

The Slanghtered and Packed Articles.
The Animals on the Hoof.

# SCIENTIFIC AMERICAN <br> ESTABLISHED 1845 

MUNN \& CO.
Editors and Proprietors
Publishod Woekly at
No. 361 Broadway, New York

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NEW YORK, SATURDAY, AUGUST 24, 1907.
The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are will receive special attention. Accepted articles will be paid for at regular space rates.

THE QUESTION OF TWO ENGINEERS IN THE CAB.
There have been of late so many cases of the sudden disablement of the engineer at the throttle, thereby leaving the train without control, as to lead to a renewed discussion of the question of placing two engineers in the cab, at least on the more importanl fast trains. Cases have occurred where a train, after the disabling of the engineer, has run for many miles before the accident was discovered. The peril of such conditions is too obvious to call for any comment. That the danger is not so infrequent as to be negligible, is suggested by the fact that our esteemed contemporary, the Railway. and Engineering Review, in a recent editorial drew attention to three serious cases of this kind, which had occurred within the previous two or three weeks. The first of these was a collision on the Mobile and Ohio Railroad, caused by the engineer of a passenger train falling unconscious at his post. The train ran past a station where a stop should have been made, and the fireman did not discover what had happened in time to stop the train before it collided with a switch engine. Another case was that of the engineer of a passenger train on the Lake Shore and Michigan Southern Railway, who was overcome by heat and fell unconscious as the train was approaching Cleveland. Fortunately, in this case, the fireman observed the engineer's condition in time to prevent an accident. Mention is also made of the case of an engineer on a freigit train on the Chicago, Rock Island, and Pacific Railway, who became suddenly insane and persisted in running his train at full speed in spite of the efforts of the fireman to prevent it. The above cases are only typical of many which are continually recorded in the daily press. There was a time, in the days of smaller locomotives, when the fireman had mor: leisure than now for general observation, both of the signals and of conditions in the cab. He was in closer touch with the engineer. To-day, however, the locomotives have increased to such largo dimensions, that the attention and energy of the fireman are fully occupied in keeping the huge furnaces fully supplied with fuel, and the boiler with water. Not so very many years ago 2,000 square feet of heating surface was the maximum to be found on most of even the largest engines; but to-day the standard express passenger engine will have from 2,500 to 3,500 square feet of surface, and the most powereul freight locomotives from 4,500 to 5,500 square feet. From personal experience when riding in the cab of fas: and heavy passenger trains, we know that what time the fireman is not shoveling coal, he is attending to his injector or peering ahead for the first glimpse of the signals. It is our conviction that locomotives have grown to such a size, that the railroad management should give careful consideration to the question of placing a third person in the cab of the largest of placing a third person in the cab of the largest particularly necessary on those locomotives in which the engineer's cab is separate from that of the fireman.

## STEAM TRIALS OF THE "LUSITANIA."

Later advices regarding the official steam trials of the "Lusitania" show that this remarkable vessel made even higher speed than she was credited with in the earlier reports. On the measured mile she steamed at $261 / 4$ knots, and on the forty-eight-hour deep-sea trial, over a measured distance of 1,200 knots, she maintained a mean speed of 25.4 knots. As the conditions of the sea trial were practically identical
with those which ordinarily obtain on a transatlantic trip, she should easily maintain an average speed, as called for by the contract with the British government, of 24.5 knots on a round voyage across the Atlantic. The 300 -mile course for the deep-sea trial was laid between the Corsewall Light on the coast of Scotland and the Longship Lighthouse at Land's End. This was covered four times, the vessel making two runs to the north and two to the south. On both of the night runs there was a northwesterly wind, which freshened to considerable strength, and its effect was shown in the recorded speeds. On the first southerly course from Scotland to Land's End, the average speed was 26.4 knots. Returning, the average was 24.3 knots; on the second southerly trip it was 26.3 knots, and the final 300 miles was covered at 24.6 knots, the mean speed, therefore, working out as 25.4 knots for the whole 1,200 miles.
This was certainly an exceptional performance. Trial trips are usually associated in our minds with a short dash over a measured mile, with everything keyed up to the highest point for a supreme effort; and consequently, trial speeds have come to possess merely an academic or spectacular interest, useful as matters of record or for their effect in the advertising literature of the owning company, but giving no sure indication of the day-by-day service of the steamer. To all intents and purposes the trial of the turbine liner was a service test, both in time, distance, and in the fact that the regular routine methods of a transatlantic trip were followed by the offiods of a transatlantic trip were followed by the offi-
cers, staff, and crew. Therefore, that the "Lusitania," cers, staff, and crew. Therefore, that the "Lusitania,"
with her engines absolutely new, and the staff neces sarily unfamiliar with the ship and its motive power, should have exceeded by two knots an hour the speed made by any previous ship over the same distance, marks her as a phenomenal boat, and raises a reasonable expectation that during the present season the transatlantic record will be placed at a point which must necessarily stand for many years to come. Neither the "Lusitania" nor the "Mauretania" will prove to be the first "four-day" boat, but they are likely to bring the record down to four days and a half, and possibly a little below that.
To marine engineers the most significant fact, as stated by our esteemed contemporary Engineering, is that every unit of the machinery should have worked throughout this long trial with uninterrupted mechanical precision. The air pressure in the ash-pits at the boilers did not, at any time, reach the maximum of $3 / 4$ of an inch prescribed in the specifications by the Cunard Company. With a boiler pressure of 186 pounds, the pressure at the receiver of the highpressure turbine varied little from 150 pounds. The mean vacuum was 28.2 inches, and the mean revolutions of the four shafts were 188 per minute. The horse-power, determined by that ingenious but we fear not very reliable device, the "torsionmeter," which determines the torque by the amount of twist of a given termines the torque by the amount of twist of a given
length of the shaft, was 64,600 horse-power. When we bear in mind that the contract horse-power was 68,000 , it will be seen that the accomplishment of a greater speed with 3,400 less horse-power (if the torsionmeter was correct) is full of promise for further high-speed performance.
"CECILIE": THE FASTEST RECIPROCATING-ENGINE LINER AFLOAT.
The arrival at the port of New York of the transatlantic liner "Kronprinzessin Cecilie," of the North German Lloyd Steamship Company; marks the advent of the last and finest of that great quartette of high-speed ocean steamers of this company, which has helped so greatly to advance the speed and com-
fort of transatlantic travel. Commencing with the fort of transatlantic travel. Commencing with the
"Kaiser Wilhelm," which was the first ship to maintain an average of over 23 knots an hour across the Atlantic, the company have placed in service at intervals of a year or two the "Kronprinz Wilhelm," with a record of 23.47 knots; and the "Kaiser Wilhelm II.," which raised the speed to 23.58 knots, the present record of the Atlantic. The last-named ship, which was brought out in 1904, proved to be so eminently satisfactory that, when the company decided to build the "Cecilie," they considered that they could not do better than duplicate the "Kaiser Wilhelm II." in every particular. This was done; and that the ship will equal, and probably exceed, the performance of the sister vessel is shown by the fact that on the trial trip, over a measured course of 60 miles, the "Cecilie" averaged a speed of 24.02 knots.
In view of the fact that the "Lusitania" has shown such good results on her trial trip, and is likely to capture the Atlantic record, and that the German Lloyd Company are certain, in the future, to make an effort to win back the record, it is probable that the "Cecilie" is the last high-speed transatlantic steamer of very great power that will be built with reciprocating engines. In fact, it may be taken that in this ship the German shipbuilders have carried the development of the reciprocating marine engine up to the high-water mark of its possibilities.

Further advance will be either along the lines of the steam turbine, or of turbo-motors with the electric motors direct-connected to the propeller shafts; or it may be that the next advance will be marked by the introduction on a large scale of the marine producergas engine. That the limits of the reciprocating engine have been reached, is shown by the great magnitude attained by many of the engine parts, and notably by the propeller shafts. These last in the "Cecilie" are $25 \frac{1}{4}$ inches in diameter, and upon each devolves the heavy duty of transmitting at times as much as 24,000 horse-power. This is an enormous load to be imposed, day and night for nearly a week, upon a single member, and the question of further increase of power is halted by the serious difficulties that would be encountered in the forging of shafting of the necessary size, elasticity, and durability. For this reason alone, naval designers are being driven to the use of three and even four shafts; and to such an arrangement the steam turbine lends itself perhaps more readily than the reciprocating engine. In the new record-breaking ship which the North German Lloyd Company are pretty certain to undertake, it will be a question of great interest as to which of the four leading types of turbine will be adopted-whether the English Parsons, the American Curtis, the German Zoelly, or the F'rench Rateau.
If we are right in our conjecture that the "Cecilie" will mark the highest point to which the development of the reciprocating engine will be carried in highrowered steamers, the "Cecilie" and the sister ship will always be notable landmarks in the future annals of the marine engine. They have set the figures for fuel economy at a point which must ever tax the skill of the steam turbine builders to surpass, if indeed they ever attain it. Before giving any details of the motive power, we may mention that the "Cecilie" is 706 feet long, with a beam of 72 feet, a depth of 44 feet 2 inches, and a displacement of 26,000 tons. She has the usual double bottom, and the hull is divided into twenty water-tight compartments. All the bulkhead doors may be closed directly from the bridge; and like all modern liners of the first class, she may be considered unsinkable by any of the ordinary agencies of disaster. Of the interior accommodations of the ship it is sufficient to say that they are superior, even to those of the later ships of this line; while the decorative features are marked by the simplicity and refinement of the latest school of marine decorative work.
The engines of the "Cecilie" are four in number, each carried in its own separate water-tight compartment. Each engine has indicated about 12,000 horsepower in actual service. They are placed in pairs in tandem, two on each shaft. In the four engines there are altogether sixteen cylinders-four high-pressure, four first intermediate, four second intermediate, and four low-pressure cylinders. The high-pressure eylinders, which are carried in tandem over the first intermediates, are $373 / 8$ inches in diameter; the first intermediates are $491 / 4$ inches; the second intermediates, $747 / 8$ inches in diameter; and the low-pressure cylinders reach the truly enormous size of $1121 / 4$ inches diameter, these being the largest marine cylinders, we believe, ever built. The common stroke is 6 feet. Steam is supplied from nineteen cylindrical boilers, at a pressure of 230 pounds to the square inch, through four main steam pipes, each of which is 17 inches in diameter. To produce this steam 764 tons of coal are burnt every twenty-four hours in 124. furnaces; and, as we have above stated, the resulting 48,000 horse-power of the main engines has proved sufficient to drive the vessel at slightly over 24 knots an hour.
It is an interesting coincidence that the finest, and what will probably be the last, of the reciprocatingengine liners, should be placed in service at about the same time as the first of the new high-speed turbine liners. The performance of these two ships will naturally be watched with the keenest interest; for in spite of the fact that the turbine-driven ship greatly exceeds the other in size and power, the "Cecilie" herself, with her displacement of nearly 30,000 tons, and her horsepower of nearly 50,000 , is sufficiently large and powerful to eliminate, when driving into a head sea, much of the advantage due to the higher momentum of the larger ship. It is to be hoped that the facts as to relative coal consumption will be made available for the technical world. Just now, the steam turbine is being saddled with a reputation for extreme costliness in fuel; and predictions along these lines are being made so freely regarding the new Cuncrders, as to suggest that perhaps the wish, in some quarters, may be father to the thought. For ourselves, we think it is likely that, because of the size of the plant and the high speed at which the turbines are being run, the new Cunarders will show about the same economy as the latest reciprocating-engine ships. This has been brought down in the "Cecilie" to 1.4 pounds of coal per horse-power per hour, including the auxiliaries.

GOVERNMENT FUEL TESTS AT JAMESTOWN
-The government fuel-testing plant, which for two by the order of Congress to Norfolk, where it has been located near the main entrance to the Jamestown exposition. In the course of the work done at St. Louis, the United States Geological Survey in charge of the plant showed that by more economical methods of burning the coal, it would be possible to make a saving of ten per cent of the total coal consumption of the country each year, an amount which would represent a saving in value of $\$ 160,000,000$ annually. The work now to be undertaken at the testing plant will be devoted, first, to increasing efficiency and so preventing waste of the fuel resources or the country, and secondly to the testing of coal used by the government, particularly on warships. Under the first head, the most valuable tests will be those made to determine the relative efficiency of the steam boiler and the gas producer. Already it has been demonstrated at this plant that the gas engine is capable of producing over 100 per cent more work from a pound of coal than can be secured from the average steam engine. Experiments in this connection will be continued with the 235 -horse-power internal-combustion engine which forms part of the plant. It is to be supplied with gas made in two producers from the same grades of fuels that will be used in the koilers. It is proposed to make in this way comparative tests of the poorer fuels, such as slack coals, culm, lignite, and peat. Particularly valuable to steam users will be the result obtained by the engineer in charge of the steam division of the plant, Prof. L. P. Breckenridge, who has already succeeded, or practically so, in separating the results obtained in the boiler from those obtained in the furnace; and particular attention is to be paid to the efficiency of the furnace alone. Exhaustive tests will be made to determine what conditions are necessary to burn these low-grade fuels without smoke, and the lessons learned will be valuable, not only from the standpoint of economy, but also as tending to abate the ever-present smoke nuisance.
In its work of testing fuels for the navy, the testing plant will have at its service three briquetting machines; one of German make, which will be used for briquetting the lignites of Texas and the Northwest; another an English machine, which has already been in use at the plant in St. Louis; and also an Americanmade machine. Although the advantages of briquetting have been thoroughly understood for many years in Europe, this form of fuel has not received the attention it deserves in the United States; and it is hoped that the work of the testing bureau on American coals will prove that briquetting will give as good, if not better, results than are obtained from lump coal taken from the same mine as that from which the coal for the briquettes is secured. For the navy, the briquette should prove especially useful; for it is practically smokeless, and concealment and invisibility are most important factors in the strategy of war. It will probably be shown in the forthcoming tests, that in locomotive boilers or marine boilers using any forced draft system, the use of the coal in briquette form so largely increases its efficiency as to more than offset the cost of briquetting.
Other tests, which should yield valuable results, will be made with five 15 -horse-power gasoline engines, which have been erected at the plant for the purpose of testing the relative efficiency of gasoline, kerosene, denatured alcohol, and other liquid fuels, in the production of power and light. Finally, an investigation will be made to determine the exact cause of the spontaneous combustion of stored coal, and upon the results obtained recommendations will be made as to the best methods of storing.

## THE 24-HOUR AUTOMOBILE RACE ON THE BRIGHTON

 BEACH TRACK.Since it has been decided that there will be no Vanderbilt Cup or other big road race this year, interest has centered chiefly in the new form of track race-the 24 -hour event. Several of these races have been held on race tracks at various places, the latest and most successful one having been run off on the Brighton Beach track on the 9 th and 10 th instant. Fifteen machines started in this race, as follows: A 60 horse-power Thomas, 40 horse-power Lozier, Jackson, and Mitchell cars, a 50 -horse-power Darracq, a 45 -horse-power Delahaye, 35 and 28 horse-power Oldsmobiles, a $28-32$ horse-power Pilain, a 35 -horse-power Stoddard-Dayton, 40-horse-power Matheson, 50-horsepower De Dietrich, Welch, and Frayer-Miller cars, and a 60 -horse-power Lozier. With two exceptionsthe Thomas and the De Dietrich-two drivers were provided for each car, one to relieve the other. The race was started at 10:20 P. M. Within the first hour, several cars were obliged to stop to light their red tail lights. Much trouble was experienced from these lights going out during the night hours of the contest. The De Dietrich, after making a round on three cylinders, pulled into the center of the oval and
renewed a blown-out gasket on its engine. This car had considerable trouble from this cause. The tire repair stations within the oval were early called upon. The Stoddard-Dayton was kept waiting for nearly four hours as a result of tire trouble and a demolished rim. It was finally withdrawn after 16 hours, during which it covered 216 miles.
Other cars that were soon obliged to drop out were the 60 -horse-power Lozier, the Frayer-Miller, the De Dietrich, and the Pilain. The first two, owing to a sharp turn in a soft spot (which caused the tie rod connecting the front wheels to break) and the bursting of a front tire respectively, ran through the fence and were damaged sufficiently to put them out of the race; while the two French cars quit after cracking two cylinders and demolishing a front wheel. The latter accident caused the Pilain to run through the inner fence and injure a number of spectators who were sitting thereon. In less than three hours the car was running again, but on account of a cracked frame it was ruled off the track. It covered 219 miles, while the De Dietrich covered 311. Both were withdrawn at the end of the ninth hour. The FrayerMiller (which was the sole representative of the aircooled cars) covered 268 miles in 6 hours and was in first place at the time of its accident. The Lozier covered 104 miles in 3 hours before it dropped out. From the end of the sixth to the end of the twentythird hour the Jackson led, with the Thomas second and the 40 -horse-power Lozier third. During the last hour of the race, the Jackson had trouble with its timing gear owing to a set-screw loosening. The motor misfired badly and finally stopped. The 60 -horse-power Thomas, which had been gaining gradually upon its 40 -horse-power rival, then assumed the lead, and finally finished with 997 miles to its credit, while the Lozier had 972, and the Jackson 966. The 40-horse-power Mitchell, which had been doing some very consistent running after experiencing a broken fan and damaged radiator in the first hours of the race, was fourth with a score of 774 miles. Only two other machines, the French Delahaye and Darraca cars, were still in the race at the finish. These cars scored 720 and 560 miles respectively. Each of them experienced various troubles that kept them off the track for long stretcnes at a time, and neither of them was actually running when the finish occurred.

## THE CURRENT SUPPLEMENT.

Tebessa, though not one of the largest, is one of the most interesting towns of French Algeria, chiefly because it is the Theveste of the Romans. Its archæological curiosities are interestingly described and illustrated in the opening article of the current Supplement, No. 1651. In an article entitled "Photodynamic Phenomena," Prof. Henry von Tappeiner describes some luminous animals and plants. The first installment of a most. thorough treatise by Col. C. W. Larned, of the United States Military Academy, on the history of map making and topography, is published. Heavy freight trains are historically and mechanically discussed. Every student of mechanism knows the difficulties that have been encountered in fully grasping the meaning conveyed by a textbook description of the properties of a particular mechanism, and the effect of altering its proportions. An English engineer has devised an apparatus for overcoming such difficulties. This is called the Newman kinematic apparatus for the study of mechanism, and is described in the current Supplement. A new system for laying and fixing rails for street surface railroads is explained by the English correspondent of the Scientific American. Francis Elgar's excellent paper on unsolved problems in the design and propulsion of ships is concluded. Horace C. Hovey gives a picturesque account of the Mammoth Cave Cathedral. To simplify the mechanical construction of storage batteries, and at the same time to improve their operation and increase their efficiency, is the avowed object of two inventions by Thomas A. Edison, which form the subject of an article in the current Supplement. The presidential address before the British Association for the Advancement of Science was delivered by Sir David Gill, who took as his subject the science of measurement and its application to astronomical research. An extensive abstract of this paper appears in the current Supplement.

It is reported that President Roosevelt has approved certain suggestions as to new coinage which have been made by the American Numismatic Society, and that he has called for a report from the Secretary of the Treasury. A new coinage of the eagle and double eagle, from designs by the late Augustus St. Gaudens, is already in hand. A strong committee of the Numismatic Society recommends that Congress be petitioned to authorize an entirely new coinage of artistic design, to consist of ten denominations, and in order that the designs of the new coins be truly artistic the best talent in the country should be called upon to submit drawings. The resolutions read: "That the sum of $\$ 10,000$ be appropriated for each special coin model,
without regard to the monetary value of the coin to be issued, whether a cent or a twenty-dollar goldpiece, as it is important to have the smallest coins as artistic as the highest. That the six best designs received for each piece shall be awarded $\$ 1,000$ each from the above sum of $\$ 10,000$, and that the committee hereinafter proposed shall have the right to select the best of the six designs, and to accept the model with or without modification by the designer, paying the successful competitor an additional sum of $\$ 4,000$."

## SCIENCE NOTES.

The sea around Bermuda has long been noted for the wealth of its zoological life. In many of the shallow, clear waters around the coast it is possible for visitors to scan the ocean bottom, where the lirilliant coloring of corals, plants, and animals can be plainly seen. A laboratory for biological research has already been established in Bermuda, and its work will probably receive an impetus from an interesting forthcoming visit. The Seventh International Zoological Congress, held in Boston August 19 to 23, has arranged for an excursion to Bermuda in order to give the members of the Congress an excellent opportunity to get a glimpse of this most interesting zoological region and to become acquainted with the manner in which the work is conducted. The local programme of the trip will include several collecting and dredging trips, so that those who go there will have an ing trips, so that those who go there will have an
opportunity to collect and preserve much material.
Archæological work is being carried on in the island of the Nile known as Elephantine, under the auspices of the French govermiaent and directed by M. Clermont-Ganneau. This island is situated in the middle of the Nile, not far from the first cataract. Cwing to the character of the ground, the work of excavation is somewhat difficult; but a number of objects, some of which are of considerable value, have been found. Among these may be mentioned two large steles of diorite, covered with inscriptions of Thotmes III. A curious kind of sanctuary decorated with miniature obelisks and covering a spot which was used for burying the bodies of sacred animals was also found. These animals proved to be rams, carefully mummified and buried in sarcophagi of granite. The wrappings of the mummies are gilded and ornamented with painted scenes of a mythological character and bear inscriptions. The ram was among the sacred animals of Egypt, and seems to have been specially consecrated to the deity Khnoum, one of the principal deities of the island. Among other finds are many fragments of texts inscribed upon pieces of pottery and known as ostraca. The inscriptions are in hieroglyphic, hieratic, demotic, Greek, Arab and Coptic, and there are about a hundred in all. The presence of the Aramean language shows that even as far back as the fifth century B. C. the island was inhabited by the Jews, as also the neighboring locality of Aswan. Papyrus inscriptions had already proved this fact, but now we find just what quarter of the ancient city was inhabited by the colony of Jews; as the ostraca are not found anywhere else. According to the records a Jewish temple must have existed in this locality, and the excavators are hopeful of finding it.
From time to time lumps of butter are dug out of the Irish bogs, and specimens of it may be seen in various museums. A chemical examination has recently been made by Messrs. Radcliffe and Maddocks of a sample of such butter, which was found four feet below the surface of a bog at Maghery, county Tyrone. The original lump, which weighed about 20 pounds, is probably some centuries old, and it is suggested that it had been put into peat water to preserve it, or to give it a flavor, and had then been forgotten. Yet so effectually had the fat been preserved by the peat water that it still retained many of the chemical characteristics of butter fat, though naturally its appearance had greatly changed. The exterior was white and granular, and the whole mass had been converted into a wax-like material. The conclusion that it had once been butter, however, was confirmed by the fact that numerous cows' hairs were present. A similar alteration of animal fats when buried in the earth for a long period has frequently been noticed, and the wax-like product is known as "adipocere." The name originated with Fourcroy, who, in 1789, communicated to the French Académie des Sciences the results of his examination of the fat of some of the bodies transferred from the church graveyards to the Catacombs of Paris. The change in the fat was most noticeable in the case of bodies that had been buried about fifteen years and originally crowded together, the bones being then coated with a gray plastic substance. Fourcroy came to the conclusion that this adipocere ("fatwax") was formed by the slow decomposition of any animal substance, with the exception of bones, hair, and nails; but Chevreul, who studied the phenomenon in 1812, showed that only the fat originally present was affected in this way, and his conclusion was confirmed by Gay-Lussac.

## OPENING OF THE LARGE DRYDOCK AT LEAGUE

 ISLAND.The handsome drydock at League Island, after much delay, has been opened to the nation's warships. So large is this new dock, that although the "Kearsarge," the first warship to be towed into the dock, is 368 feet long, with a beam slightly in excess of 72 feet, she ooked far less than her size when the huge basin was empty of water.
The length of the dock over all from the oute groove to the head of the dock is 750 feet; the length of the bottom is 698 feet; and the width amidships is 134 feet. The width at the bot tom, amidships, is 80 feet. At the entrance to the basin the width is 102 feet at the top and 80 feet at the bottom. mean tide the water over the sil is 30 feet deep, a sufficient depth to accommodate the largest battleship afloat.

The basin is built in courses of stone and concrete narrowing as the bottom is ap proached. It repre sents four years of most arduou toil, and the mas tering of engi neering difficulties that were well nigh baffling. Two
or three of the sub-contractors engaged upon the work were forced to suspend, unexpected physical problems arising which made the cost of excavating and building the elementary portions of the basin far more expensive than the government's appropriation would warrant. In constructing this expensive work, quicksand proved to be the most serious difficulty. This necessitated the driving of 4,000 piles to provide a foundation strong enough to prevent the massive superstructure and its loads from serious settlement. With this quicksand in mind, the engineers watched closely the docking of the "Kearsarge"; but even with the weight of the battleship added, the dock stood the test with every evidence of stability.

The walls of the new basin have an unusually steep pitch. This improvement makes possible the floating and docking of the largest war vessels in the basin with less water than would be required by a much smaller structure.

The drydock was authorized by Congress in 1898, at the close of the war with Spain. It is the design of the Navy Department that each of the divisions of the Atlantic squadron shall have its particular drydock; and to League Island have been permanently assigned the "Kearsarge," "Kansas," "Georgia," "Maine," "Brook lyn," "Columbia," "Minneap olis," "Montgomery," "Dixie," "Prairie," "Yankee," and "Panther." The old drydock at the navy yard is large enough to accommodate all except the largest of the bat tleships.

## MAGICAL CURES <br> by randolph i. gear

From time immemorial people in almost all countrie have believed in the curative properties of certain natural objects prepared by special methods, as well as in the supernatural power of images, idols, and fetiches of all kinds. Stones of different qualities have been supposed to possess divine attributes. Elias Ashmole, who
[
silver, flints into rubies, diamonds, sapphires, etc. By means of vegetable stones, men, beasts, birds, fishes, and plants could be made to grow and bear fruit. The magical stone enabled one to discover any person in any part of the world, as well as to understand the language of birds and beasts, while the "angelicall" stone endowed its possessor with divine gifts, causing angels to become manifested, besides conveying the power of conversing with them through dreams and revelations. Even such men as Lord Bacon and Sir Isaac Newton speculated on the so-called philosopher's stone, so that those of our day who visit mediums and believe in rappings and slate writings are no whit more credulous than they. Dr. Christopher Girt anner, a famous professor of Göttingen, prophesied as late as the last century that before it had passed the transmutation of gold would be generally known and practised. "Every chemist and artist," said he, "will make gold; kitchen utensils will be of silver and even gold, which will contribute more than any

Indian Medicine Man's Rattlé,
 are believed to be increased in proportion as there is mystery in their modes of life. Toads and other batrachians come under this category, and hence lizards which have been dried and neatly stretched upon bamboo splinters, are greatly in demand in China and other countries where the primitive medical man still holds sway. In Japan merely the skin of a snake is still supposed to be a sovereign cure for abdominal pains. Turtles, too, are regarded with great awe in China, and so are tigers' bones and carbonized monkeys' skulls, which are prepared by putting them into clay vessels exposed to heat until the crania are thoroughly calcined. Birds are also carbonized for medicinal purposes, and the nests of certain swallows, made out of the gelatinous substance of seaweeds partly digested and disgorged, are believed in that country to be most invigorating as medicine for the sick.
The Indian medicine-man does not by any means rely wholly on magic for his cures; he makes people well by producing uncanny noíses, which are believed to frighten away the spirits of disease. For this purpose a wooden rattle covered with buck-skin, and made up in the shape of a turtle, is often employed, while for similar purposes of exorcism the Tibetan lama wields a whip with a handle of human bone and lashes of human skin, while he beats upon a drum formed out of the upper parts of two human skulls.
Charms and incantations were common among the Druids for the cure of diseases, and often the former consisted of nothing more than rags, old clothes, pins, or needles. In Persia there is a superstition that a patient has only to deposit a rag on certain bushes to obtain a cure. Pieces of garments that have touched the "pilgrim camel" are preserved with great veneration, and when persons are dangerously ill, they lay these things on their bodies as infallible
remedies. Among the Indians and Norwegians, and remedies. Among the Indians and Norwegians, and
other northern nations, the hoof of the elk is regarded as a sovereign cure for epilepsy, if applied to the heart of the sufferer and then to his ear. Fn the Hawaiian Islands a fetich consisting of a human thigh-bone and a braid of human hair is regarded as a panacea to ward off misfortune; while a straw image thrown out of a Korean's house on the last day of the year, is believed in that country to carry with it the
left. Before her was a band of the executors of her vengeance, two of them with red grinning masks, black shields, and naked scimitars. White lines, like rays, issued from the bodies of the others, to indicate infection. On the right was a group of men with spotted bodies inflicted with the malady; bells were hung at their cinctures, and a few of them waved black feathers. These were preceded by musicians with drums, who supplicated the pity of the furious
having peculiar power over some special form of disease. Thus, the Zuñi Indian makes a clay image to represent a mountain lion, and the spirit of that animal, which is the guardian of the Northwest and the master of the gods of the hunt, comes to dwell in that object, protecting the owner from injury by accident and helping him to success in the chase. A Korean sorcerer's image, stuffed and covered with buckskin, and often represented as riding on horseback, is used


Idol at Korean Crossroads, Used to Frighten Away Spirits, Which are Much Dreaded in the East.


The Famous Scythian Lamb-a Woolly Rootstock of a Plant Alleged in Myth to be a Young Sheep. The Plant is Grown in China for Medicinal Purposes.
sins of the household, as well as to obliterate all traces of bad luck.
In old England the women were no doubt as anxious to appear charming as here in modern times, but their efforts to do so were far more simple and less expensive than now. For instance, if they were disfigured by warts, they merely had to steal a piece of beef from a butcher's shop, rub the warts with it, bury it, and (presto!) they disappeared; or, did their complexions need to be more pink, all they had to do was to eat some kind of plant, seeds and all; roses took the place of sallow skin. In Algeria, too, women follow this practice, using a plant called fenugreek for the purpose. The wonder of it all is how, after failure must have proved the inefficiency of the remedies in a large majority of cases, they went on believing (and in many countries still believe) in these absurd remedies; but had it not been so, human nature would have had to be different from what it is, has been, and probably will be, and there would then be no truth in the saying that every one likes to be fooled part of the time.
It would not do to omit mention of the powerful aid rendered by the various gods and goddesses in China, India, Java, Korea, and other countries, in exorcizing disease. The Hindoo goddess who had a superintending power over smallpox, for example, was approached with solemn ceremonies and presents to propitiate her. She was represented as standing with two uplifted fingers, threatening to strike on the right and
deity. From behind her advanced a bevy of smiling young women, gracefully carrying on their heads baskets with thanksgiving offerings, in gratitude for their lives and beauty having been spared. A little boy with a bell at his girdle conveyed something emblematic of inoculation from the arm of the goddess. By such means and humble intercession the benign goddess gradually stayed her fury, and the diseased were thus made whole, or were at least supposed to be cured, which appears to have answered just as well. In Java some idols are provided with bells for calling the attention of the god and goddess to the need of their exercising sacred powers in behalf of the sick and unfortunate.

Akin to this blind faith is the credulity of some classes of Japanese, whose doctors know very little more of anatomy and physiology than the patients themselves, and for purposes of diagnosis they rely mainly on the pulse. Three pulses are found to be in each wrist, they explain, viz., the heart, controlling the right upper pulse; the lungs, the left upper pulse; the stomach, the right middle pulse; the liver, the left middle pulse; the right kidney, the right lower pulse; and the left kidney, the left lower pulse. Thus, by a careful examination of the six pulses, he at once discovers what is the matter with the patient, and proceeds in his own way to effect a cure, or to instil into the patient's mind that he is already made whole. In Korea and among the North American Indians images are made out of various materials, each kind
in like manner, and is believed by the natives to be all-powerful in averting calamity and death.

An interesting announcement of which we shall look for confirmation with interest, comes from the School of Medicine at Rochefort (France) regarding a new radio-active substance discovered by a young student named Luncien. It is said that the substance is uranyl-molybdate, and as its constituents uranium and molybdenum are fairly abundant elements there should be no undue trouble in providing the materials, nor would there be in preparing the substance. The molybdate is formed by adding ammonium molybdate to uranyl nitrate, when a white amorphous powder separates. This is dried in the dark and apparently must be kept there, as it is unstable. It is said to give radio-active effects practically as intense as those given by radium. Though costly-about $\$ 110$ per ounce-the price is slight compared to radium, which has reached many thousands of dollars per ounce.
Commander Peary's attempt to reach the Pole has been postponed for twelve months. In a statement which he has issued, Mr. Peary says that the delay has been caused by the failure of the contractors who were installing new boilers to keep their agreement. The work was to be completed on June 1, but was two months late. The "Roosevelt" will, it is hoped, be able to visit Etah, Greenland, this year, where it will deposit a supply of coal for its use next year.


Dried Lizards Stretched on Splints of Bamboo. Used in China as a Medicine. Reptiles in China as a Medicine. Rep
are Widely Used as Fetiches.


Straw Image (Korea) Thrown Out of the Javanese Idol with House on the Last Day of the Year to House on the Last Day of the Year t.
Carry Sins and Bad Luck with It.
 God.


Hawaiian Fetich of Human Thigh-Bone and Braided Human Hair. A Supposed Means

The unscientific mind usually attributes sickness or misfortune to some malign external influence which must be appeased. In the supplication or propitiation an object of human origin, or one modeled into human form, is frequently used.

## A HOME-MADE ALTERNATING-CURRENT RECTIFIER.

 by wilmar f. LentThe experimenter who has only alternating current at his disposal is seriously handicapped by the lack of an apparatus which will successfully convert this alternating current into unidirectional or direct current. Likewise, the owner of a gasoline automobile, having alternating current at hand, greatly feels the necessity for a rectifying apparatus suitable for charging his ignition batteries. For large currents and high efficiencies, the mercury arc rectifier is pre-eminently satisfactory; but for small currents, when the efficiency is not so important and first cost becomes a serious item, the electrolytic rectifier answers. In what follows we will first summarize the principles and essential features involved in the successful action of the electrolytic rectifier, and then give plans for the construction of a small apparatus suitable for charging storage batteries, operating electrolytic processes, and in fact supplying current for any use requiring from 3 to 5 amperes at 15 to 25 volts.

An electrolytic rectifier consists essentially of an aluminium and a conducting plate (of carbon, lead, iron, or any metal not attackable by the electrolyte) immersed in an electrolyte which is capable of acting in a certain manner on the aluminium when current passes from an external source through the cell. It is found that when a current flows from the conducting plate to the aluminium (i. e., when the aluminium is made the cathode) there is no resistance encountered beyond that of the electrolyte; but when an attempt is made to pass the current in the other direction (making the aluminium the anode) so great a resistance is met with that the current practically will not flow. This peculiar action is attributed to a very thin coating of oxide which forms on the aluminium plate. The cell has been aptly called an "electric valve," in that it allows elec tricity to pass freely in one direction and not in the other. Cells possessing this property are called asymmetric.
The application of this cell to the rectifi cation of alternating currents will readily be seen. One-half of the alternating wave can be suppressed by placing the rectifier in circuit. $A$ (Fig. 1) represents the sine curve of an alternating current. When the cell is put in circuit, the curve assumes the form shown at $B$. It will be seen that only half of the current is used. It is possible, however, to so connect up one or a number of cells to utilize all the current, that is, to change the sine curve to a curve as shown at $C$. Figs. 2 and 3 represent two of the methods of connection.
In Fig. $2 \pm$ represents the alternating mains, $T T$ a transformer having three secondary terminals, $X Y Z$, of which one ( $Z$ ) is attached to the middle of the secondary coil, and $A, A_{1}, C$, aluminium and carbon plates respectively in an asymmetric cell Current passes in the direction of the ar rows; it cannot pass in the opposite direction. No electricity can pass between $A$ and $A_{1}$ in either direction in virtue of the oxide films on both of the plates. When $X$ is negative, the current traverses the path $Z M C A X$; when $Y$ is negative the path is $Z M C A_{1} Y$ The current. at $M$ is unidirectional. In Fig. $3 \pm$ rep resents the alternating-current mains, $A A_{1} C$ an asym metric cell as in Fig. 2, $C_{1} A_{3}$ and $C_{2} A_{2}$ two more cells. Current passes through the cells in the direction of the arrows. No current can flow from $A$ to $A_{1}$ or from $A_{1}$ to $A$. When $X$ is positive, the current follows the path $X C_{2} A_{2} M C A Y$; when $Y$ is positive, the path is $Y C_{1} A_{3} M C A_{1} X$. The current at $M$ is unidirectional
Of these two methods of connection, the one shown in Fig. 2 is without doubt the best-the resistance of the electrolyte is much less, there are fewer sources of leakage, the apparatus is more compact, etc. The difficulty in its use lies in the fact that it is protected by patents. The method of connection shown in Fig. 3, devised by the author, will be used when the construction of the rectifier is taken up.
There are certain factors essential to the efficient operation of an electrolytic rectifier. First, the electrolyte to be suitable must have a low resistance, must not attack the aluminium when current is not passing through the cell, must not attack the aluminium too vigorously wher current is passing through the cell, and must be composed of a stable substance. Sodium phosphate acidulated with sulphuric acid, potash alum, Rochelle salts, phosphoric acid, and in fact most of the soluble phosphates, sulphates, and tar trates, meet the requirements with more or less success. The author has had considerable satisfaction from the use of acidulated sodium phosphate solution.
The surface density at the aluminium plate must be comparatively high-not less than $1 / 10$ of an ampere per square centimeter of surface. On account of this large amount of current traversing the electrolyte, the heating is quite excessive. Since the eff-
ciency decreases greatly as the temperature rises, an adequate means of maintaining a low temperature must be provided. Cold water, passing through glass worms in the electrolyte, is the most efficient method. It is inadvisable to apply more than a certain voltage to a single cell. Beyond this limit the oxide film seems to break down and lose its asymmetric properties. The limit voltage for an aluminium-sodium phosphate-carbon cell is about 30 volts. Higher voltages may be rectified by connecting cells in series. construction of a small rectifier.
The following are plans for a rectifier suitable for utilizing 104 to 110 volt alternating current at commercial frequencies, and for delivering direct current of 3 to 5 amperes at 15 to 25 volts. The apparatus can, however, be made to utilize any alternating-current voltage by merely changing the transformer.
It is necessary to have a transformer to step down the voltage of the alternating-current line to a value which may be handled by a single cell. Since more than 15 or 20 volts direct current is rarely needed for electrolytic work, this transformer has the further advantage of increasing the secondary current without increasing the main-line current. Thus less current is used from the supply mains for the same direct current than if full potential were employed. For want of space here, the designing of this transformer, being quite simple, is left to the builder, who, if he is not sufficiently well informed, may consult any standard textbook on alternating currents. The transformer must be constructed to deliver 5 amperes and 25 volts at the normal load. Leads must be brought out from a few of the end coils for voltage regulation. (See Fig. 6, C.)


## details and connections of the alternating-current

 RECTIFIER.taining jars, the middle cell with the two aluminium plates being $6 \times 4 \times 21 / 2$ inches, and the end cells with one aluminium plate $6 \times 3 \times 21 / 2$ inches inside measurements. The aluminium plates are cut out of $1 / 8$-inch sheet aluminium, and are the same size and shape for all the cells. (See Fig. 4, A.) The carbon plates are cut from $1 / 4$-inch carbon plate with an old hacksaw. (See Fig. 4, B and C.) Two of $B$ are made for the end cells, and one of $C$ for the middle cell. Both the carbon and aluminium plates are provided with binding posts as shown in the figure. The lugs of the carbon plates are dipped in melted paraffin to prevent creeping of salts. Hard-rubber tops are provided for the jars to retard evaporation of the electrolyte. The carbon and aluminium plates are suspended from this top, and held $1 / 2$ inch apart by hardrubber separators. The positions of the plates in each cell are shown in Fig. 5 .
Six glass worms (Fig. 4, D) are bent from $3 / 8$-inch (outside measurement) glass tubing with thin walls. They are of a size to fit correctly on each side of the plates in each cell ( $a b c d e f$, Fig. 5). The inlets and outlets ( $a$ and $b$, Fig. 4, $D$ ) should rest on the edges of the jars, $c$ and $d$ should just project above the surface of the electrolyte, and $e$ and $f$ should nearly reach the bottoms of the jars. Fig. 5 shows the connections of the water-cooling system, $a b c d$ ef representing the glass cooling worms. They are connected with each other and the water supply and waste ( $K$ and $L$ respectively) by stout rubber tubing bound on tightly with wire. The water is supplied by $1 / 8$-inch iron piping; the waste is $1 / 4$-inch pipe. As the middle cell passes twice as much current as the end cells (refer to Fig. 3) it will get twice as hot. With this condition in mind, the cold water is first passed
through the middle cell and then through the end cells. The end cells may be kept cool enough by increasing the water supply at the valve $g$ (Fig. 5)
If the electrolyte is of acidulated sodium phosphate, a saturated solution of the phosphate is prepared and the jars filled, with plates and cooling worms in position, to within an inch and a half of the top. After the apparatus is assembled, the sulphuric acid is added as will be shown below.
The switches are shown in the assembled apparatus (Fig. 6). $G$ and $H$ are ordinary 15 -ampere knife switches on slate or porcelain bases. $F$ shows a conventional fuse block on the alternating-current line. Three ampere fuses are quite sufficient. $C$ is a point switch controlling the voltage of the transformer. Small binding posts $b b$ are provided for convenient connection with the electrolytic cells; they are insulated from the panel by hard-rubber bushings and washers. At $M$ are two massive binding posts; the direct current is taken off here. $A$ and $V$ are an ammeter and voltmeter respectively. These instruments may be omitted, though they are very useful. They must be of the hot-wire type to correctly record the pulsating current. $T$ represents the transformer; $g$ is the handle to the valve controlling the cooling water; $K$ and $L$ represent the inlet and outlet water pipes respectively; the alternating mains are shown at $\pm . \quad W W W W$ represent the connections of the cooling worms. The panel is of $1 / 2$-inch seasoned oak, $15 \times 29$ inches. At $B$ is a shelf of the same material. The electrical connections are shown diagrammatically in Fig. 7. $\pm$ represents the alternating current mains controlled by the switch $G, T T$ is a transformer, and $C$ the switch controlling the voltage of its output. $B$ shows the asymmetric cells connected as in Fig. 3. $A$ is the ammeter connected in series with the direct-current circuit; $V$ is the voltmeter connected in shunt across same. $H$ is the direct-current switch, and at $M$ are the binding posts where the direct current is obtained. All the wiring is done behind the panel on porcelain insulators. The piping for the water cooling is also partly behind the board.
When the panel is all connected up, the electrolyte is brought to the proper conductivity by adding sulphuric acid in each cell until the ammeter registers 5 amperes at full load. Before using the rectifier in actual work, the aluminium plates must be "formed." This is accomplished by running the rectifier with a resistance at $M$ (Fig. 6) at full load for a couple of hours. In starting the apparatus, first turn on the main alternating-current switch $G$ (Fig. 6); then regulate the voltage by the switch $C$ to the desired value. Close the direct-current switch $H$. The current is now regulated to the proper quantity by $C$. Now - turn on the water by the valve $g$, but slightly at first, then more and more as the cells grow hotter. The best efficiency is obtained when the cells are coldest and the current density is greatest. To stop the apparatus, open the direct-current switch $H$, then the alternating-current switch $G$, and lastly turn off the water. The aluminium plates will need occasional cleaning, as a hard barnacle-like substance forms on them. At certain intervals the aluminium plates will need renewing because they wear away slowly. The electrolyte will also have to be changed each time the plates are re newed.
The current obtained from such a rectifier as de scribed above is not strictly direct-current but pulsating, unidirectional current. (See Fig.1, C.) This type of current is desirable for charging storage batteries, as more time is allowed for chemical action, and therefore less "gassing" is the result. Let it be understood, however, that the wave form of the current does not hinder its application to the operation of all direct-current machinery.

Fighting Coal mine Fires With Chemicals.
For fighting fire in its anthracite coal mines a new form of chemical fire engine is now being used by the Delaware, Lackawanna \& Western Railroad. This engine is built on a truck which can run upon tracks throughout the mine. When an alarm of fire is sounded the engine is attached to an electríc mine locomotive and rushed to the scene of trouble at high speed. Water played upon a coal fire is almost in stantly converted into steam, which further disinte grates, forming a gas so suffocating that it drives away the men fighting the fire. Blue flames which shoot out when water strikes the hot coal often set ablaze pockets of gas in the ceiling. When a chemical engine plays upon burning coal the heavy gases evolved cling to the floor and smother the blaze by excluding the air. Men are not annoyed by the fumes and can stay close enough to do effective work,-Rail way Engineering Review.

## the meats we eat.

The recent rise in the cost of meat, which has affected the pocketbook very severely, has awakened considerable interest in the subject of meat slaughter ing and meat packing. This is one of the most important industries in the country, and the total value of the products is well up toward the billion mark. The following table prepared by the Bureau of the Census gives the salient facts concerning this gigantic industry:

Slaughtering and meat packing-materials used, by KIND, QUANTITY, AND COST; AND PRODUCTS, BY Kind, QUANTITY, AND value: 1905.
Materials used, total cost. ..... . $\$ 805,856,969$ Beeves:
$\qquad$
Gross weight on hoof, pounds $7,485,407,944$ Net weight, dressed.......... 4,066,264,877 Cost . . . . . . . . . . . . . . . . . . . . . $\$ 289,040,930$ Sheep:
Number
10,875,339
( $930,168,367$
Cost .............................. $\$ 444,359,804$
Hogs:
Number ....................... $30,977,639$
Gross weight on hoof, pounds $6,586,349,782$ Net weight, dressed. . . . . . . . 5, $5,048,832,850$ Cost $\ldots \ldots \ldots \ldots \ldots$................ $\$ 329,765,480$ Calves:
Number ..................... $1,568,130$
Gross weight on hoof, pounds $261,683,572$ Net weight, dressed. . . . . . . . . 161,049,581 Cost ......................... $\$ 12,665,557$
Dressed meat, purchased fresh or partially cured (to be manufactured)
$\$ 53,114,957$ All other materials............ $\$ 76,848,336$ Products, total value. . . . . . . . . . . \$913,914,624 Beef:

Sold fresh-
Pounds 3,748,055,377
Value 247,056,724
Canned-
Pounds 87,697,815 Salted or curedPounds

136,896,697 Value \$8,107,952 Mutton, sold fresh:

Pounds . . . . . . . . . . . . . . . . 460,754,244
Veal, sold fresh:
Pounds .................... 154,212,652
Value ...................... $\$ 12,856,369$

## Pork:

Sold fresh-
Pounds 1,224,932,910
Value
\$91,749,323
Salted-
Pounds . . . . . . . . . . . . . . . . . 1,558,886,256
Value .................... \$116,626,710
Hams, smoked bacon, sides,
and shoulders:
Pounds ................... $1,364,015,706$
Value . $\$ 132,210,611$
Sausage, fresh or cured:
Pounds
324,416,039
Value $\ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots$
All other meat, sold fresh:

Lard:


| Value | \$74,116,991 |
| :---: | :---: |
| Neutral- |  |





Other oils:

| Gallons | 4,893,133 |
| :---: | :---: |
| Value | \$2,595,951 |


Val
Hides:

| Number | 8,039,204 |
| :---: | :---: |
| Pounds | 456,443,857 |

Value. ...................... $\$ 44,206,107$
Wool:
Pounds . . . . . . . . . . . . . . . $16,377,333$
other products, including
amount received for custom
and contract work.
$16,377,333$
$\$ 5,229,521$
$\$ 76,880,536$
The figures are for the year 1905 (the last totals
available) and we have attempted to show graphically, as we have already done with bread, etc., what this industry really means.

The composite beef, which is literally on the hoof, is only 1,236 feet long to the shoulder, and is only 927 feet high to the shoulder. This animal only weighs some $7,485,407,944$ pounds as he stands on his hoofs, but cuts up with some loss of weight, the product being:

|  | Pounds. |
| :---: | :---: |
| Fresh beef | 3,748,055,377 |
| Canned | 98,663,931 |
| Salted or cured. | 136,896,697 |
|  | 3,983,616,005 |

Showing an apparent loss of $3,501,791,939$ pounds, but all that comes to the meat packer is in the nature of grist, and it is doubtful if the actual loss is very great. The hides, the horns, the hoofs, the bones, the blood, etc., all have to be reckoned with.
The fresh beef is represented by hind and fore quarters of beef, one 480 feet high, the other 504 feet, and 280 and 290 wide respectively. The beef that is salted would fill a barrel 220 feet high and 147 feet in diameter at its widest point. Canned beef makes a nice little seven and a half million dollar can, 145 feet high and 128 feet wide. That much-abused animal, the pig, also makes a good subject, for the total number of hogs slaughtered in 1905 was $30,977,639$, weighing $6,586,349,782$ pounds on the hoof, and $5,048,832,850$ rounds, dressed, thus showing a comparatively smaller shrinkage. The cost was $\$ 329,765,480$, and value of the product was much more. The height of the composite hog would be 785 feet, and the length "over all" would be 1,570 feet. The pork that is salted would fill a barrel 332 feet in diameter at its largest part, and 495 feet high. The lard would fill a tin pail 334 feet high and 295 feet in diameter. The smoked ham would be 499 feet high and 374 feet across at its widest part. The sausages placed end to end would make a continuous chain 151,714 miles long, or 6.1 times the circumference of the earth.

The sheep is the smallest of the trio, being only 666 feet long and 555 feet high to the shoulder. This animal is made up of $10,875,339$ sheep, and weighs $930,168,367$ pounds on the hoof, but the net weight is $464,872,621$ pounds, showing quite a shrinkage. The amount of fresh mutton sold amounted to $460,754,244$ pounds, valued at $\$ 36,880,458$.

The total value of the material used was $\$ 805,856$,969 , and the total value of the products was $\$ 913,914$, 624 , showing a difference of $\$ 108,057,659$, certainly a tidy little sum for labor and profit. Such is in brief the slaughtering and meat packing industry.

## (tarxequondence.

## The Capsized Lighthouse Caisson.

To the Editor of the Scientific American:
In your issue of December 15, 1906, I notice an article relating to the lighthouse in Chesapeake Bay which tipped over during construction some two years ago. As I made a personal examination of this lighthouse at the time, and also made plans for its restoration, I thought it might be of some interest to your readers to know these conditions, as the field is a broad one, and the same principle might apply to the salvage of vessels to a limited extent.
In carrying out the plans for building the lighthouse, a wooden caisson was constructed on shore in Baltimore, and then launched and towed to the site of the proposed lighthouse, after having placed the first ring of cast-iron segments on the deck. When it was towed to the site, this cast-iron shell stuck up above the water, as the line of flotation was somewhere near the top of the caisson. As soon as the caisson reached the site, additional rings were put on and then some concrete was placed in the shell, causing the caisson to settle down in the mud. Owing to the fact that there was a little more concrete on one side than on the other, the caisson settled unevenly, one side being about 2 feet lower-than the other. The cast-iron shell at this time was 25 feet high, and divided by two bulkheads into three sections of equal wirdth but unequal areas. The two outside sections were to be filled with concrete, and the center section with stone and sand. The section on the low side had about 120 tons of concrete in it, and the other side considerably less.
It was at this point that it was decided to level up the caisson by putting on an excess of concrete on the high side, and it was this excess load on one side which tipped the structure over. Concrete was placed in the section on the high side until the caisson began to settle on that side, and the more it settled the greater the overturning effect of the excess load, which was about 150 tons, became. The movement continued until the structure lay on its side, almost in a horizontal position. The slight storm which occurred at this time had no effect whatsoever. The material at the point where the caisson landed is very soft mud
for a depth of 30 or 40 feet. As a matter of fact, the mud is so soft that it is very difficult to determine with a sounding lead just where the mud actually begins. This being the case, the caisson was landed in a material which was almost as fluid as the water, and it was almost as difficult to maintain the equilibrium of the structure as if it had been entirely afloat. The mud was so soft that when the structure tipped over, it sank in the mud for a distance of 20 feet. This, coupled with the fact that the wood, which was light and tended to float, was on the bottom of the structure, and the cast iron and concrete, which were heavy, were on top, makes it apparent that this structure was most unstable at best; and as the construction progressed the instability increased, so that it would seem practically impossible to have constructed this lighthouse without a very strong pile structure around it to hold it straight, when as a matter of fact there was nothing whatsoever to fasten to except the barges, which were simply anchored.
There can be no question but that the uneven loading led to the wrecking of this structure, and it seems incomprehensible that any contractor would undertake a construction of this kind without a thoroughly substantial pile structure to support the work, and it is also surprising that the government engineers would permit the work to proceed without such a structure.
With regard to the problem of righting the structure, there was only one of two things to do, but there were several ways of doing the work along either one of these lines. First, the cast-iron segments and concrete could be removed, and it would be a simple matter to handle the caisson, which was of wood. The other method was to straighten the structure up as a whole. With regard to removing the concrete and cast iron, it might be blown off with dynamite, but the objection to this was the destruction of the cast-iroil segments and the probable damage to the wood in the caisson. The five shafts which ran through the con crete into the caisson also added to the difficulty of using this method. An attempt was finally made, believe, to remove the cast-iron segments by the us believe, to remove the cast-iron segments by the use
of divers; this attempt was apparently a failure, and it left as the only feasible method the straightening up of the structure as a whole.
This involved the handling of something over a thousand tons of weight in addition to whatever mud may have gotten into the structure, owing to the fact that it was 20 feet deep in the mud, this weight being somewhat reduced by the displacement of the submerged parts; but it meant that a structure must be rigged for lifting at least a thousand tons, in order to be sure that there would be sufficient power to do the work. One of the problems involved in this method was the question as to whether the timber structure of the caisson, which was simply fastened with drift bolts, would not pull apart just below the deck when sufficient strain was put on it to lift the structure The weight which it was necessary to lift was too much for any floating derrick, and a permanent pile structure was necessary, with rigging of a very substantial nature, arranged. in such a way as to completely right the structure. This important point seems to have been overlooked in the rig described in your paper, as it seems that it only raised the structure to an angle of 45 deg . and could not get it any further. The method proposed at the time involved the construction of the two pile platforms as described in the article in your paper, but instead of using the derrick as shown, it was proposed to build this pile structure to a height sufficient to allow the caisson to swing clear in revolving upward. On top of the pile platforms it was proposed to erect a heavy timber cribbing, and on top of this cribbing to place steel plate girders spanning the space over the caisson. These girders were to be made so that they could take the load at any point. On top of the girders it was proposed to place eight 200 -ton hydraulic jacks with a stroke of $2 \mathrm{f} \in \mathrm{e} t$. Over the top of these jacks would be passed a 2 -inch plow steel wire cable, which would be passed around the cast-iron shell so as to make one full turn, with the ropes crossing each other on the bottom of the caisson, and returning back over the top of the jacks, the ropes being fastened together where they crossed on the bottom. The ropes would be cut into short pieces with sockets fastened on the end of each piece, and the pieces fastened together through the sockets, so that the short pieces could be removed as the caisson was lifted. There being eight jacks altogether, it was calculated that four jacks would be enough to hold the caisson in position while the other four were being changed. It was also proposed to use two girders, in order to enable the shifting of the position of the girders if necessary as the caisson rose. It would also be necessary to shift the position of the jacks toward the center of the girder as the caisson rose. This was all provided for, and while this is practically the same principle as was actually used in straightening up the structure, it was designed for considerably heavier work than that which was used, and was intended to completely right the structure.
21 Park Row, New York, Ernest C. Moore.

THE "TYPHONOID"-A NEW TYPE OF MOTOR BOAT. by m. J. peltier.
The racing motor boat herewith illustrated was launched on July 27, 1907, at the Beilvaire shipyard, near Nantes, France. The boat is the invention of M. André Gambin. Its principal dimensions are: Length over all, 59 feet; length on water line, $521 / 2$ feet; greatest width over all, $51 / 4$ feet; greatest width at water line, 4 feet 7 inches; molded depth, 4 feet $41 / 2$ inches; mean draft, 2 feet $71 / 2$ inches; area of amidship section, 7.14 square feet.
When afloat the boat presents a very trim appearance, with no suggestion of the very peculiar apparatus by which it is propelled. M. Chauvalon, the assistant constructor of the little vessel, claims that it cannot be capsized, except possibly in making a short turn at high speed, when great skill on the part of the steersman will be required.
The motive power consists of two 4-cylinder V-type motors of 60 horse-power each, coupled together and to the propeller shaft. Double ignition, by magneto and 'by accumulators, is provided, to lessen the chance of failure. The boat is propelled by a "typhonoid" screw, $311 / 2$ inches in diameter, which is placed at the bow, as shown in the illustrations. The inventor has guaranteed a speed of 100 kilometers, or more than 62 miles, per hour.
M. Gambin, after fifteen years of fruitless attempts to improve the action of the ordinary screw propeller, conceived the idea of converting the defects of that apparatus into advantages by the adoption of the "typhonoid," placed at the bow, instead of at the stern of the vessel. Without going into theoretical details it may suffice to point out that the injurious effects of centrifugal displacement and the central void are thus converted into beneficial effects and the limit to the advantageous increase in the velocity of rotation of the propeller is removed. The name typhonoid is derived from a Greek word which means a whirlwind, and the apparatus is designed to act by suction, in the manner of a waterspout.
Very curious experiments were made by the inventor two years ago with models about 8 feet long, driven by clockwork, and velocities exceeding 40 miles per hour were obtained. Last May another series of experiments was made with a typhonoid 2 inches in diameter, for the purpose of determining the tractive effort and the energy expended in moving large and measured volumes and weights. The results were

side view of the new propeller, showing its location at FORWARD END OF TUBE.
not only satisfactory, but surprising. From these two series of experiments it seems fair to infer that the typhonoid will produce the maximum speed for a given expenditure of power. Furthermore, as the typhonoid presents no projecting edges, it is manifestly superior to the ordinary screw propeller for the navigation of shallow waters containing vegetable growths. The typhonoid propeller consists of a num-
ber of blades-six in this instance-symmetrically distributed around an axis and terminating in a cylindrical tube. Each blade is composed of two sheets or surfaces. One sheet is spiral-cylindrical, like a loose-ly-rolled sheet of paper, with its inner edge at the axis and its outer portion forming part of the enveloping tube. The other sheet is smaller, inclined and helicoidal, like the blade of an ordinary screw-propeller. It extends from the front edge of the cylindrical


NOVEL MOTOR BOAT FITTED WITH A NEW FORM OF PROPELLER KNOWN AS A "TYPHONOID."
that of cedar poles. While the average life of a cedar pole is about twelve years, that of a concrete pole is practically unlimited. When a cedar pole decays, the labor cost of removing it and attaching the wires to a new pole is far greater than the cost of the pole itself. Such cost is by far the greatest item of de preciation in both telephone and telegraph properties. Indeed, this very item is perhaps the only one that has made telephone securities less desirable than rail road stocks. With cement poles this renewal cost is eliminated.

A further important saving in depreciation is the protection these poles afford against lightning. Each pole becomes a lightning rod, being lightning-proof itself, thus protecting wires, instruments, and electrical machinery.

Another risk to be considered from the investors standpoint is the destruction of pole lines in sleet and wind storms. The ruin thus wrought is often a fearful loss. But no storm of wind or sleet, or both combined, is likely to affect a line of cem ent poles, so great is their strength.

The poles are graceful in form and outline, fresh and new in appearance, never need painting, and can be - aligned to mathematical exactness. In point of appearance and safety there is another factor in their favor, they being constructed in such a way as to make the pole self-supporting, thus taking care of all strains without the necessity of dangerous and unsightly anchorage.

Our forests are disappear-
sheet to a spiral line traced some distance behind the front of the cylindrical sheet of the preceding blade. The front edges of the two sheets of each blade are riveted together and form a salient cutting edge which slopes backward froぃ the apex to the circumference at an angle of 45 deg , to the axis.
A French naval engineer, after making a minute examination of the inventor's plans and calculations, has asserted that the Gambin typhonoid far surpasses all other propellers in efficiency and has expressed his confidence in the ability of the new boat to develop a speed of much more than 62 miles an hour, with an expenditure of energy of 100 horse-power.

## Cement Telegraph Poles.

by c. m. ginther.
Telephone, telegraph, and electric railway managers and investors will be interested in a new concrete pole, invented by Mr. William M. Bailey, of Richmond, Ind.
In a general way the poles are built on the plan of all armored concrete work, though the construction is quite distinctive in character. In the body of the pole and near its circumference, equally spaced, are continuous rods of twisted electro-carbon steel especially prepared for this purpose. These rods are tied together and held in position by continuous spiral binding wires. These form the skeleton work of the pole, or the reinforcement, which is then inclosed in a form into which cement is poured. After a number of days the form is removed, and the result is a concrete pole.

Extreme climatic conditions of summer and winter or heavy demands upon the strength and elasticity of a heavy pole line leave the poles made by this process absolutely unimpaired. One of the features of the poles is their remarkable elasticity. A 30 -foot pole will deflect 31 inches at the top without cracking the concrete. The breaking. strain of the pole is figured at 5,000 pounds-three times the strength of the common wooden pole.
Carefully calculated accounts of all expenditures for labor and material in the construction show that under average conditions the first cost is slightly more than
ing rapidly, and good cedar poles are almost unobtainable, and the price of those of even moderate quality is fast advancing.

It is estimated that there are forty million poles in the ground in the United States, worth two hundred million dollars. These poles have an average life of twelve years. More than $3,200,000$ poles are required every year to replace those decayed, at a cost of from fifteen million to seventeen million dollars per annum. When it is considered that much of this may be saved by the use of concrete poles, their enormous value to the public service corporations of the country may be appreciated.

A table of road resistances in pounds per ton (of 2,240 pounds), has recently been published in England. The figure given railroads is 10 . Asphalt has second place with 15,22 and 29 pounds for good, medium, and poor, respectively. Tramways and wood paving are each placed at 30 . The best macadam is from 43 to


THE "TYPHONOID" VIEWED FROM THE FRONT.

46 ; ordinary quality from 50 to 60 ; and soft macadam as high as 97 pounds per ton. The best gravel and cobbles are given as 57 and 60 respectively, while ordinary and very bad cobbles are placed at 130 and 240 pounds. Dry, hard clay is said to offer a resistance of 100 pounds per ton; a sand road, 360 pounds; and loose sand; no less than 560 pounds, or 25 per cent of the weight to be moved over it.-Iron Age.

## MAGNIFIED MODELS OF INSECT PESTS.

 by day allen willey.One of the most unique and interesting industries in this country is the reproduction of minute forms f life by means of models of such size that the anatomical features of each creature can be observed and studied by the naked eye without the aid even of the common magnifying glass. This industry has been so perfected that each part of the insect or other form of life reproduced is so faithfully copied that it is absolutely true to nature.

In recent years the discoveries in science have indicated clearly the damage done, especially to farm crops, by various types of insect pests, but be sides these there is a number of insects, either harmful or annoying to human beings, of which we have been fur nished much valuable information. The importance of having likenesses of thes for the purpose of study is obvious, and this is one reason for the construction of the models to
which we have referred. The maker of these mammoth representatives of insect life is a woman, who has devoted herself to entomology, and thus has become familiar with the subject. For a period of years Mrs. Otto Heidemann has made collections in various parts of the country, in association with her husband, who is one of the entomologists connected with the Department. of Agriculture at Washington. From continued study of her specimens Mrs. Heidemann became
expert in insect anatomy, and familiar not only with the general appearance of the body, but also with the shape and object of portions so small as to be invisible except under a powerful microscope.

To reproduce a leg, a wing, an eye, or some other part on a scale which may be several hundred times as large as the original, and reproduce it accurately
reproduction. Mrs. Heidemann has not only utilized wire, thread, celluloid, papier maché, and rubber, but has been obliged to devise compounds of various sub stances to suit her needs. The nature of these compositions is known only to herself.
In fashioning an insect model, the skeleton of the body is of course one of the most essential features In many cases this can be made of steel wire which not only retains the proper shape, but is also strong enough for the purpose, and has the necessary lightness. The covering of the skeleton depends on the nature of the insect. Some have the surface of th body covered with microscopic hairs Othershave smooth bodies. Papier maché is suitabl for many o the models, but occasion ally something else must be substitut ed such as cel luloid. Usually wire forms the "bones" of the leg, but if it must be made thicker in some portions than others, Mrs Heidemann coats it with one of her compounds. She propor-
in shape, is no small achievement, and furthermore it may possibly have to be colored to resemble the in sect's natural hue. Then it must be composed of ma terial which will retain the shape into which it has been fashioned by the modeler. When we think of even the mosquito or house fly, with the position of their legs, the curves of their wings, the conformation of their heads, it is evident that the worker must have a variety of materials in order to make a successful


The Chinch Bug and Two of Its Eggs.

The Repulsive Larva of the Lady Bug.

tions the leg properly while the material is plastic; when it hardens it assumes a permanent form. The wings of most of the designs requiring them are com posed of celluloid of the proper thickness. Occasionally wire may be needed around the edge or beneath to strengthen the wing, but as a rule the material is sufficiently stiff and strong to be used without any reinforcement. Even the minute hair is imitated with fine silk threads, while Mrs. Heidemann has also suc-

A Model of Honey Bees Filling the Cells of a Comb.



The Plant Louse. The Models Are Nearly as Large as a Page of the
Huge Model of an Apple, Showing a Wo
Huge Model of an Apple, Showing a Worm and the Ravages It Has Committed.
ceeded in devising a substitute for the covering on moths, which so strongly resembles feathers when seen under the microscope.
In making one of these giants of the insect world, the body, the wings, or the legs may be made first according to convenience, but before beginning operations Mrs. Heidemann executes a working drawing. This is indispensable in order to attain the proportions. In short, the creature is literally mapped out on paper before any part of it is finished. The drawing is always done with the aid of the microscope. After the specimen to be modeled is placed under the lens, the instrument is properly adjusted. Mrs. Heidemann next singles out a portion, and carefully scanning it as it appears enlarged, traces it on the paper. Then selecting another portion, she repeats the process until she has traced what might be termed an anatomical outline. The paper on which the drawing is made is carefully measured and divided into squares of equal size. In this way the exact proportions of the enlargement are more easily obtained.
With the drawing before her eyes, it is necessary only to select the part to be made first and begin the work. The tools of the modeler are few and simple. Pincers, scissors of various sizes, needles, and several knives comprise most of the outfit, but though the equipment is not elaborate, the various processes require so much time that a model may be several weeks in finishing. Mrs. Heidemann does not work continuously on a single specimen, however, but may have several under way in her curious laboratory, finishing a part of one, then of another, as may be most convenient to her. The occupation also produces such a nervous strain, that she is obliged to desist frequently
of the many times which the insects have been magnified can be gained when it is stated that the smallest mosquito is more than twice the length of an ordinary straw hat measured from the ends of its fore legs to the ends of the hind ones. The chinch bug, almost invisible in life, is reproduced in the collection much larger than a pair of cuffs, while its eggs, microscopic in their natural proportions, are as large as shotgun cartridges.
One of the curious results of this magnified modeling is the repulsiveness and ugliness of some of the insects least dangerous to us, and the attractiveness of some of the most harmful ones. Perhaps the most common winged creature which we know is the house fiy. It is found everywhere-on the table, sometimes in the food-and it has a most annoying habit of alighting on the person and sometimes preventing sleep. We are so accustomed to it, that we brush it away without further thought. Nervous people might shudder were they to see the specimen in Dr. Howard's collection, for it is one of the ugliest of all. Its legs end in sharp claws that might easily tear one's flesh if the fly were of this size, while the head with its great eyes and what seems to be a protruding jaw adds to its savage appearance. In decided contrast to it is the codling moth, really a beautiful creature with its many-tinted coat of "feathers." This, however, is the bane of the fruit grower, for from it comes the worm that bores into the heart of the apple, and often destroys


Fig. 3.-APPLICATION OF HIGH-FREQUENCY CURRENTS IN THE FORM OF ELECTRIC SPRAY IN CASES OF EXCESSIVE ARTERIAL PRESSURE.
and rest from it. The Division of Ento mology of the Department of Agriculture contains a very interesting collection of these gigantic facsimiles of minute animal life. The collection has been arranged under the supervision of Dr. L. O. Howard, Chief of the Bureau, and is not only interesting but highly instructive as well, especially to all interested in agriculture. It includes the cotton boll weevil, which has inflicted such damage to the staple crop of the South and which the Bureau of Entomology is vigorously
striving to eradicate. As seen thus magnified, the weevil slightly resembles an enormous spider with a long snout. This snout is the most closely studied of all parts of the weevil, and with good reason, for the creature uses it in boring into the boll, thus destroying or damaging the contents
By means of the models the distinction between the various species of mosquitoes can be clearly traced with the eye unaided. The specimens in Dr. Howard's collection include the variety supposed to carry the germs of fever, the comparatively harmless singing mosquito, and the kind which is believed to spread malaria. It would be difficult for even an expert to detect the difference in the actual insect unaided by the microscope, but as already stated, the model: make the distinction plain. As a matter of fact, the more harmless of the series might be considered the most dangerous, for it is much uglier in appearance than the others, with its spotted legs and scraggy body The anopheles, which has such an evil reputation for its bite, is the most harmless in appearance. An idea


Fig. 2.-CONDENSER BED.
most of the fruit before it works its way to the surface. One of the most interesting parts of the collection is a huge apple made principally of papier maché, showing the worm done in plaster, feeding in its interior. The homeliest specimen in the collection is one of the greatest friends of the horticulturist. This is the variety of beetle known as the lady bug or lady kird. It is probably the greatest enemy to the San José scale which has thus far been discovered. It is needless to refer to the great damage done to peach orchards in various parts of the country until the lady bug was introduced and fed upon the pest. As seen magnified, the beetle looks like a land turtle with its thick rounded shell. It is large enough to hold a cigar in its mouth, which gives a further idea of the enormous size of the reproduction. On the other hand, the body of the scale is quite graceful in form and its wings resemble lace, so delicate are they in appearance, but the long legs and huge eyes of the creature cause it to bear a slight resemblance to a lobster. The ugliest specimen of all, however, is a design of the quency currents.

ig. 1.-DR. MOUTIER'S APPARATUS FOR THE REDUCTION OF TERIAL PRESSURE BY MEANS OF HIGH-FREQUENCY CURRENTS. pared on the same scale, for instruction, is also finding favor among the agricultural colleges, and there is no doubt that already they have been of much benefit in educating the rural classes in a very important topic to the farmer.

EMPLOYMENT OF HIGH-FREQUENCY CURRENTS IN THERAPEUTICS.
by jacques boyer.
The arterial blood pressure which is equivalent to about 6 inches of mercury in health, rises to 10 inches or more in certain diseases and falls to 4 or 5 inches in other diseases-neurasthenia, for example. Excessive arterial pressure is a common symptom of arteriosclerosis, or hardening of the arteries. It is easily detected by the sphygmometer, but until very recently no method of arresting the progress of the disease was known. Now, however, arteriosclerosis appears to be curable by the method of Dr. Moutier, which is based upon Prof. d'Arsonval's discovery that the blood pressure is instantly reduced by the action of high-fre-

The patient is seated on a chair inside of a spiral coil of wire which is traversed by high-frequency currents. (Fig. 1.) The cabinet shown at the right of the photograph contains a transformer, which gives to the alternating current a tension o1 40,000 or 50,000 volts and a frequency of 500,000 or 600,000 alternations per second. This treatment, continued for five minutes, reduced the arterial pressure from 10 to 7 inches. In a second treatment, given to the same patient a few days later, the arterial pressure, which had risen during the intervai to 8 inches, was brought down below 7 inches in a few minutes. Repeated applications gradually reduce the arterial pressure to its normal value of 6 inches. In Dr. Moutier's very interesting experiments, the rapidity with which the pressure was lowered appeared to have no relation to the age or gravity of the case, or the degree of hypertension, but to depend chiefly on the state of digestion.

The duration of treatment consequently varies with the condition of the patient, but in general only a few treatments are required. The important feature is that the cure-the reduction of arterial pressure to the normal value-is permanent, and that the progress of the arteriosclerosis is arrested by the removal of the excess of blood pressure. Dr. Moutier has even witnessed the disappearance of functional troubles caused by this hardening of the arterial walls
By the use of the condenser bed (Fig. 2) Dr. Moutier has succeeded in ameliorating the condition of gouty and rheumatic patients by means of high-frequency currents conveyed directly to the body by the conductor, which is grasped by the hands of the patient.
Finally, the arterial pressure, if abnormally low, can be increased by the action of high-frequency currents applied in the form of the electric spray or effluvium. The patient, seated on an insulating platform (Fig. 3), grasps one electrode, and the other, which is a comb with a number of points, is moved up and down along her spine but at some distance from it. In this way Dr. Moutier has successfully treated a number of cases of neurasthenia.

## AN IMPROVEMENT IN SAFETY RAZORS

In the accompanying engraving we illustrate a razor of the "safety" type which has the form of an ordinary razor and which, furthermore, is provided with removable, double-edged blades. The blades are secured in what may be called the body portion of the razor, and this body portion is formed with a tang which is pivoted in a slotted handle, so that the razor may be folded after the usual manner to protect the cutting edges. The body portion of the razor comprises a guard section, $A$, and a cover plate, $B$, fastened by screws to the guard section. The latter is shown in Fig. 3 with the cover plate removed. Formed


## AN IMPROVEMENT IN SAFETY RAZORS.

on the face of section $A$ is a tongue or rib, $C$, provided with a pair of opposite lateral projections, $D$. When the cover plate is fastened in place the tongue, $C$, serves to space it from the guard section. In the narrow space or slot so formed the thin razor blade, $E$, is received, as shown in cross section in Fig. 4. The razor blade (see Fig. 5) is slotted at $F$ and is formed with notches, $G$, so that when the blade is pressed home between the members $A$ and $B$, the slotted ends will spring over the projections, $D$, and interlock therewith. The outer end of the razor blade extends beyond the guard and cover and is formed with finger holds, $H$, whereby it may be grasped and withdrawn from the body portion whenever desired. The razor is formed with opposite cutting edges, which are safeguarded in the usual manner, by means of projections, $J$, on opposite edges of the guard section, $A$. Each razor is equipped with a magazine of blades, so that when a blade becomes dull it may be removed and a fresh blade immediately inserted. A patent on this improved safety razor has just been secured by Mr. J. F. Bailey, Owens Ferry, Ga.

## A NOVEL VEHICLE SPRING.

A patent has recently been secured on a new form of spring which, while elastic under a light load, is equally efficient under a heavy load, owing to its selfreinforcing characteristics. When the spring is forced down into the bolster one member will support the other, so that the spring will not have a tendency to break. As shown in the accompanying illustration, the spring consists of two sections of identical form. The sections are made of bar steel, bent to form an upper and a lower member, connected at their outer ends by an open loop. The inner ends of these members are provided with eyes, whereby they may be applied to the vehicle. Both the upper and lower members are curved inwardly, this curvature being on the arc of a 70 -inch circle. The method of attaching the sections to the sill of the vehicle is illustrated in Fig. 2. A bracket secured to the sill is provided with a projecting end, which passes through the eye of the upper member, and is made fast
by means of a cotter pin. The lower members are se cured to the bolster by means of a pair of $U$-shaped clips, which saddle the bolster. One of the clips is provided with extensions, which pass through the eyes of the spring sections, and the eyes formed on the other clip end are secured by means of cotter pi: . This provides a simple means of applying the spring sections to the vehicle. Owing to the curvature of the spring sections, when a heavy weight is carried by $t$ e vehicle the upper and lower members of the spring will be forced into contact with each other, and there-

by tend to reinforce each other. A modification c this spring is shown in Fig. 5. It will be observed that the spring consists of a single continuous band of metal in place of two separate sections. A means for strengthening the spring is shown in Fig. 4. It consists of an inner auxiliary spring section, having a terminal eye with two leaves extend ing therefrom. This auxiliary spring is inserted in the loops of the main spring, and secured therein be tween a pair of washers by means of a bolt and cotter pin. In practice the leaves of the auxiliary spring serve to support the main spring. at its weakest point The inventor of this novel vehicle spring is Mr . Her man A. Grafe, of Newburg, Oregon.

## AN IMPROVED INVALID'S BED.

A number of important improvements are embodied in the invalid's bed which we illustrate herewith. The bed is made in sections, which may be separated and adjusted relatively to each other, so as to enable the physician or nurse to gain convenient access to the patient without materially discommoding the latter The sections are is arranged that one or both lowe limbs or the trunk of the patient may be elevated, as desired. In the illustration the main section is indi cated at $A$, and the two foot sections at $B$ and $C$ Each section consists of a frame supporting an indi vidual bed-spring section. As shuwn in one of the figures, each bed-spring section at its outer end is provided with arms pivotaliy attached thereto, so that when the spring section is raised, the arms there on will rest on the slats of the bedstead and hold the spring section in place. The arms may be formed with notches adapted to engage the slats, and whereby the sections may be adjusted to any desired angle The foot sections of the bed are secured to the main


## IMPROVED INVALID'S BED

section by means of hinges, so that they may be swung laterally apart, if desired. The sections are locked together by means of a U-shaped bolt, which passes through eyes formed at their adjacent outer ends. When the bed is thus locked together, it may be used as an ordinary bed. It will be observed that the construction is very simple, and that the bed is adapted for home use, as well as for use in a hospital. A patent on this improved bed has been granted to Mr. Charles O. Lewis, of Fayette, Mo.

BARREL STAND AND TRUCK
Pictured in the accompanying engraving is an improved barrel stand and truck, intended to facilitate the handling of barrels while inserting a faucet therein, and to assist in placing the barrel in position and in removing the same from place to place. When lifting the barrel to an upright position after the faucet has been applied, there will be no danger of injuring or breaking off the faucet. The stand also provides means for collecting the drippings from the barrel and storing them in a reservoir. One of our illustrations shows a cross section of the stand, showing its box-shaped form. The stand is supported on four truck wheels. The rear end of the stand is curved to provide a rocking surface, on which the stand may be rocked or tipped downward to the position shown by dotted lines in one of the illustrations. At the rear of the stand are a pair of adjustable handle bars, comprising a pair of side bars and an upper cross bar. The side bars are preferably tubular, and are adapted to receive the downwardly-turned ends of the cross bar. A pair of set screws threaded into the side bars are adapted to engage the ends of the cross bar, and firmly secure the latter at the desired adjustment. The upper face of the stand is provided with an octagonal depression formed by nailing molding to the stand. The depression is covered with zinc plate. In this depression the barrel is seated, and any drippings therefrom will collect and flow through an aperture therein into a reservoir below. This reservoir is a vessel supported on a shelf in the stand, and may be readily removed when desired to empty its contents. In use the stand is tipped over to the position shown by dotted lines, and the barrel is then rolled on to the handles. When in this position the faucet is applied, and then the barrel and stand may be lifted to upright position.


BARREL STAND AND TRUCK.
A patent on this barrel stand and truck has been secured by Mr. Peter T. Herreid, of Blair, Wis.

## The Source of Radium.

Doubts have been cast on the generally accepted theory that radium is a decomposition product of uranium, says Nature. A recent investigator showed that, starting with a solution of uranium nitrate carefully purified by repeated crystallization, the amount of radium formed in eighteen months was less than $1-2,000$ of the amount which the disintegration theory called for. In a recent experiment upon the growth of radium from actinium, this same scientist decomposed a kilogramme ( 2.2046 pounds) of carnotite ore, containing about .20 per cent of uranium, in an excess of hydrochloric acid. This solution was then so treated as to separate the actinium from the other constituents. It was secured in the form of a chloride, which was then sealed in a glass tube. After two months the gases from the tubes were placed in an electroscope and the activity of the emanation determined. The tube was then resealed and allowed to remain for several months longer. The emanation at the end of this time was found to indicate an activity corresponding to three times the former amount of radium. From this rate of increase it is computed that the half period for the evolution of the emanation would be about 3,100 years. Since the amount of actinium in a mineral is apparently always proportional to the amounts of uranium and radium present, it is thought that actinium may prove to be the looked-for intermediate product.

First American Turbine Liner.
America's first large turbine steamship, the "Creole," was 'placed in commission July 9. She was built at the Fore River yards, Quincy, Mass., and is one of the three vessels of the same size and type recently added to the Southern Pacific's Atlantic fleet, except that the "Creole" is propelled by turbines. The "Creole" is 440 feet long, 57 feet beam, displaces 10,600 tons, and has a speed of 18.5 miles per hour carrying 4,500 tons. In addition to the cargo, she has 152 staterooms and accommodations for 250 steerage passengers.

## RECENTLY PATENTED INVENTIONS.

 HardwareLOCK.-A. N. Wickham, Lincoln, Neb. This lock may be placed in a door with a portion of the casing bearing the latch-bolt arm arrange uppermost. It may be inverted and placed in ing latch tumblers and locking tumbler ar ranged uppermost. So arranged these tumblers drag over the inner casing and fall into locking engagement with the casing of their own weight, and operate even if certain springs become inoperative. Means aid in holding the tumbler edges against the inner casing, as the end of the latch bolt extends through the faceplate of the main casing.
SNAP-HOOK.-F. S. Bieber, Poughkeepsie,
N. Y. This hook may be termed a rein and trace hook, since it is particularly designed for use on the portions of the harness of horses that draw fire engines or fire apparatus or ventor is to provide a snap hook that will ventor is to provide a snap hook that will the ring or link can be quickly and conve-

## Heating and Lighting.

COMBINATION BOILER AND FURNACE.N. Frost, Bloomington, Ill. This invention relates to heating apparatus having a boiler ar-
ranged within a furnace and both located within a warm air chamber, thus utilizing the gen-
erated heat for hot air heating and ventilating purposes as well as for direct or indirect steam heating purposes. The object is to utilize the heat generated
heating attachment for grates. F. A. Delph, New Orleans, La. This attachof one or more return flues or pipes detachably of one or more return flues or pipes detachably
connected with a front plate adapted to cover the space above the grate basket and project the space above the grate basket and project-
ing therefrom into the room where the grate is located. The plate is hinged to the grate frame so that it may be swung laterally to-
gether with the return pipe or flues, when desired to replenish the grate basket.

Household Utilities.
SAD-iron heater.-N. A. Westerlund, Superior, Wis. The object of the improvement is to provide an arrangement whereby a number niently from place to place. More specifically, the invention contemplates an arrangement
whereby the same handle may be used for moving the heater or for applying the irons to the irg the heater
MOP-HEAD.-Esther M. Lefevre, New taltz, N. Y. This mop head proviaes and cleaning walls, especially cornices, moldings, and ledges of all kinds, where there are numerous crevices
and cornices which are difficult to reach by and cornices which are difficult to reach by
mop heads hitherto devised. It will be found mop heads hitherto devised. It will be found
to be of advantage in scrubbing stairways, to be of advantage in scrubbing stairways,
where it is necessary to mop about railings and in the corners impo

## Machines and Mechanical Tevices.

 KINEMATOGRAPHIC APPARATUS.-R. T Haines, Melbourne, Victoria, Australia. Theinvention relates to mechanism designed to produce a more perfect reproduction of living pictures or animated scenes upon any desived exhibiting surface by obviating the fluctuation of light, flickering and blurring and by minimizing the vibration and unsteadiness, spots
and other imperfections or irregularities, which and other imperfections or irregularities, which
render so unsatisfactory all processes and mechanisms now in use.
nUMBERING APPARATUS.-O. G. Bartusch, New York, N. Y. The object here is to provide an apparatus, more especially de-
signed for use in printing presses to consecutively number the printed sheets, and arranged to permit the use of a prefix forming part of the actuating mechanism for the numbering wheels and interchangeable with a non-prefix part automatically covered up during the passage of the inking rollers to prevent inking
of the non-prefix part without cutting the rollof the non-prefix part without cutting

LIFTER ATTACHMENT FOR TYPE-SETTING AND TYPE-CASTING MIACHINES.-E. C. Lampson, Jefferson, Ohio. It is sought by
this invention to enable an operator to raise this invention to enable an operator to raise the assembler at will as many times and as
often as he cares to do so, the ascent of the often as he cares to do so, the ascent of the
assembler being always made with uniform assembler and both the ascent and return of the assembler being positive, yet the movement requiring principally no expenditure of energy,
the entire handling of the assembler being effected by the application of power.
LOOSE-LEAF BINDER.-J. F. Gloe, Manning, Iowa. The improvement relates to that form of binder in which two symmetrical halves are made to clamp the edges of the
loose leaves and have telescopic anchorage loose leaves and have telescopic anchorage
posts which protrude through slots in the posts which protrude through slots leaves and also marginal clamping edges mechanism may be adjusted toward or from each other to clamp or release the interposed leaves.

Railways and Their Accessories. Dobos, New York, N. Y. The provision made
in this invention is for a fender and cleaner for use on street cars, autlow convenient and
vehicles, and arranged to allow quick adjustment of the fender relative to the roadway or track rails, and to permit the
person in charge of the vehicle to quickl person in charge of the vehicle to quickly
throw the fender or cleaner into an active position or to move the fender into an inactive position
LOCOMOTIVE-PILOT.-B. T. HAMILTON Fort Smith, Ark. Switching engines are
provided on their forward ends with a draw provided on their forward ends with a draw
beam having a coupling adapted to be conSuch are a car in front of the engin with a stub pilot so as not to interfere with coupling the engine to a car on its forward end. No pilot used, the engine is not suited
for road service, as live stock when struck by the engine going at high speed are liable o be thrown under the train and cause seri ous accident. When a stub pilot is used the
draw beam projects so far beyoñd the face of the pilot that the stock when struck often become lodged under the beam and fall off the pilot to the track, frequently derailing the
train. This invention provides a pilot for use on an engine designed for switching on road service. Mr. Hamilton has invented an other pilot, which is adapted to remove ob
stacles and live stock from the path of the stacles and live stock from the path of the adjusted relatively to the draw beam so as no to interfere with coupling of the cars to th

## Of General Interest.

music-holder.-J. B. Way and C. Fezler Patchogue, N. Y. One embodiment of this in means for holding the back sheets in open po sition. A number of spring-pressed arms, each having a device for removably attaching it to the tension of the springs before the sheets are turned by the stem of the key, the latte and detached sheets.
LEVELING-ROD.-F. Wulff, Torreon, Coa huila, Mexico. This rod easily takes the rea ing on a horizontal line, through a level, t accomplishes this directly without referring to the unit marks on the rod below or above the reading and without undue straining of the eyes. The rod is covered with graduations on
all sides, which provide sufficient space fo marking the figures in large type, the gradua ations of each succeeding side differing by a fraction of a unit, which gives the graduations
CHIMNEY-COWL-
eb. In this impr-- A. Gerrard, Monroe wind on the uppermost blades operates to draw and thus ancreases or improves the draft and clearance at the top of the chimney as draft and The cover is formed from a flat plate of metal approximately square and bent to bring its diagonally opposite corners downward to form the side wings. The wheel is mounted to turn loosely on its shaft, the latter being bushed to operate withc ut unnecessary noise. The van separa
SEPARATING-POT.-G. Nebel, Monterey uevo Leon, Mexico. This separating pot is for use in smelting, to separate the matte from the slag, as well as from the crust formed by the cooling of the slag. The inventor reme holes, and having a provial sha pot withou of which the slag and matte as well as the crust are poured or taken out separately, and so rapidly that only a very thin crust is formed on the sides of the pot.
Ellifsograph.-J. T. Kelley, West Rush, . Y. The invention relates to improvements whereby curves other than arcs of circles may ee readily drawn. It is particularly designe or drawing ellipses, and the compass may b set to draw an ellipse of any given major or minor axis as readily as an ordinary compas can b
eter.
Prospecting-tool.-T. Johnstone, Mus kegon, Mich. The tool is such as used by cially useful for gold miners in locating gold deposits in ancient river beds or streams. The inventor's object is to produce a tool readily operated to raise a quantity of the deposite y separating the solid afritions of the earth from the water which is brought up with the earth.
Dentimeter.-R. H. Macy, West Palmbeach, Fla. One purpose of the invention is to provide an instrument especially adapted when measuring a tooth or a root in crown bridge work. Another is to provide an in
strument of but two members, and to so struct and combine said members that the end of a loop of wire may be quickly and conveniently inserted into the instrument and locked
from.
Note.-Copies of any of these patents will be furnished by Munn \& Co. for ten cents each.

## NEW BOOKS, ETC.

Rustic Carpentry. Edited by Paul N. and diagrams. Philadelphia: David McKay. 16mo. cloth; 160 pages Price, 50 cents.
"Rustic Carpentry" is a form of amusement that can readily be indulged in by all, what work contains directions for making a number of useful and ornamental objects in rustic style.
electrical Ignition for Motor Vehicles. By W. Hibbert. New York: The Macmillan Company. 16 mo
128 pages. Price, 50 cents.
The ignition of gasoline engines has become subject of such general importance that every one connected with their operation must
have some knowledge of electricity. This book have some knowledge of electricity. This book batteries, both primary and storage, and mag. netos. The appendix contains the principles upon which battery action is founded, a
Motor Bicycle Building. Edited by Paul ings and diagrams Philadelphia: David McKay. 16mo.; cloth; 160 pages. Price, 50 cents.
Although motor cycles may seem at first yet when resolved into their component parts they are reasonably simple. There is no reason
why anyone of ordinary mechanical ability why anyone of ordinary mechanical ability
should not build for himself a motor cycle, if he has at his disposal the proper directions and the correct designs. This handook con
tains, in comprehensible form, a number of articles contributed by a cycle and motor maker and expert, Mr. W. Travers, to "Work," a weekly journal. It is complete in all its Coils and contains a chapter on lanniow writer on practical electrical subjects.
Handy Book for Brewers. Being Practical Guide to the Art of Brew rn Research Which Bear Upon the Practice of Brewing. By H. E. Wright. Third edition,
thoroughly
revised
and London: Crosby Lockwood \& Son pany. 8vo.; cloth; 562 pages. Price, $\$ 5$

Brewing is an art in which the final prod many of which have but recently been dis covered, while others are so obscure that their very existence can only be guessed at. The in himself, besides a knowledge of the raw materials he makes use of, the qualities that go to make up the chemist and the biologist.
Naturally, a textbook on such a subject must oover a field so wide that to merely give a int of its contents would be nearly impossi .e. One can form a slight idea of it cription of raw materials and their prepara tion, the headings, "Water for Brewing," "The Laboratory,","Ferments," "Culture from a Single Cell," and "The Brewery and Plant," number of other chapters of almost equa mportance
The Humanizing of the Brute. Or the
Essential Difference Between the Human and Animal Soul Proved from Their Specific Activities. By $H$. Muckerman, S.J. St. Louis: B. Her-
der. 12mo.; cloth; 114 pages, 5 $\begin{array}{ll}\text { der. } & 12 \mathrm{mo} \text {.; cloth; } 114 \\ \text { plates. } & \text { Price, } 75 \text { cents. }\end{array}$
If the thought-processes of the human mind are difficult to trace, how much harder must activity of the lower forms of life. The most ommon method of investigating these impulses is very apt to be untrustworthy; namely, the observation of various actions, and the supplying, from our own experience, of the mental attitude that prompted them; since the observer
projects himself into his interpretation. The projects himself into his interpretation. The
author has avoided this error in his work which consists of a collection of observations discussed with a view to proving that man of a "soul"; a something which he alone has. To us it seems, though, that the treatise proves the lower forms of life to possess brains of correspondingly short, reducing the results of experience to a negligible quantity, rather than that there is a sharp dividing line be-
tween mankind and the rest of the creation. Problems of the Panama Cana亡̀. Including Climatology of the Isthmus, Phy sics and, Hydraulics of the River
Chagres, Cut at the Continental Divide, and Discussion of Plans for the to Date. By Brigadier-General Henry
The Macmillan Company. 8vo. cloth; 269 pages. Price, $\$ 2$.
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the work in a complete and readable manner. the work in a complete and readable manner.
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frequently dinned in our ears of late, yet few of us know, even in a general way, the en ormous difficulties that are there being sur mounted. Brigadier-General Henry S. Abbot, who was for seven years connected with the
work in question, has written of the problems work in question, has written of the problems
of the canal in a manner that deserves the of the canal in a manner that deserves the highest commendation. His book is a minute and painstaking description of every detail of in every labor, with full tables of statistic markably is the the interest to the casual reader is not de stroyed. The engineer in search of exact in formation, and the layman wishing for genera information will both find it equally interest ing.
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how to transport the wounded or injured.
annals of the Astronomical Observa tory of Harvard College. Vol. LV Part I. Second Catalogue of Variable Stars. By Anne J. Cannon. Unde the direction of Edward C. Pickering. Observatory.

## INDEX OF INVENTIONS <br> For which Letters Patent of the United States were Issued <br> for the Week Ending August 13, 1907.

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apparatusular for structures, method and
forming, reinforced, $\mathbf{R}$.


 Corn popping apparatus, C. Cretors.
Corn Shock tying device, A. Larson.
Corn tester, ing ind C. E. Ewamley....
 Cotton cleaning feeder, J. R. Fordyce......
Cracker cutting
vice for, A. Bleichines. pan skipping de..................... Crankshaft, sectional, A. F. Rockweli...
Cultivating implement, hand garden, M. i
Carraway


 Curtain fixture,
Curtainin fixture,
Curtain pole. A. .

Cutting and rineping device, Carkin \& Jefts
Cutting gage for lathes and other tools,

 Dolls, apparatus for turning and bowing the
heads of, H. Fiedeler





Dye, black mordant azo, A. $1 . \ldots . . . . . .$.
Dye houses or bleacheries.
lating, J. H. Lorimer. means for vent Dyeing machine, Smith \& Drum..
Dynamo construction, H. Leitreer
Egg atase, H. St Wood. W. W.


 Electric time alarm, J. L. Grass. et al....
Electrical energy, method of and aparatu
for transmitting, W. C. Yeatman..... Electromagnet, D. L. Lindquist...........
Electromagnetic sonding aparatus, Seid
\& Sossenhoff Embossing press, A. H. Uhrig......
End gate, wagon, G. M. Parsons.
End gate, wagon, B. L. Wilson.
Engine sparking device, Wis.

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