded by the inertia of the water above it, having only to further compress this
small amount of air which finally reaches a tension that insures its passage to the air chamber.

HYDRaUliC Ram.-J. A. SNavely, Crock-
ett Depot, Va. One of the objects of this invepot, Va. One of the objects of this in-
vention is the provision of valve means for controlling the intermittent flow of the curent under pressure so as to vary the number of pulsations per minute, and to secure a decrease or increase in the capacity of the appa-
ratus. Means are provided for ratus. Means are provided for deadening the ound and limiting the play of the waste valve
a novel form of check valve is also employed which is adapted to quickly seat itself after each pulsat
imize wear.

## Hardware.

SOLDERING-IRON.-C. A. Kaiser, Long sland City, N. Y. Mr. Kaiser's invention reburned therein whereby to neat the iron. The instrument comprises a body or head part and removable lid, the lid having an igniting ori-
fice, the covering being mounted on the lid to swing toward and from the orifice therein and a cover for this orifice.
Clipper.-R. F. Werk, New Orleans, La Mr. Werk is the inventor of an improved chper for cutting the outside fibers from cord-
af any sort. The instrument is of pe culiar construction involving two knives or sets of knives which are relatively movable
n concentric circles, the cord being passed hrough the center of such circles.

## Mechanical Eevices.

POWER DEVICE.-D. Lubin, New York, N . The object of the present invention is to of simple construction that will be found of reat utility and adapted for a variety of uses on a farm, such as drawing vehicles
loaded with various products to a central delivery station, and for drawing or propel ling tillage implements.
VARIABLE-SPEED AND REVERSING
GEAR FOR MOTOR-CARS, TOOLS, OR GEAR FOR MOTOR-CARS, TOOLS, OR other apparatus.-J. E. Mennessier, 59 Rue de la Roquette, Paris, France. This sy
tem of variable speed and reversing gear is chiefly characterized by the arrangement upon driving shaft of an eccentric which is shaft for the purpose of gradually varying the speed, which transmits through the medium of a rocking lever and pawl-carrying arms a movement of rotation to two ratchet wheels
which are thrown into gear alternatively, by means of a clutch, with a driven shaft, wherey a continuous rotary motion is imparted ICE-MAKing machine.-R. F. Learned particula, Miss. This invention relates more can of ice-making machines, the can being ntended to receive from below a supply of which is allowed to pass through the body of water and result in a clear transparent block provided with a sub-chamber adapted to ceive the charge of air or gas. An improved rom liquid pressure from above and below in rom liquid pressure from above and below in
rder to exclude brine from entering the can, the valve mechanism opening freely to air or APPARATUS
aPPARATUS FOR DISTILLING LIQUORS. -J. C. Bertsch, Atlanta, Ga. Distilled water contains a certain quantity of air and if this
water be used for making ice, the cakes of ice will have air bubbles therein. To produce absolutely clear ice it is necessary to eradicate
the air bubbles from the water by "reboiling" the water. The present invention provides a economical system for this purpose, whereby
the water of condensation is led to the reboiling apparatus at the highest possible tem perature.
FEED-ROLL-G. A. Ensign, Defiance, Ohio n that invent in provides improvement or other surfacing machines, in which a serie of individual rollers are so mounted upon a rotary shaft by means of intermediate, nonrotatable hubs and so acted upon by springs as to allow them to yield to accommodate strip or pieces of lumber which are of diferent pporting shaft
BRAKE MECHANISM.-R. B. HAIN, Los is especially adapted for use in connection with transmission gear devices in which a plurality of brake drums are included, and it
is especially adapted for use in connection with peculiar forms of transmission gear devices which are covered by another patent of Mr rain's.
APPARATUS FOR THE PRODUCTION OF FLAT HELICES, HELICAL SPRINGS, Like.-G. Trouve, Paris France. The present invention relates to improved apparatus by means of which flat helical springs, and
helical shafts of any kind wound edgewise can be produced from strips of metal in a very simple manner. The apparatus comprises a revoluble mandrel on which the helices are be adjusted toward and from each other KNitting-machine.-G. W. Ruth, Nor-cular-rib-knitting machine and the improve ments lie in certain novel devices for controlling and actuating the cams of the cylindel
and dial needles A pattern wheel is em-
ployed and the machine also comprises a pawl
arried thereon for actuating the pattern wheel, a device for periodically throwing the pawl ut of action and a plunger serving to
cally throw the pawl back into action.
FRICTIONAL GEARING.-E. RAWSON, Moscow, Idaho. An improved frictional gear ing is herein provided which is designed for use on sawmills, planers, etc. The construc-
tion is simple and durable, very effective in operation and arranged to enable the operator o quickly and conveniently adjust the gear ing to any desired speed, or to reverse the
same according to the nature of the work in hand.
PLANER.-E. Rawson, Moscow, Idaho. An
improved planer which is of simple and durable construction, and very effective in operamachine is more especially designed ducing timber to especially designed for rewidth, and it is arranged to permit the opera or to shift the side cutter-heads independen CLUTCH-M Lungus, New Yor This novel form of clutch will transmit rotary movement from one part to another in one direction, but permits free rotation of parts
in the other direction. The clutch is of simin the other direction. The clutch is of sim
ple and durable construction, and is applicable all sorts of machinery, as, for example, the cloth cutting machine described below. CLOTH-CETTING MACIINE.-M. LaNG-
inan, New York, N. Y. The present invention ran, New York, N. Y. The present invention
relates to a cloth-cutting machine in which the blade has a combined reciprocal and edgewise movement, the blade having a wide cutting end edge, and a cutting side edge. The advantage of this construction is that as the knife descends longitudinally, its wide end
performs a downward cut and then, as the periforms a downward cut and then, as the tion of its side edge and performs a further set
SELF-PLAYING MUSCIAL instrument -J. Kruft, Jersey City, N. J. This musical provided with hammers to strike the strings with a recoil action so as to insure softness and sweetness of tone. The construction per-
mits convenient removal of the guitar-zither mits convenient removal of the guitar-zither
to permit of playing it by hand whenever it is to permit of play
desired to do so.

## Railway Improvements

SAFETY-GUARD FOR RAILROADS.-W Morsehead, Yale, Mich. Means are provided in the present invention for the prevention points along the railroad track caused by the retention of the foot of a person which may be inadvertently introduced between a track rail and an adjacent edge of planking that overs such a crossing
CAR-FENDER.-W. B. Collins, North Sartmouth, Mass. This improved car fender is normally in a position a distance above the track to readily clear switches and the
like. The fender may be moved suddenly into he will of the in caman argen tendant to cause the fender to safely pick up any obstacle that may be in the path of the trolley-pole harp.-J. H. Walker, Lexington, Ky. The construction of this trol ey-pole harp is such that it will not shear Also it will not hang up in any angle of wires Also it will not hang up in any angle of wires
and will not pull down on top of low wires, nor allow wedging of the wires between the wheels and the prongs of the harp.
CONTACT FOR TROLLEY-HARPS.-J. H ion provides points for a trolley-harp which will constitute a journal for the pin or axle supporting the trolley-wheel. The construction of the
contact points is such that the rotary motion of the trolley wheel will be impeded but very little, as the improved contact points are contact usually employed
trolley-Catciler.-E. M. Zwing, Phildelphia, Pa The present invention aims to provide means for automatically preventing a trolley pole from flying upward to a vertical position when the trolley roller or shoe jumps of an overhead conductor, thus preventing the pole from assuming a position sufficiently high to inj
stays.
rail-Joint.-C. O. H. Miller, Williams An improved rail-joint is provide in the present invention which is of such a character as to lessen, if not entirely obviate, ing of the car wheels as they roll from rail 1 across the spaced ends thereof w

## Miscellaneous Inventions.

## MEANS FOR SEALING PRESERVING

 ARS.-W. Walmbr, Shelton, Wash. Preof the present invention in a way to overnce of a vacuum at the top jar. Also the accumulation of air will be prevented, thusmold on the fruit.
HOLDER FOR PRENS PENCILS. OR THF
improved holder for pens and pencils is proconveniently invention. The device may be ment, or to the inside of a pocket to allow the wearer of the garment to readily insert and securely hold the pen or pencil and conveniently remove
sired to do so.
TRICK-SWORD.-W. Thomas, Palatka, Fia. This invention provides a device for creating living person. "The trick sword comprises a blade sections and curved arms connected respectively with these sections, the curved arms being adapted to pass around one side
of the body of the user. In connection with the trick sword is a flexible tube and a bulb Which may be operated to force out a liquid SUPPORT FOR VESSELS.

- P. Hallock, by provided for supproved device is hereother vessels in such a manner that the vessel is securely held in position against accidental displacement on a stand, and when it is desired to pour out the contents of the ves-
sel, the vessel can be readily tilted without equiring much physical exertion on the part the operator
York York, N. Y. Mr. Parker's invention relates to a fastening used by glaziers for securing
window-panes in the sashes of windows shape of the fastening is such as to adapt it to a great variety of uses. The fastenings can be placed around overlapping edges of panes of glass, so that the lap will hardly be no-
ticed and the joint thus formed is a perfect ticed and the joint thus formed is a perfect nion and is practically airtight.
COMPOSITION OF MATTER.-J. Poliato a Moscow, Russia. This invention relates larly for use in of matter designed particuticles such as ornaments, vases and the like It consists in reducing glue to liquid form under heat, adding plaster mixed with water and bringing the material to boiling point, then adding glycerine and wax and finally adding hrome alum. This composition will be found practically unbreakable and waterproof.
CUlinary appliance.-S. Worley and appliance which is provided by this iowa. The appliance which is provided by this invention
may be conveniently used in any oven for roasting meat. It permits the meat to be easily aced in or removed from the device, allows the roast to be conveniently turned from
time to time, and provides for holding the oast at any desired point of adjustment in order that the meat may be browned at any particular part.
HAIR-PIN.-T. C. Allen, Sydney, N. S. W., Australia. The invention provides a pin
which, when inserted in the hair, will firmly which, when inserted in the hair, will firmly
retain its position until it is desired to refirmly retained in the desired position, and thus is obviated the inconvenience and annoyance so often caused by falling out of pins w used for the purpose.
head For oil-wells.-F. J. Moser, Kane, Fa . Means are provided in this inven tion for packing the tubing of an oil-well in
the casing-head so as to prevent leakage of the casing-head so as to prevent leakage of
the gas. The head which is screwed on the top of the casing is provided with horizontal nipples for the gas tubes and a stuffing box for
the vertical tube. Means are provided for adjusting of this tube without permitting escape of the gas.
GLASS-CUTTER'S BOARD.-A. T. WhiteHouse, Lisbon, No. Dak. This invention provides a simple means for holding the stralght
edge on the glass to be cut, also permitting the straight edge to be moved to dired the of the board and to any desired angle, and to swing upward from the board when it is same.
SiIelving.--J. M. Lippincott, Oakland,
IIl. The improvement belongs to that class of shelving in which a shelf-section is movable vertically to a height above the ordinary fixed shelving and then adjusted back over
said shelving. In the present invention the object is to simplify a construction provided by a former patent, thus rendering the apparatus easier to operate, and to improve its general appearance.
APPARATUS FOR LAUNCHING LIFEBOATS FROM SHIPS.-C. F. Petersen, Wil-
mington, Del. By the use of this mechanism mington, Del. By the use of this mechanism
boats may be launched from either side of boats may be launched from either side of
the vessel with the least possible manipulathe vessel with the least possible manipula-
tion of tackle. The boat is run off the gunwale and dropped in a position read to she side of the ship or dock to permit free to the side of the ship or dock to permit
use of the oars on both sides of the boat. SUBSTITLTTE FOR WHALEBONE STIFF ENING-STRIPS.-A. M. Weber, New York, N. Y. The materi known as "plassava" or
of vegetable fiber
"bast," and obtained from the Attalea funi"bast," and obtained from the Attalea funi-
fera. a palm whose leaf stock is stiff and wiry, yet flexible. These fibers are long, hair-like siliency. and are are bound together and held by means of a covering woven upon them.
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promptly. The Garvin Machine Co., 149 Varick, cor.
Spring Streets, New York. Inquirr No. 3577.-For dealers in levigated oxid
of tin.
Wanten.-Machinist used to light machinery, sew,
ing machines and repairs. References. "Newark," Box $\tau \boldsymbol{T} 3$, New York. Inquiry No. 3578.-For manutacturers of gas bal
lons. Manufacturers of patent articles, dies, stamping
tools. Iikht machinery. Quadrixa Manufacturing Company, 18 South Canal Street, Chicago.
Innuiry No. 3579.-For the address of the Ger
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Inquiry
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ehine Company. Foot of East 138th Street, New York.

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Patent For SAle.-" Trolleg Mail Box Carrier"
carries the mail box from the line of the . F. D. Do the resilience and return it to tine of delivery. Something
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zie sprays simiar
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rubber hose and hose couplinys.
Inquiry No. 3.585.- For machines for knitting hos
Inquiry No. 3586.-For manufacturers of flypaper






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Infiniry No. 3.9.5.-For machinery for making
peaributtons.
Inquiry No. 3596.-Far machines for
iny articles from the hull of the coconanut.
Inquiry No. $\mathbf{3 i s 9 7}$.- For makers of polishing pre
parations for metals.
Inquiry No.
washing machines

Innuirv No. 3600.-For coiled iron pipe of special
dimensins.
ins
Inguiry No. 3601.-For parties dealing un parts of
horizontal engines.
 Notes
and Queries.

hints to correspondents






tharesses of houses manuacturing or carrying
Special mititen Information on maters of persona
rather than general interest cannot te expectel
 Mininer.e. sent for examination should be distinctly
marked or or labeled
(8774) W. H. H. wants a receipt to obtain a red cherry color on pure copper, done
by immersion in hot acid, not by battery ot dynamo. What 1 want is not enameled, but colored, same as Tiffany or Whiting do large A. A color of this kind in copper can be obained by slowly heating in an air bath, with
radually rising temperature. Long heating at a comparatively low temperature or more
rapid heating at a higher temperature will rapid heating at a higher temperature will
give the same effect. As soon as the desired give the same effect. As son as the desired
color is obtained, cool rapidly by plunging it will water. If lacquered after finishing
(8775) F. M. H. asks: How many cubic feet of free air will it take to fill an a tank having a capacity of 100 cubic feet at
pressure of 200 pounds per square inch? hessure of long a time wound will this amount of com
how of 5 air run an engine doing actual wor free air will it take to raise 5,000 gallons of
water 50 feet being compressed; state what water 50 feet being compressed; state what
pressure, using the direct air lift system? It will require 1,400 cubic feet of free air
ro ill the tank of 100 cubic feet capacity at 200
pound pressure. This amount of air will run a 5 horse power engine 2 1-3 hours. The amount of free air at an average of 100 pounds 50 feet high may be from 600 to 800 cubic eet, depending upon the efficiency of the pumping system.
(8776) G. O. W. asks: 1. Please in form me how many ounces one cubic foot o
hydrogen gas will lift. A. A cubic foot yddrogen at 30 inches of the barometer, and at the freezing point, weighs 0.00562 pound
cubic foot of air under the same condition A cubic foot of air under the same conditions
weighs 0.08071 pound. A cubic foot of hydro weighs 0.08071 pound. A cubic foot of hydro-
gen will balance in the air under normal onditions, as above, the difference of thes wo weights, and will lift a weight slightl
less than this difference, or about 0.07 pound This is the basis of the usual statement that 1,000 cubic feet of hydrogen will lift 70 pounds. It will do so when the barometer
stands at 30 inches and the temperature is stands at 30 inches and the temperature
at freezing. 2. How to deposit platinum black on string or wire. A. To deposit platinum
black on a string is not easy. We cannot suggest any better way than to mix the finely ivided platinum with a gum or muct For win dip or cover with platinic chloride and heat
dip a Bunsen burner till the platinum is re duced to a black powder. The ammonium platinum chloride can be reduced better than
the simple chloride. the simple chloride
(8777) T. E. M. asks: What is the freazing pressure of water? About what pres
ure does freezing exert on fence posts set in wet ground? A. The pressure exerted by water in the act of freezing is enormous; how
reat we have no means of knowing. Heav reat we have no means of knowing. Heavy
teel tubes have been filled with water and screwed up. So, too, have bombshells. Whe water flashed into ice in the instant when the pressure was relieved. It is believed that This is because water has its freezing poin lowered by pressure. A pressure of 15 pound
to the square inch lowers the freezing poin . 0175 deg. Fahr., and for other pressures in ing of the wet earth around a post greatly in he pressure is relieved by the rising of the earth around the post. This is easily ob served, as also around stones. The reaso
why posts are more strongly fixed in the rozen earth is that the whole mass, eart and post, becomes one solid mass, and canno
be raised without breaking the mass open as a piece of ice or stone is broken.
(8778) W. F. G. says: I want to mak liquid blacking to apply with sponge lightly nd then with a few rubs with small cotto
cloth produce a brilliant polish. A. Mix three pounds of fine lampblack with 1 quart of stale beer and $1 / 1 /$ pint of sweet oil; then add unce logwood extract. Copperas can be pur
hased from any dealer in chemicals and most Cuggists, and is worth only a few cents
pound. Logwood extract can be bought from
dealers in dyestuffs or can be made by boildealers in dyestuffs or can be
ing logwood chips with water.
(8779) W. S. C. asks: 1 . If the electric current enters a building from the street, is it proper to place switch first, or fuse
block first: A. The rules of the Fire Under writers require knife switches to be placed so that when open they cannot drop together,
that is, they must not turn up when opened There is no regulation given as to the position of the fuses with relation to the switch. They must be placed as near the point where the
current enters the building as possible. Please describe the méchanism and operation of the American Clock Company's clock of
Chicago. A. We have no description at hand of Chicago. A. We have no description at hand of
the American Clock Company's clock. 3 . Where and how is sal-ammoniac produced?
The chief source of sal-ammoniac is the "am monia water" of gas works. This is the water through which the gas is passed to remove
the ammonia. By adding hydrochloric acid to this liquid, ammonium chloride is formed. 4 . In wiring for electric bells, why is it proper to
connect the carbon side of battery to the push button instead of to the bell? A. It seems to tain order to a circuit rather than that it s proper to do it in either way. The bell operate as well either way. 5. In making it proper to connect the zinc pole to the ground? A. There is no reason to say it is in groper to connect the zing pole to the ground graph, the battery is divided, one-half at one the line, the zinc must be grounded at one end and the carbon at the other end of the line. cells are required for cautery work, such as done by doctors and dentists? A. The number of cells needed in cautery will depend upon
the size of wire used, probably five or more 7. How many ampere hours will an ordinary battery cell give? A. The number of am-
pere hours a cell will give depends upon its size. Dry cells and sal-ammoniac cells can hardly be said to have any ampere hours,
since they cannot be used on closed circuits since they cannot be used on closed circuits.
Edison-Lalande cells have from 15 to 600 Edison-Lalande cells have from 15 to 600
ampere hours according to type. 8. How much A an ampere is ren lamp uses from two one-half to four watts per candle. A 10 c . p. lamp will consume from 25 to 40 watts. 9 . About how many years do carbon cylinder battery cells last when used for dwelling house purposes? A. The sal-ammoniac solution must be renewed in a carbon cylinder battery when the cell tests a volt or a little above
one volt. The zincs will go till nearly worn hrough, and the carbons will not need renewing. Use a voltmeter for this purpose. 10.
About how many watts are used to charge an electric auto when new? A: A storage bat ery is charged at $21 / 2$ volts per cell, and at maximum of $61 / 2$ amperes per square foot of positive surface, reckoning both sides of the
positive plates. 11. About what voltage does a spark coil give that is attached to an auto matic gas-lighting burner? A. A spark of good volume, a thick spark of $1 / 8$ inch, will is commonly used. Several thousand volt are required to force a spark through a half
inch of dry air. 12 Are series or shunt wound motors used on automobiles? Either series or shunt motors may be use
on automobiles. 13. About how many miles
in will an electric auto run after being fully charged. and about how long does it take to charge them? A. It is stated that automobiles have run 100 miles or more on a charge, but
about 20 is a fair run. 14. I noticed on the ame plate of some generators is stamped fiv volts drop. What does this mean? A. Fiv age is used in the machine itself and must be provided for. 15. Does the Atlantic cable consist of a positive and negative wire, or is the ground used for the return current? A.
An Atlantic cable has a bundle of wire in the enter for a conductor. There is no retur wire. 16. Is the zinc that is used in battery
cells pure zinc, or is the zinc alloyed, and cells pure zinc, or is the zinc alloyed, and
what alloy is used? A. Open-circuit cells do not usually have the zincs amalgamated hough this may be done with advantage Daniell:s. Leclanche and gravity cells are
used with unamalgamated zincs. Other cells have their zincs amalgamated. This is don by cleaning the zinc in acid and coating
with mercury.

## INDEX OF INVENTIONS

For which Letters Patent of the United States were Issued for the Week Ending December 16, 1902,
AND EACH BEARINGTHAT DATE. [See note at end of list about copies of these patents.? Acid from galvanizing works, treatment
spent, Howard $\&$ Hadley Acid, making acetic, Pa Boossne....
dvertising device, J. F. Smiley
Air and gas mixe.



 116,029
7


 | 716,111 |
| :--- |
| 716,258 |


Caster, Yurniture, Rentschler \&
Caster pintle, W. Livingstone
Caster socket, W. Livingstone
Casters, etc., wheel or roller for, ..... กี่\%






 716,276
716,237


 716,295


| 715,930 |
| :--- |
| 716,208 |
| 716,60 |
| 716,184 |



## 715,762

thereor, F . Gater closets and the seat

Disk implement cleaning aitachment, $W$ W. | 715,910 |
| :---: |
| 716,139 |


 (Continued on page 470).


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$=\mathrm{wtat}$

Lan tern, signal, A. C. Baker
Lathe doge T. C. Thom pson
Lathe
 $=2=2$

 Life preserver, J. E. Armstrong...
Lifting jack, screw, T. Hampton.
(Continued on page



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(Continued on page 472)


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