
a WELKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES,



Froum Phoograpl by Symonde \& Company, Portsmonta, England. 1.-First-olass Battleship "Brandenburg." Olass of Four Ships,



Dlsplacement, 11,130 tons, Speed, 18 knots . Normal Coal Supply, 650 tons. Armor: Belt, 113 inches; gn positions, $93 / 4$ to 6 inches; deck, 3 inches. Armanient, four $9 \cdot 4$-inch rapid-ifrers, eighteen $5 \cdot 9$-inch


NAVIES OF THE WORLD-V. GERMANY.-[See page 250.]

## Srientific emmerican.

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## THE THIN END OF THE WEDGE.

Englishmen and Americans alike have been quick to realize the significance of the recent placing of orders in this country by England for locomotives and bridge work.
Outside of their splendid shipyards, there are prob ably no industrial establishments in which the English take greater or more justifiable pride than in the great locomotive shops from which the railroad system of England has been hitherto exclusively supplied with its motive power. To have first one and then another of its great trunk roads place an order for a score of first-class locomotives with a foreign firm has, therefore produced a degree of surprise and misgiving which no subsequent explauations by the directors have been able to allay. The suspicion that foreign invasion of exclusive markets had commenced in earnest was deepened into conviction when, a few weeks later, the British government awarded to an American firm the contract for a bridge to be built on the line of the new railroad in the Soudan.
It is not enough to say that the sending of these orders abroad was due to the fact that English firms are crowded with work, some of which represents longstanding orders that were delayed by the great engineering strike, the rest being due to the remarkable era of prosperity in that country. This may have been the occasion, but it is not the cause. The cause lies deeper than any accidental shortage of locomotives on an English road or the military exigencies of the Soudan campaign. 'These may have hastened the insertion of the thin end of the wedge of competition, but they are not to be mistaken for the power which day by day will drive it home. The strength of American competition lies in the quality and low cost of our finished product, and in our ability and willingness to adapt it to the needs of the buyer, and to deliver it to him in so much less time than our competitors.

At the same time our success in foreign markets is not due merely to the fact that in many lines we can undersell our competitors. It was not the fact that our locomotives are from $\$ 2,000$ to $\$ 3,000$ cheaper than the English locomotives or that theSoudan bridge could be delivered at so many cents a pound less by an American firm that brought the orders here. We won those contracts because of our ability to promise prompt and early delivery, and this element of speed is only one among several which will give us a commanding position in every market of the world before many years pass by. The secrets of our success may be summed up categorically as follows :

1. We study the wants of each particular market and try to accommodate our products to the needs of the purchaser. On the other hand the English manufacturers demand that the market shall accommodate itself to the goods.
2. The design, manufacture, and finish of our commodities are governed by considerations of utility first and last. The finished article, whether it be a lock or a locomotive, must be pre-eminently useful. It must do its work quickly, and with the least possible care and expense to the user. If we secure these features of handiness and durability in the highest degree, we care very little how cheap a material is used, or how small an amount of finish for mere appearance sake is put upon the finished article. We realized long ago that cheap cost is not synonymous with weakness, nor mere weight with strength, nor polish with practical utility. We substitute wood for iron, cast iron for steel, and steel for the costly alloys when we are once satisfied that the cheaper material will serve the purpose equally well.
3. Capital and labor in America are both agreed that there is mutual profit in the substitution of the machine for the man wherever it is possible. Antomatic and semi-automatic machinery cheapens the product, increases the demand, and so gives employment to five men for every one that it displaces. In England the operative, misled by the pernicious teachings of the trades unions, believes that the introduction of the labor-saving machine means the extinction of the mechanic. The result is that, while his American brother gets all he can, the English operative gets can brother gets all he can, the English operative

If we were asked to name the cause which above all others is contributing to our success, we would point to the foregoing.
4. Our manufacturers realize the important economies which result from thoroughly systematized management. The clerical force, the draughting offices, and the shops are organized with a careful attention to detail, and are run in many cases with a strictness of discipline which is military in its order and method, and more than military in its accomplished results: The work is highly specialized, and its progress through the shops from the raw material to the finished product is so arranged as to avoid delay and enable it to pass from bench to bench and from department to department with the least amount of rehandling.
5. While our manufacturers aim to meet the demands of particular localities, they endeavor, as far as possible, to standardize their work, with a view to building for stock and keeping a surplus on hand to meet a sudden demand. We have carried this practice into fields in which our European competitors have never attempted to apply it. There is no valid reason why locomotives and (in the smaller sizes) bridges should not be sold out of stock, as well as lathes, reaping ma chines, or bicycles. They vary in size, shape, and capacity, and in proportion as the trade of our great industrial establishments extends, the risk of keeping such costly material in stock is lessened, while its value from a competitive point of view is immeasurable.
One of the English firms whose bid on the Soudan bridge was rejected on the ground of delay, declared that only a bridge-building firm that kept bridges in stock could guarantee delivery in the time proposed by the successful American firm. While this is not true, our excellent system of building to standard de signs and with standard shapes gives us an unquestionable advantage in competitive bidding.

The performance of these American locomotives on the Midland and Great Northern railways will be watched with keen interest by the English master mechanics, or locomotive superintendents, as they are called over there. If they are only approximately as economical in fuel and durable under hard service as English locomotives of equal hauling power, their cheap cost and the rapidity with which they can be delivered will either make them the pioneers of many more to follow, or produce a radical change in the appearance and cost of the home-made English locomotives.

## ECHOES OF THE WINDSOR HOTEL FIRE.

It is characteristic of the rush and ready forgetful ness of the times that the horrors of the Windsor Hotel fire should already have ceased to occupy the public mind. There are three or four thousand guests in similar fire traps (there are many of them) in this city, who are living contentedly in brick and timber hotels that would probably immolate a large propor tion of their inmates if they should once become well ablaze by day or by night. It is impossible to believe that these people are conscious of the hourly risk they run, or the simplest instincts of self-preservation would cause an early emigration to the modern fireproo buildings, which. while they might not live fully up to their name, would at least be so far slow-burning as to afford time for the escape of the guests.
But although the inmates of these older hotels may have forgotten the awful objeet-lesson of the Windsor fire, there are others, such as the hotel proprietors and the members of the fire and building departments, who do not forget, and surely will not be so criminal as to ignore this latest warning. If "the life of a man is worth more than that of a sheep," we shall surely see some early steps taken to protect the inmates of the many non-fireproof hotels referred to. The least that can be done is to provide some speedy and re liable means of escape from the building, for it may as well be taken for granted at once that a six or eight story hotel with hollow wooden floors opening into hollow wooden partitions, when once ablaze, will burn like kindling wood or a Fourth of July tar barrel.

The late fire has shown once more the inadequacy of the stereotyped means of escape. It takes an athlete to descend a rope, and the aged and sick are helpless on balconies and fire escapes; internal stairways and elevator shafts are so many great flues impassable for smoke, if not for flame; and smoke and fire belching from outside windows frequently render the ordinary outside fire escape impassable. It is probable that more victims are overcome by smoke than by flames. It is the all-pervading smoke that so quickly renders useless the various means of escape both within and without the building.
What is needed is some independent stairway or ele vator shaft, external to the building, and having no direct connection with the building through which fire and smoke can enter. This emergency shaft could be built either within or outside of the main walls of the building, provided that the openings at the different floors led out on to balconies on the outside of the building and there was from cellar to roof absolutely no direct opening from the building to the shaft. If this shaft were constructed of fireproof brick and with
hollow walls, the elevators and stairways within it could be used even while the interior of the building was a seething furnace. At each floor there should be a door through the side walls of the building, if the shaft were on the inside, or through the wall of the shaft remote from the building, if it were on the outside, each door leading onto a balcony communicating with each of the rooms or passageways on that side of the house. In the case of new buildings, the designs should be so drawn that the walls in the immediate neighborhood of the ewergency shaft should be windowless. At the ground floor a fireproof passageway should communicate directly with the street.
Now, with regard to the older fire-trap hotels existing in this and other cities, it is evident that these fire escape shafts could now be built against the rear walls in positions where they would not mar the architectural appearance of the buildings. Two such additions to the Windsor Hotel, with connecting balconies on three sides at every floor, would probably have enabled every victim that was shut out by fire and smoke from the interior elevators and stairways to escape. There is certainly every reason why shafts should be built against the rear walls of every important hotel of the older class and the necessary connecting balconies added.
It is true the inconvenience and cost would be considerable, and the balconies would be somewhat un-sightly-though it would not be necessary to use them on the main front-but we have yet to learn that the buildings in question have so much architectural beauty that an iron balcony more or less would materially alter the effect.
We commend this suggestion, which comes to us from Mr. C. Baillairge, a civil engineer of Quebec, who has devoted many years to the advocacy of better means of escape from fire, to the notice of the building and fire departments of this city. If "the life of a man is worth more than that of a sheep"-which many people seem to doubt-it is surely well worth while to enforce the erection of this, or, if such can be found, some better way of escape from fire, in connection with the older hotels with which our large cities abound.

## NAMING THE NEW WARSHIPS.

The warships authorized by the recent naval appropriation bill have been named by the Secretary of the Navy as follows: The three battleships, which are to be of 13,500 tons displacement and $181 / 2$ knots speed, are to be known as the "Pennsylvania," the "New Jersey" and the "Georgia;" the 12,000-ton cruisers will bear the names of "West Virginia," "Nebraska," and "California," while the six 3,000 -ton protected cruisers will be known as the " Denver," "Des Moines," "Chat tanooga," "Galveston," "Tacoma," and "Cleveland." It is provided by law that the battleships shall be called after States, and the cruisers after towns. It was in accordance with this provision that our first two armored cruisers, the "Brooklyn" and the "New York," were named after cities; but it will be noticed that the new cruisers of this class are to noticed that the new cruisers of this class are to
take the names of States. This is more agreeable to the size and fighting power of these vessels, which actually have more in common with the battleship than with the cruiser. It is certainly proper that the names carried by our warships should be representative of their size and importance, and the trend of later designs shows that the battleship and the cruiser are destined before long to merge into a common type.
In this connection we think the selection of the names of States for the three little monitors " Florida," "Wyoming," and "Connecticut" is greatly to be regretted, particularly in view of the fact that giving the names of States to armored cruisers as well as to battleships will so much the sooner exhaust the list of available names, of which twenty-one out of a total of forty-five have already been appropriated. It would have been better, we think, to have named our monitors after famous admirals, particularly as there is a historical fitness in giving the names of Farragut, Porter, and others of their day to a type which originated in the stirring times which made these men famous; but inasmuch as these names have been given to the torpedo buats, would it not be well to continue to name this class after famous Indian chieftains or tribes, as was done in the case of the early monitors? Such names as Miantonomoh, Monadnock, and Canonicus appeal to us both for their euphony and strong historic interest.

## A RECORD TORPEDO BOAT TRIAL.

The builders of the new cup challenger, the "Shamrock," have just completed a torpedo boat which has broken all records for an official trial trip by making a speed of 33 knots an hour. The "Albatros" is one of five sister vessels completing for the British government, whose contract speed is set down at 32 knots. She is of 360 tons displacement and her engines are designed to develop 7,500 horse power. In our own navy the vessel that most approximates to her is the torpedo boat "Stringham," of 340 tons displacement, 7, 200 horse power, and an estimated speed of 30 knots. Thirty three knots, while it is the highest speed attained at
an official trial, is not the highest speed ever attained, the "Turbinia" having steamed 35 knots, and the "Hai Lung," a torpedo boat built by Schichau for the Chinese government, $35 \cdot 2$ knots an hour in private trials, the last named standing as the fastest speed ever made by any type of vessel.

## LIQUID AIR AS A NEW SOURCE OF POWERANOTHER ENGINEERING FALLACY.

ring 1894-95 the present writer prepared two articles under the title of "Engineering Fallacies," which were published in the Stevens Institute lndicator, vol. xi., pp. 273-294, and vol. xii., p. 125.
Since that time, though several new forms of what might be termed in a general way " Perpetual Motion Schemes" have appeared, none of them has seemed of sufficient importance to warrant any special notice, but in the March number of McClure's Magazine there is published an article entitled "Liquid Air-a new substance that promises to do the work of coal and ice and gunpowder, at next to no cost," which is so eminently calculated to mislead the general reader and even to become the basis of financial frauds, like that of the Keely Motor, that it would seem a duty to draw attention to the fundamental errors in scientific principles and in statement of facts which this article contains.
This McClure article may be fairly considered as made up of two prominent elements or parts, one of which is the statement of certain things as facts which, as I shall presently show, cannot possibly exist and are inconsistent with other facts stated in the same article and known from other sources to exist as so stated; while the other main element consists of rather vague statements concerning general principles which, though in a general sense true, yet as here used are calculated to cover up or befog the too obvious inconsistencies of the statements of facts with the established principles of science.
As an example of the first element, we find on page 400 as follows: "I have actually made about ten gallons of liquid air in my liquefier by the use of three gallons in my engine." This I shall presently show is simply impossible and inconsistent with data given elsewhere in this article and known to be substantially correct.
A sample of the other element is found on page 399, in the following:
"That is perpetual motion, you object. 'No,' says Mr. Tripler sharply ; 'no perpetual motion about it. The heat of the atmosphere is boiling the liquid air in my engine and producing power exactly as the heat of coal boils water and drives off steam. I simply use another form of heat. I get my power from the heat of the sun ; so does every other producer of power.'"
This, while true as a general statement of what might be done on an impractical scale, is not correct as here used to imply that in his experiments Mr. Tripler actually derives or can derive any adequate amount of energy from the heat of the atmosphere or in that sense directly from the sun. This I shall show later, but will first take up the statement that three gallons of liquid air have supplied or can supply the power to liquefy ten gallons.
On pages 402 and 403 of the McClure article we are told that Mr. Tripler uses to make his liquid air a steam engine of 50 horse power and that with this he can make liquid air at the rate of 50 gallons a day. This I know, from other sources, is substantially correct, and means that each horse power in a day (say 10 hours) makes 1 gallon of liquid air. In other words, 1 gallon for 10 horse power hours.
It is again stated in this article on page 405 that a cubic foot of liquid air contains 800 cubic feet of air at ordinary atmospheric temperature and pressure, or, in other words, any volume of liquid air, if adequately heated, will expand 800 times in reaching atmospheric temperature and pressure. This also is substantially correct.
We may remark in passing that this is nothing wonderful; for water, when expanded into steam at atmospheric pressure, increases about 1,700 times in volume or more than twice as much as liquid air.
Now if we apply to the above data the well known and universally accepted formula for the maximum work done by air when expanded at constant temperature,

$$
W=p_{2} v_{2} \operatorname{hyp} \log _{\mathrm{v}_{1}}^{\mathrm{v}_{2}}
$$

we find that a pound of liquid air in expanding 800 times would develop about 190,000 foot-pounds of work. As a gallon of liquid air weighs about 8 pounds, this would give eight times as many foot-pounds, or $1,520,000$. If this work were accomplished in an hour. it would represent almost exactly three-fourths of a horse power, because one horse power means $1,980,000$ foot-pounds of work per hour, and $1,520,000$ is only a trifle over three-fourths of this.

From the above it follows as a matter of absolute certainty that the maximum power which liquid air could develop in an ideally perfect engine without any loss from friction or other cause would be three-fourths
of a horse power for an hour for each gallon of liquid air expended.
We have seen, however, that with his 50 horse power plant, which on account of its size should operate with considerable efficiency, Mr. Tripler makes only 1 gallon of liquid air with 10 horse power hours. In other words, he requires to make a gallon of liquid air twelve times as much power as a gallon of liquid air could possibly develop in an ideally perfect engine.
In face of this, how supremely absurd is the statement that with a little engine such as the pictures and descriptions in the McClure article show, lacking all conditions for efficient working, Mr. Tripler can make 10 gallons of liquid air by the use of three.
Turning next to the statement about using the heat of the atwosphere to develop mechanical energy or work, let us put this to the test of a quantitative example.
Assume the temperature of Mr . Tripler's laboratory to be $70^{\circ} \mathrm{F}$. and that he has an abundant supply of water at $50^{\circ} \mathrm{F}$. These will be of necessity the limits of work he can get out of the atmosphere, because any lower temperature is only secured by doing work and so expending energy which will be at least equal to the power obtainable from the use of such lower temperature. All the work that can be obtained for nothing is that which nature will freely give in the warm air and cool water, supposing both to be supplied freely without charge.
The $20^{\circ} \mathrm{F}$. which we may assume as being possibly taken out of the air by the cool water will represent the maximum gift of nature in this shape of "power costing nothing." Now, 42 British thermal units or pounds of water changed $1^{\circ} \mathrm{F}$. per minute will represent one horse power, and as the specific heat of air is about one-quarter that of water, we should need four times as many pounds of air to produce the same effect. This would call for 168 pounds of air changed $1^{\circ} \mathrm{F}$. If, however, the air is changed $20^{\circ} \mathrm{F}$. in place of $1^{\circ} \mathrm{F}$., we need but $\frac{1}{20}$ or 8.4 pounds of air parting with $20^{\circ} \mathrm{F}$. each minute, to give us 1 horse power at $70^{\circ} \mathrm{F}$. For "round numbers," let us say 8 pounds. Now, a pound of air has a volume of about $13 \cdot 3$ cubic feet. Call this also, for "round numbers," 13 cubic feet, then 8 pounds of air would be about 104 cubic feet, and this volume of air would have to part with its $20^{\circ}$ F. heat each minute to the apparatus, in order to develop one horse power. For a 50 horse power engine fifty times as much air would be required, or 5,200 cubic feet each minute; this would be the contents of a room $26 \times 20$ feet on the floor and 10 feet high, which would have to be drawn through the apparatus each minute in such a way as to completely yield its $20^{\circ} \mathrm{F}$. between $70^{\circ} \mathrm{F}$. and $50^{\circ} \mathrm{F}$. What sort of a boiler or heat-absorbing apparatus can we imagine which would absorb from air at $70^{\circ} \mathrm{F}$., $20^{\circ} \mathrm{F}$. of its temperature while the said air was passing through it at the rate of 5,200 cubic feet a minute?
It would surely need to be "as big as a house," to use a fumiliar phrase.
This also, be it remembered, makes no allowance for loss by friction, eddy currents, and the like, which would be enormous, nor for the power to put this air in motion.
Obviously, such a machine would be simply huge in size, and, indeed, the friction involved in it would probably use up a large part of the power it could deprobab
velop.
Suppose, however, that it could be built and operated in place of Mr. Tripler's 50 horse power steam plant. Its entire output would be 50 gallons of liquid air a day, and this, as we have seen, could only develop in an ideally perfect engine $3 / 4$ horse power for an hour for each gallon or $33 / 4$ horse power for a day of 10 hours.
This does not look as if heat obtained from the atmosphere and operating an engine by aid of liquid air is likely to become a dangerous rival to the coal mine. On page 402 of the McClure article it is stated that Mr . Tripler makes his liquid air at a cost of twenty cents a gallon.
We have shown above that the maximum power obtainable from this liquid air, by heating it to ordinary atmospheric temperature, is $3 / 4$ of a horse power hour. This, at twenty cents, would be vastly more expensive than power derived from an ordinary stean engine, whose cost ranges from less than one cent per horse power hour under the best conditions to three or four cents, where a profit is included, or the conditions are less favorable.

The really difficult thing to explain in connection with this McClure article on Mr. Tripler and his liquid air, is how those concerned in its publication (being as I do not doubt honest men) can be deceived or have so deceived themselves as to make and repeat such obviously impossible statements.
In this connection, however, I will make a suggestion founded on experience.
Some years ago I was called upon to examine an en gine operated with liquid carbonic acid, which was said to have ten times the efficiency of an ordinary steam engine.

I of course told the applicant that such a thing
was physically impossible and did not deserve investi gation, but, finding that a number of substantial people had been so impressed by what had been shown them that they would not be satisfied without an in vestigation, I consented to make one. This proved an easy piece of work. I found that the promoters and others were under the impression that a horse power was measured by the raising of 33,000 pounds one foo high irrespective of time, and in their demonstration were contented with showing that their engine did this amount of work in ten minutes. As, however. a horse power involves the raising of 33,000 pounds one foot high in one minute, it was obvious that the power shown by the carbonic asid engine was $\frac{1}{10}$ of a horse puwer and not one horse power, as those exhibiting he engine claimed.
This, of course, explained the situation. An engine developing $\frac{1}{10}$ of a horse power might easily require only $\frac{1}{10}$ as much fuel as an ordinary steam engine developing 1 horse power, without violating any of the established laws bearing on this subject. The curious thing was that such people as were concerned in this matter should have been misled on such a simple and elementary subject; but if they were, as I personally know, so misled, why may not Mr. Tripler and his friends be in a similar case?
I could give from my own personal experience many like examples, but have said enough for the present to make it evident that what is claimed in this McCiure article as a new source of "power which costs nothing " is not founded on fact, but is probably the result of some oversight in observation or calculation not inconsistent with honesty of intention.

## THE NEW SATELLITE OF SATURN.

Prof. William H. Pickering, as the discoverer of the new satellite of Saturn, suggests that the name "Phoobe," a sister of Saturn, be given to the new satellite. Three of the satellites, Tethys, Dione, and Rhea, have already been named for Saturn's sisters, and two, Hyperion and Iapetus, for his brothers. The direction of the motion, which is toward Saturn, shows that the apparent orbit is a very elongated ellipse and that it lies nearly in the plane of the ecliptic. Prof. Asaph Hall has pointed out that this is to be expected in a body so distant from Saturn. The attraction of the latter only slightly exceeds that of the sun. Hyperion appears as a conspicuous object on the plates which have been taken by direction of Harvard College Observator:, and the new satellite appears about a magnitude and a half fainter on each. As seen from Saturn it would appear as a faint star of about the sixth magnitude. Assuming that its reflecting power is the same as that of Titan, its diameter may be about 200 miles. It will, therefore, be noticed that while it is probably the faintest body yet found in the solar system, it is also the latest discovered since the inner satellites of Uranus in 1851. Prof. James E. Keeler, director of the Lick Observatory, says: "Considering the extreme faintness of the satellite and its great distance from Saturn, it is not surprising that this discovery was not made by visual observation. With a great telescope directed to Saturn the satellites would be far beyond the limits of the field."
The last discovery of a satellite of Saturn was made in September, 1848, by Prof. W. C. Bond, then director of Harvard College Observatory, and his son, Prof. George P. Bond. The satellite Hyperion was seen by his son September 16 and 18, but its true character was first recognized on December 19, when its position was measured by both father and son. Soon after it was discovered independently by Laselle at Liverpool.

## PROGRESS OF THE ZOOLOGICAL PARK

Two new buildings are rapidly nearing completion in the grounds of the new Zoological Park. These are the reptile house and the winter house for birds. The Park Department is also constructing walks and roads and is laying sewer and water pipes. Much work has also been accomplished upon the various outdoor animal dens. In a hollow in the park is a body of water which will be utilized for aquatic rodents. The beaver pond is also ready, while up on the elevated portions among the rocks work on the bear dens is well under way. Owing to the configuration of the park, many of the outdoor inclosures need but little changing beyond fencing in. The work on the buffalo house is rapidly progressing.

The English Society for Checking the Abuse of Public Advertising, or "Scapa" as it is called for short, has approached the Chancellor of the Exchequer with the suggestion that exposed advertisements should be taxed, contending that a moderate impost would tend to greatly reduce the volume of displayed advertisements without causing any real loss or hindrance to legitimate forms of advertising. The Chancellor replied that he could only regard the matter from the point of view for revenue, and he could not see on what ground the tax on advertisements could be defended unless newspaper advertisements were included.

A BOILER OF NOVEL CONSTRUCTION
In a new boiler invented by Jacob F. Klugh, of Highspire, Penn., ingenious means have been provided for securing a rapid circulation of the water, a large heating surface, and a utilization of the fuel to the utmost profit.
Fig. 1 illustrates the boiler in perspective, parts being broken away to show the interior construction. Fig. 2 is a sectional plan view taken through the water and steam compartment. Fig. 3 is also a sectional plan

a boiler of novel construction
view, but taken through the lower portion of the water and heating sections.

The boiler comprises a series of concentric, circular water-sections, closed at the bottom, but opening at water-sections, closed at the bottom, but opening at outermost of these sections extends below the others and is seated in a circular groove in the base of the boiler. By reason of this arrangement, annular heat ing spaces are formed between adjacent water-sections and a central flue is formed by the innermost wate section, which flue extends up through the water or steam compartment and the crown-sheet to open into a heat and smoke box arranged above the crown-sheet. The lower, closed ends of the water-sections are branch connected, so as to enable the water to circulate through the boiler. Through the water-sections and the water or steam compartment pipes extend; through the crown-sheet similar pipes extend to connect the heating spaces with the heat and smoke box ; and in the outermost water-section are pipes opening at their lower ends into the grooves of the base. A draft and heating chamber surrounds the outermost water section and opens into a dome. Between the heat and swoke-box and the dome a valved connection is provided which enables the two chambers to be directly connected.
In a boiler thus constructed the heat is required to penetrate only a thin sheet or body of water, thereby very rapidly converting the water into steam with a minimum amount of heat.

A SHIP'S BOAT SUPPORTING AND LAUNCHING DEVICE. A ship's boat, in order to be launched by the ordin

matson's boat-launching device.
ary method, must first be raised before being swung out and lowered. In cases of emergency this operation could be properly performed only by a ship's crew An invention patented by Henry J. Matson, of the steamship "La Touraine." Compagnie Générale Transatlantique, Pier 42 North River, New York city, provides a simple device whereby the launching of a boat can be readily performed by the passengers without the assistance of the crew.
Of the accompanying iliustrations, Fig. 1 is a perspect ive view of the device showing a boat placed thereon. Fig. 2 is a longitudinal section through a supporting block used in connection with the device. Fig. 3 is a cross-section showing the supporting-block in two positions.
To the deck of the ship, beneath each boat, are se cured two cross-beams. Upon guideways in these beams, plates slide to which the blocks which support the boat are hinged, in such a manner that they may be swung aside to the position shown in Fig. 3, in order to leave the boat free. To the plates nuts are screwed which engage bars mounted in the beams. These bars have a right-handed thread at one end and a lefthanded thread at the other. To the outer ends of the threaded bars, wormwheels are secured which mesh with worms on a shaft journaled in the two crossbeams, and connected by bevel-gears with a vertical shaft operated by a hand-wheel.
In launching a boat, the hand-wheel is turned to separate the supporting blocks by the operation of the threaded bar which engage the plate-nuts previ ously mentioned. When the block are sufficiently drawn apart the are sumpo down into the po the are swn shown in Fig. 3 . The boat being
thus left freely suspended, may be readily swung out over the ship's side and lowered by the ordinary tackle without the necessity of be ing first raised. The entire opera tion may be performed by a single person and in much less time than would ordinarily be required.

## Electrolytic Galvanizing.

A company started some two years ago to introduce a new cold process for galvanizing, and now a number of plants are running. The New York plant, with a capacity of about two tons per day, gal vanizes any kind of jobbing work and fills sample orders for manu facturers to show the advantages of the process. A glance at the old method will show clearly by comparison the advantages offered by this new process. As is well known, zinc is the only metal which will effectively preserve iron from rusting, and therefore is used for galvanizing purposes. The process of zincing by heat is defective. It puts on much superfluous metal, leaving the surface of the object treated rough and uneven, and does not give a coating of uniform thickness and strong adherence. Screws and threads have to be recut after treatment, involving much extra labor. All such defects are claimed to hav been overcoure by this new process of electrolytic gal vanizing $A$ multitude of articles can thus be vanized. Screws, nuts, cutting instruments, tool of every description, springs, locks (inside and outside parts), umbrella frames and artistic metal articles can be treated. Screws and threads need no recutting; springs preserve their elasticity and temper. The coating adheres to the surface of the iron, and all designs retain their origina orms. Iron sheets or wire can be bent, folded, twisted, etc., without injury to the galvanizing. The exposure of articles to atmospheric influence will not injure their rust-proof character, nor will salt water cause corrosion.
Cast and wrought iron, steel, brass and copper can be treated, and such articles afterward brassed, coppered or silver or gold plated for decorative purposes. A considerable reduction in cost of operating is effected, 80 to 90 per cent of spelter being saved, and there is also a saving in fuel There is no dross, which in the old process consumes 30 to 50 per cent of zinc, and the use of sal ammoniac is avoided. The gradual depreciation of the expensive zincing kettle, caused by burn ing out, and the keeping up furnace fires day and night, essential with the old method, is entirel avoided. The size of the article to be galvanized is immaterial, it being merely a question of mak ing tanks to correspond. The bath prepared for galvanizing is permanent and only requires an occasional addition of inexpensive chemicals. Or dinary zinc plates are used for anodes. The process can be made continuous-that is, the articles first put in the tank will be galvanized and ready to be taken out by the time the tank is filled with the material to be galvanized, provided it is made of sufficient size. Electrolytic galvanizing
is particularly adapted to articles consisting of two or more movable parts, such as pulley blocks, gage tools, snap inooks, etc., as no parts are soldered together by the galvanic process.

## AN IMPROVED FIRE-ALARM.

In many of the fire-alarms at present in use it is first ecessary to open the door of the box by means of a key before sounding an alarm. Often the box is rendered useless by turning the key the wrong way, and sometimes the key is broken by not inserting it far enough in the keyhole. A fire-alarm invented by Harlie E. Greene and John W. Haley, of Hot Springs, Ark., seeks to overcome these objections by employing a box in which an alarm is sounded by breaking a glass plate and by operating a push-button. Our illustrations represent this inproved fire-alarm with the door of its box opened and closed.
The outer casing of the box is provided with a hinged door having at its lower portion a glass panel. Secured to the lower portion of the inner wall of the casing is a slotted barrel, in which there slides the spring-pressed shank of a push-button. On the sbank there rests a cam, the inclined upper surface of which engages a pin sliding in vertical guideways at right angles to the push-button. Through the medium of a series of spring-pressed levers this vertically-sliding pin operates a stop-lever engaging the notch of a stopwheel journaled in the upper portion of the casing.


## an Improved fire-alarm.

The stop-wheel is connected by clock-gearing with a commutator wheel provided with two brushes, one of which is in fixed contact with the commutator and the other of which is adapted to engage contact points on the wheel. Two line-terminals are connected by wires with the two commutator brushes, one line-terminal being directly connected with one brush and the other having in the circuit bell-magnets and a bell, which may, however, be cut out whenever it is desirable or necessary.
When it is desired to send in an alarm the glass panel is broken, and the push-button is then forced in against its spring. The inclined surface of the cam will then raise the superposed pin; and the pin will operate the connected spring-pressed levers to raise the stop-leve from engagement with the notched stop-wheel. The clock-gearing will be set in motion and will drive the commutator-wheel so that the points thereon will com plete and break the circuit as they alternately pass into and out of contact with the movable brush. The rela tion between the commutator and stop-wheels is such that the former will make two revolutions for a single revolution of the latter, thus sending in two alarms for one operation of the push-button. Should the fire-alarm circuit at any time be disabled by the burning-out of the magnet-coils, the magnets and bells can be cut out and direct communication established between the brush and terminal. The inventors claim that the fire-alarm will have a resistance no greater than 20 ohms, and that by cutting out the bell-coils the resist ance is still further reduced, hence permitting the use of small battery-power in operating the lines.

The Incineration of Garbage in Hamburg.
At a recent meeting of the German Society of Public Hygiene, Meyer (Tribune médicale, N. Y. Med. Jour.) described the system employed in Hamburg for the cremation of garbage. It applies to the central part of the city, occupied by about half the population. The works consist of thirty-six Horsfall furnaces. The material to be burned is delivered in sealed metallic re ceptacles. Combustion is promoted by forcing warm dry air into the furnaces. This is found to be superio to the English practice of employing steam. Except for kindling purposes, no adventitious fuel is required the combustion is complete. The heat generated is turned to account in operating dynamo-electric machines for illuminating and other purposes.

## CARDINAL WOLSEY'S HAT

Christ Church, Oxford, has secured a hat that once belonged to the great Cardinal Wolsey. Christ Church, Oxford, was founded by Henry VIII., in 1545, but, in reality, he merely adopted the magnificent work commenced by Cardinal Wolsey in 1524 . It may be said that Christ Church, Oxford, is not a church, but a college. The great cardinal intended "Cardinal College" to be a splendid institution for the advancement of learning and a memorial of his own greatness. In order to create it he abolished monasteries, pulled down churches, collected costly vestments, and sent agents to buy manuscripts. A considerable part of the building was finished in 1529 . He drew up statutes providing for a dean, fellows, and many graduates, scholars, and others, and appointed the first holders to


CARDINAL WOLSEY'S HAT.
these offices, and, curious to say, some of these turned out to be the pioneers of the Reformation. The col lege was at work when Wolsey fell, in October, 1529 and a year later the college was suppressed. Fifteen years later Henry VIII. re-established it under a new name, but the buildings were chiefly Wolsey's, and the endowments were taken from endowinents provided by Wolsey.
Quite recently a new treasure was obtained by the college-a hat which is said to have been Wolsey's hat. While the pedigree of the hat is incomplete, it is ancient at any rate. For years it was one of the curiosities of the famous Strawberry Hill collection of Horace Walpole. When it was sold, it was bought by Charles Kean, the actor, who, it is said, wore it while he was acting. In 1898 it was exhibited at the Tudor exhibition, and in the same year it was bought and presented to Christ Church, where it will be very carefully preserved.

It has a large, flat brim of red felt; both brim and hat are absolutely round. The hat, is $31 / 2$ inches high and $71 / 2$ inches in diameter. It is so very round that it is a wonder it could have been worn. The brim is perfectly flat and measures not quite 6 inches in width, so that the whole diameter of the hat and brim is about 19 inches. The tassels are lost, but the place where they went in can be seen. A narrow cord ran around the outside of the bottom of the hat along the nner edge of the brim and passed by two bmall and passedby two small holes through this edge, so that the ends of the
cord could be brought cord could be brought
together and tied. That t is a genuine cardinal's hat seems beyond doubt, but whether or not it is Wolsey's hat is, of course, open to quesion. We are indebted to Black and White for our our engraving and for the foregoing particulars.

## American Locomotives

 for the Barry Dock.The directors of the Barry Dock have accepted American tenders for the construction of their locomotives. They get quicker delivery and the price will be about $\$ 500$ less per engine.


The Ascent.


With Steadying Pouch Fully Inflated.


Towing Home.


In Mid-Air.

A CAP FOR SLIDING DOORS.
The illustration presented herewith represents an improvement in caps or devices for covering the tracks upon which sliding doors run, the improvement rendering it possible readily to repair the moving parts of the door-mechanisin.
Fig. 1 is a perspective view of the device. Fig. 2 is a vertical section taken through the improvement.
Secured above the door opening is a plate which is bent to form a track for the door. Upon this track the door is hung by means of barsin which wheels are journaled, rolling upon the track. Above the track there is fastened to the wall a plate provided with an inwardly turned roll
The cap which covers the track is also made in the


DOANE'S CAP FOR SLIDING DOORS.
form of a plate, but is provided with an outwardly turned roll intermeshing with the previously mentioned inwardly turned roll, so as to secure the two plates together and to form a hinge whereby the cap can be raised.
The cap extends down over the door and at its lower end is provided with a stiffening-rod held in place by a roll in the edge of the plate. At each end the cap is provided with eyes which are engaged by hooks. If it be so preferred, the eyes may be formed upon the ends of the stiffening-rod.
Should the wheels run off the track, or should the door become impeded, the cap is unhooked and swung up, thus enabling the necessary repairs to be made.
The cap has been patented by the inventor, Elias H. Doane, Tonica, Ill.

The Use of Peat Moss in Europe
As we have had many inquiries concerning peat moss, we take pleasure in giving some additional particulars regarding this interesting substance which are furnished by United States Consul Listoe, of Rotterdam. The largest dealer in, and exporter of peat moss in the Noth, peat moss in the Nethfllows Mos litter as used for the bedding of horses and cattle, while the peat dust is used for disinfecting purposes; that is to say, by mixing it with manure the moisture of the latter is absorbed and there is no unpleasant odor. It is also used as a packing material for fruit. Mixed with molasses, peat dust forms a fodder for cattle. This is mostly made in Germany, and the sales of this molasses fodder are daily increasing. The peat dust is sifted from the moss litter; the peat fiber is used in Holland to make horse clothes and carpets and also antiseptic wool for dressing horses. A few years ago there was established at Maestricht works for making peat wool, but the enter prise was not a suc cess.
No paper is made from peat moss in Hol land, and it is not be lieved it is a fit material for paper mak ing.

Miscellaneous Notes and Receipts
Swiss Alpen Kraeuterbitter-Liqueur.-(Bitters-liqueur made from Alpine herbs.) -

| Gentian ro | $500 \mathrm{grns}$. |
| :---: | :---: |
| Juniper berries | 500 |
| Angelica root. | 40 |
| Thyme. | 120 |
| Sage. | 120 |
| Calamus. |  |
| Ceylou cinnam | ${ }^{1200}$ lite |

Digest eight days and add, after pressing and filter ing, Malaga wine 5 to 6 liters. Water, up to 100 . Color brown.-Colonialwaaren Zeitung.

Diamonds in a Volcano.-An interesting discovery from a geological view-point has latterly been made inthe Witries Hoek Mountains, in Natal. On the sum mit of an extinct volcano near the edge of a lake fill ing the former crater, soundings have established the presence of a sand layer containing small diamonds. It would be instructive to know whether these dia monds were there accidentally or whether the find is connected with a diamond field, for the said moun tains are not situated in a district known to be diaman tiferous. Considering the latter supposition, the presence of precious stones in the crater of a volcano will doubtless throw some light upon the formation o precious stones in nature.-Die Edelnetall Industrie.
To Reproduce Old Lithographs.--Prepare a bath consisting of sulphuric acid, 3 to 5 parts, according to the age of the picture, thickness of the paper, etc., alcohol 2 to 5 parts, water 100 parts, in which the picture is immersed for 5 to 15 minutes, whereupon it is spread face downward on a glass or ebonite plate, allowing a weak jet of water to run over it for a time. If the paper is very thick, the sheet is turned over and the water is permitted to run over the face as well. Now remove the lithographic print lay it on a piece of blotting paper, cover it with another, and dry the picture as far as possible between the two blotters.
The print, still somewhat moist, is then, with the picture upward. laid on a glass plate, well smoothed down and covered with a layer of weak gum solution, using a very soft sponge. The picture is now ready to take the printer's ink or lithographer's ink diluted with oil of turpentine, as is customary in lithographing. After this is done, spread a sheet of suitable paper on it and pass a dry roller over it. A reversed imprint is the result, which is transferred to a zinc plate or a lithographic stone, from which numerous impressions can be made.-Neueste Erfindungen und Erfahrungen.
Coating for Parts of Iron in the Open Air.-The iron parts are cleaned with suitable tools, the joints puttied up and priming is done with a paint consisting of iron minium and linseed oil varnish, which is applied twice. When the grounding is perfectly dry, coat twice with a paint consisting of white lead 1 kilo., zinc-gray 1 kilo., ultramarine 20 grammes, finely ground with 500 grammes of boiled linseed oil. Cast iron or wrought iron water pipes are painted with gas tar heated to $180^{\circ} \mathrm{C}$. or with a mixture of asphalt 1 kilo. with colophony 1 kilo., which is thinned with tar oil.
A coating for iron which is impervious to fire is obtained as follows: First apply a water-glass solution which is mixed with finely powdered glass. After drying, lay on a thin paint consisting of quartzose sand 14 parts, powdered hammer-scale, slaked lime $1 / 2$ part, clay $1 / 2$ part, and water-glass solution as necessary.
Rust-proof paint for iron and steel.-Dissolve caoutchouc in benzine, and put on the thickish solution by means of a brush.
Coating for wrought iron pipes.-Boil 72 per cent of coal tar, free from oily substances, with 28 per cent of crude asphalt until the necessary consistency is reached. The mixture must not be overheated.-Centralzeitung fur Optik und Mechanik.
Piercing Majolica and Porcelain.-Ceramic objects can be quite readily pierced with steel tools. Best suited are drills of ordinary shape, hardened like diamond and moistened with oil of turpentine, if the glaze or a vitreous body is to be pierced. In the case of majolica and glass without enamel the purpose is best reached if the drilling is done under water. Thus, the vessel should previously be filled with water and placed in a receptacle containing waler, so that the gimlet is used under water, and, after piercing the clay body, reaches water again. In the case of objects glazed on the inside, instead of filling them with water, the spot where the drill must come through may be underlaid with cork. The pressure with which the drill is worked is determined by the hardness of the material, but when the tool is about to reach the other side it should gradually decrease and finally cease almost altogether, so as to avoid chipping. In order to enlarge small bore-holes already existing, three-cornered or four-square broaches, ground and polished, are best adapted. These are likewise employed under water or, if the material is too hard (glass or enamel), moistened with oil of turpentine. The simultaneous use of oil of turpentine and water is most advisable in all cases, even where the nature of the article to be pierced does not admit the use of oil alone, as in the case of majolica and non-glazed porcelain, which absorb the oil, without the use of water.-Metallarbeiter.

## A CONVERTIBLE DUSTING-BRUSH.

The accompanying illustration represents a simple The accompanying illustration represents a simple being detached, may be shifted from one end of the brush to the other, so as to secure a uniform wear of the bristles.
Fig. 1 is a perspective view, showing the brush and handle arranged to form a long-handled brush. Fig. 2 is a side elevation showing the brush and handle arranged to form a floor brush. Fig. 3 is a transverse vertical section of the brush, the handle being omitted.

The dust-brush is provided with a tubular portion open at both ends, into which a double-ended handle is


## HAM'S CONVERTIBLE DUSTING-BRUSH.

adapted to fit. At its upper face the tubular portion is provided with three apertures, one at each end and one at the center. At the bottom of the tubular portion, in transverse alinement with the central aperture, a depression is formed, as shown in Figs. 2 and 3.

The handle at each end is provided with an aperture which is adapted to register with the end apertures of the tubular brush portion.

When the brush is to be used as a hand-brush, the handle is run through the tubular portion, and is secured by means of a pin which passes through the handle aperture and through one of the end apertures of the tubular portion.
By causing the pin to pass through one or the other of the end apertures, the brush can be converted from a short to a long-handled brush. Fig. 1, for examplé, shows the arrangement of the parts for a long-handled brush. When the brush is to be used as a floor brush, the handle is inserted in the central aperture of the tubular portion and into the depression registering with the central aperture, as shown in Fig. 2. The frictional engagement between the walls of the central frictional engagement between the walls of the central
aperture and depression and the handle is sufficient aperture and depression and the handle is sufficient
to maintain the handle in the brush body. It is evident that a brush thus constructed can be so arranged in its parts that the bristles may be evenly worn. The inventor is Henry H. Ham, of Portsmouth, N. H.

## A NEW FORM OF FIRE-ESCAPE

There has recently been patented by Emile Robiole, of 313 Amsterdam Avenue, New York city, a novel fire escape, in which a piece of furniture is used as an anchor for the ladder.


## a new form of fire-escape.

Fig. 1 is a perspective view showing the fire-escape in operation. Fig. 2 is a section of a chair, showing the general arrangement of the parts of the fire-escape. Fig. 3 is a section of a portion of the device, showing the position of the parts when the ladder is running out of a window. The chair or other piece of furniture
is provided with the usual seat and legs, and with a supplemental back behind the ordinary back. Below the seat a casing is arranged which communicates with the space between the two backs. In order to enable the chair to serve as an anchor, a heavy weight in the form of a plate is attached to the lower portion. Within the casing a spindle is mounted, upon which a fire-ladder, formed of steel wire cables to which steel rungs are secured, is wound. A portion of this ladder extends up between the two backs, and, at its outer end, is provided with a heavy weight normally resting upon the upper end of the back and upon a roller in the supthe upper bon whe plemental back. When not in use, the various parts from place to place. When it is desired to use the firefrom place to place. When it is desired to use the fire-
escape, the chair is moved to a window, as shown in escape, the chair is moved to a window, as shown in
Figs. 2 and 3 , and the weighted end of the ladder Figs. 2 and 3, and the weighted end of the ladder
thrown out of the window. As the window-sill might interfere with the downward movement of the ladder, the inventor has pivoted arms to the back of the chair, in the free ends of which arms a roller is journaled. This roller enables the ladder to unwind readily; and the connection of the arms with the piece of furniture is such that they will serve as braces to prevent the tipping of the chair. When the fire-escape is not in use, the arms will hang downward as shown in Fig. 2. In order to wind up the ladder after having been used, a winding-crank is employed which fits in a socket in the ladder-spindle.

## A Rectifier for Alternating Currents.

For many purposes in which electricity may be used, says Dr. Kalischer in the Elektrotechnische Zeitschrift, the direct employment of alternating currents is not convenient. In consequence of this, one has been forced to make use of intermittent direct currents. But the rectifiers with movable parts finding employment for this purpose are more or less unreliable and irregular in their action, besides which a loss of energy is represented by the sparking which occurs at the contacts upon the opening and closing of the circuit. The substitution of a rectifier without these defects, and adapted to work in conjunction with alternating currents, would therefore appear desirable. This has been rendered possible by the recently published discoveries made independently by Messrs. Pollak and Graetz, who have utilized certain properties of aluminum to assist in rectifying alternating currents by employing anodes of this metal in conjunction with certain electrolytic solutions, such as, for instance, potash-alum and sodaalum. By this means a very great resistance may be opposed to the passage of the current in one direction, which is, indeed, quite prevented provided its E.M.F. does not exceed a certain maximum.
It is obvious from the foregoing that if we connect one or several such cells, as may be necessary (in series), possessing aluminum or lead or carbon electrodes in circuit with an alternate current generator and the primary winding of an induction coil, the current will be able to circulate through this winding only when the aluminum forms the cathode, so that the coil will be alternately choked and opened with perfect regularity. By employing two cells or group of cells, it is further possible to excite two inductions simultaneously, and so to fully utilize the current generated. It need hardly be added that a part of the alternating current may be employed for other purposes without in any way interfering with the action of the induction coils. Electro-plating baths might also be connected, as will be readily understood, and at the same time a portion of the current from the common source of generation transformed into a continuous current through the medium of the arrangement of connections suggested by Messrs. Pollak and Graetz.

## The Manna of the Bible

In a recent number of La Nature there is an interesting note by M. Henry Castrey on the manna of the desert, which played such an important part in the bistory of the Jews. At the present day Arabs who are compelled to traverse the sandy desert wastes of Arabia not only feed their camels upon this little known food, but also consume it themselves. The "manna" is really a fungus, the thallophyte, either Canona esculenta or Lichen esculentus. The fun gus is very abundant and is found upon the sand after every rain, sometimes in great mounds or heaps. It is of a gray color and is about the size of a pea, and it breaks with a mealy fracture, and the taste is rather agreeable and somewhat sweet. When eaten it acts as a laxative, and the analysis shows that the fungus has the following composition :

|  | Per cent |
| :---: | :---: |
| Water. |  |
| Nitrogenous matter |  |
| Non-nitrogenous matter. | 22 |
| Carbohydrates.. |  |
| Fat....... |  |
| Mineral matte |  |

This analysis demonstrates the fact that the manna, while not a complete food in the strict sense of the term, is still rich in certain kinds of food material and it is capable of sustaining life for a time.

## Sorrespondence.

## Lightning Protection

To the Editor of the Scientific American :
Referring to the excellent article by Mr. Hopkins on "Lightning Protection" (SUPPLEment, March 25, 1899, page 19434), I beg to suggest that a protection ful filling all the indications may be very cheaply arranged on a country house by nailing a few lengths of common barbed wire to the roof and bringing the ends to a point where they can be twisted around the iron pump of a driven well.
This gives an enormous number of points and a perfectly adequate water connection. The device was used inany years ago by the late Dr. Henry J. Bigelow, of Boston, for the protection of a sinall isolated wooden house at Nantucket, and has apparently been perfectly effectual.
W. S. Bigelow, M.D.

60 Beacon Street, Boston.

German Steel Arch Bridges.
Your issue of March 25 will be read with great interest by all civil engineers interested in the introduction of bridges that will be more æsthetic in their design and still retain their stability, etc.

For the beautiful illustrations of the two bridges across the Kiel canal (Holstein, Germany), at Levensau and Grünenthal, you will have the acknowledgment and thanks of the entire profession.

As to the credit due in designing these bridges, I believe Mr. Muller v. d. Werra is in error. The bridge at Grunnenthal was designed by Mr. Claus Greve, C.E., an assistant to Mr. Föltsch, chief engineer of the said canal and of late one of the commissioners appointed to examine into the practicability and cost of the Panama canal.

For above work Claus Greve received recognition and a decoration in person, during the time of its inaugu ration, by the Eimperor of Germany.
H. Rohwer,

As. Eng. Mo. Pac. Ry.
Sedalia, Mo., April 6, 1899.
[Our correspondent is in error in supposing that the credit for designing the Grunenthal bridge was given, in the article referred to, to Prof. Krohn, the designer of the Levensau bridge. We are obliged to Mr. Rohwer for supplying us with the name of the designer of this notable structure, which was inadvertently omitted from the article.-ED.]

Twelve-pounders Better than Six-ponnders for the Maine.
To the Editor of the Scientific American.
The description of the new battleships of the "Maine" class, recently given in the Scientific American, discloses the fact that they are to continue a feature for which our ships are already notorious-namely, the lack of a sufficient number of small rapid-fire guns. To give a first-class battleship, in the year 1899, a secondary battery composed of twenty-four 6 and 1 pounders seems incredible, especially in American ships, which have always had at least the reputation of a heavier armament for their size than any afloat.
The small rapid-fire gun has shown its value more and more every year. In the battle of the Yalu it did a great part of the execution on both sides. At Santiago the 6 pounders were responsible for a large propor tion of the total damage inflicted. At Manila, the sweeping of the decks by these small guns contributed largely to the wretched showing made by the Spanish gunners. Moreover, at Santiago the two Spanish de stroyers were principally demolished by the fire of these small rapid-firers.
Here are the three important battles so far fought with wodern vessels, and in each of them the rapid-fire gun has played the predominant part.
There is also another event in which the ship's safety will depend almost entirely on the small rapid-fire $\kappa$ uns -namely, a night attack by a torpedo boat fleet. Here every rapid-fire gun will count and the ship lacking them is sure to suffer
A table comparing the "Maine" with representative foreign ships will be found somewhat startling.

| Name. | Tons. | Armament. |
| :---: | :---: | :---: |
| Maine .. | 12,500 | Four 12 in., sixteen 6 -in., twenty 6 -pr., four 3 -pr., |
| Retwisan. | 12,700 | Four 12. in., iwelve 6 -in., twenty 12 -pr., twenty- |
| Tri Sviatetelia | 12,840 | Four 12-in., eight 5.9 in ., four 47 -in.. fifty-six |
| Majestic. | 14,900 | Four 12 -in , twelve 6 -in., eighteen 12-pr., twelve |
| Bouvet. | 12,200 |  |
| Kaiser Wilhelm | 11,130 | in., twelve $1 \cdot 8$-in., twenty $1 \cdot 4$-in. <br> Four $9 \cdot 4$-in., eighteen 5.9 in ., twelve 18 -pr. twelve 1.4 -in. 8 m . |
| Italia........... | 14,387 | Four 100-ton, eight 6-in. four 4.7-in., twelve 2.2- |
| Asahi | 15,200 | Four 12,-in., fourteen 6-in., twenty 12 -pr., eight 3 pr., four 21/2-pr. |

The average number of rapid-fire guns on foreign ships is seen to be over forty. Compare with the "Maine" the Russian ship now building at Cramps,
the "Retwisan," or the "Majestic," of the English navy. The "Retwisan" has nearly twice as many navy. The "Retwisan" has nearly twice as many
small rapid-fire guns as the "Maine," guns, moreover, small rapid-fire guns as the "Maine," guns, moreover,
of much greater power, consisting chiefly of 12 and 3 of much greater power, consisting chiefly of 12 and 3-
pounders, instead of our 6 and 1-pounders. The "Mapounders, instead of our 6 and 1-pounde
jestic" also shows this same superiority.
As is well known, the 3 -pounder has a much greater range than the 1 -pounder, and, of course, the 12 -pounder is manifoldly more powerful than either. The 1 pounder is notorious for its short range, so short indeed that the gun would be seldom in range at the distances which modern artillery compels.
In the matter of suall rapid-tire guns alone, both the "Majestic" and "Retwisan" are decidedly superior to the "Maine." The argument is made that the "Maine's" four extra 6 -inch guns equalize the batteries; but no reason is apparent why our ships should not have a reasonable number of the small guns also.
The 6 -inch guns on the upper deck of the "Maine" might be placed farther apart, forward and aft on each side, as in the "Canopus," so as to allow several smaller guns to be placed in the interval between them. Then, also. the two 6 -inch guns would be in less danger of being put out of action by a single shot. Several of being put out of action by a single shot. Several
small guns could also be placed on the boat deck. small guns could also be placed on the boat deck.
There is room for at least four more of these there, There is room for at least four more of these there, without interfering in any way with the boats.
Many foreign ships are overgunned. Possibly the Russian vessel now buiiding at Cramps, the "Retwisan," has more guns than can be carried advantageously. The English, however, have always been extremely conservative in this respect; sometimes they have gone to the other extreme of undergunning their ships; but the constant feature of English ships, which ships; but the constandeature of tenglish ships, which may be always depen
Why, therefore, should the "Maine" carry twentyeight of these all-important guns when the "Majestic" has thirty-eight-thirty-eight, moreover, of greatly superior power?
Why do we so completely ignore the lessons of the Spanish war, and drop our old tradition, its value so often proved, of well-gunned ships? L. F. B.
589 North State Street, Chicago, Ill.
[Our correspondent does not realize the enormous difference in power which results from increase of caliber. The four extra 6 -inch guns on the "Maine" represent in their destructive power much more than the difference between the twenty 6 -pounders of the "Maine" and the twenty 12 pounders of the "Retwisan."
However, his argument is on the whole well made ; for it is officially stated that the 6 -pounders will be replaced by 12 -pounders before the ship is launched. $\stackrel{ }{\text { Ed.] }}$

The Telephone in the United States.
According to the annual report of the American Bell Telephone Company, last year $1,231,000,000$ messages were sent. The company now has under rental 1,124,846 instruments. This is a gain of 205,725 during the year. On January 1 there werè 1,126 exchanges, 1,008 branch offices, and 772989 miles of wire. There was a total of 338.293 circuits, 19,668 employes, and 465,180 telephone stations. The estimated number of exchange connections daily in the United States by last account was $3,823,070$. The cost to subscribers varied from less than 1 cent up to $9 \cdot 4$ cents per connection. These figures are of great interest when taken in connection with similar statistics of telephone service abroad. In 1898 the Bell Telephone Company had, as already stated, 465,180 exchange stations, while in Germany in 1897 there were only 173,981; in France, 45,000 ; in all of continental Europe, 453.844; in Great Britain and Ireland, at the end of $1898,103,084$.

## wireless Telegraphy.

The French government has commissioned Signor Marconi to install his apparatus experimentally on a cruiser. If the experiment proves a success, several French warships will be provided with the apparatus. The storm test of the Marconi system has been wade, the wind blowing a gale in England and the rain storms were constant. Similar conditions prevailed at Boulogne, but the messages passed as readily and as distinctly as though the water was calm. Signor Marconi states that he thinks of coming to the United States in October to execute several commissions for fixing his apparatus between various towns.

## The Cancer Microbe.

The Paris Figaro has announced that Dr. Bra has found the microbe of cancer, and that there is reason to hope that the discovery may soon lead to a certain cure of that dread disease. Dr. Bra is modest and cautious in his statements, saying that it must be months before a definite announcement would be pos sible. What he has succeeded in doing, however, is to isolate and cultivate a parasite from cancerous tumors and to produce therefrom cancer in animals. The parasite is fungus-like and is certainly the specific agent of cancer. Dr. Bra has spent some four years in his researches on the origin of cancer.

Sclence Notes.
Mr. L. W. Longstaff, a Fellow of the Royal Geographical Society, has donated $\$ 125,000$ to the Society for the purpose of equipping a British Antarctic expedition. It is thought probable that the vessel to be fitted out will co-operate with the German expedition
The Council of the British Association has selected Sir William Turner, F.R.S., professor of anatomy in the University of Edinburgh, as president of the Association for the Bradford meeting, which is to be held next year.
The Soudan bridge order which was given to a Pennsylvania firm is creating a great impression in England and has awakened bitter opposition. Some of the newspapers go so far as to say that the transaction was scandalous and that the specifications were altered in scandalous and that ene specifications were altered in
favor of the American contractors. This is denied by favor of the American con
the builders of the bridge.
The Russian ice breaker "Ermak," which was designed by Admiral Makaroff, has reached Kronstadt, crushing the ice with ease. When the island of Sescar was sighted, large floes of ice varying in thickness from 9 to 10 feet were met with. The ice was broken into large pieces which floated astern, but so arduous was the task of getting through the solid mass that the rate of progress was but $21 / 2$ knots an hour.
There is a remarkable collection of astronomical photographs at Harvard University. They are kept by Mrs. M. P. Fleming, who is curator. The photographs taken at Cambridge and Arequipa are preserved and arranged in catalogues as is done with books, but the plates themselves are actually preserved, because no paper copy can repeat all the minute accuracy of the original negative on glass, and prints are not taken from them for scientific use, but only for illustration. If one is destroyed, it cannot be replaced. So it necessitates the greatest possible care in preserving them.
There is now an excellent chance of Boston having another Subway. The Committee on Metropolitan Affairs of the Massachusetts Legislature has given a hearing to the proposition of the Mayor for another Subway. The proposed route extends parallel with the Charles River on the Boston side and involves the tunneling of Beacon Hill. It is proposed to connect the new Subway with the existing Subway at Scollay Square. The cost of the new project is estimated at $\$ 3,000,000$.
A special messenger of the American District Telegraph Company was recently sent by Mr. Richard Harding Davis from London with a letter to New York, one to Philadelphia, and one to Chicago. The boy was sent by the novelist in an effort to beat the Postal Union mail service, and this is undoubtedly the longest trip on record which a district telegraph boy has ever made. He is known at home as messenger No. 757; he is thirteen years old and rejoices in the name of Jaggers.
Mr. Jeremiah Head died on March 10. He was one of the best known consulting engineers in England. His paper read before the Institution of Civil Engineers in 1896 on the American and English methods of making steel plates, and a paper which he contributed in February to the same Institution in connection with his son on "Lake Superior Iron Ores," were a revelation to a large number of people in Great Britain who had not realized how rapidly Americans were forging ahead in the production of iron and steel, and the many improvements that had been introduced in transatlantic practice.
A task which has been undertaken in the interest of commerce was begun by the voyage of whalers to the Arctic Ocean, to test the Arctic currents. The effort to secure facts about the current and of the existence of a circular polar current was inaugurated by the Geographical Society of Philadelphia, backed by the United States government. Fifty patent casks of a peculiar make have been constructed in San Francisco, and will be sent out in the United States revenue cutter "Bear" and vessels of the whaling fleet. They will be distributed in different parts of the ocean and will be picked up by vessels which pass them later. It is thus hoped to determine the currents of the Arctic and the theory of an open current around the pole from the Atlantic to the Pacific.
Recently a curious sight was seen on Center Street, New York, when the old water tank of the Manhat$\tan$ Company was exposed to view. April 2 was the centennial anniversary of the bank of the Manhattan Company. It was incorporated in 1799 for the purpose of supplying the small city with water. The real motive. however, was to organize a bank in opposition to the Bank of New York. In order to keep its charter, the company must supply water; so that the old tank has been kept in working order and the engine has been kept going pumping water. The tank is 40 feet in diameter. In 1840 the company had about 25 miles of wooden pipe and 14 miles of iron pipe. At about that time its usefulness as a water supply ceased and the Croton system came into use. From time to time these wooden and iron pipes are unearthed.

## NAVIES OF THE WORLD

 v.-GERMANY.Historical.-In looking over the officiallist of the Germany navy, one is struck with the fact that it con tains the name of only one ship, the "König Wilhelın," launched prior to the Franco-German war and the unification of Germany. The German navy has grown to its present proportions under the rule of the Emperors, and, particularly, under the fostering care of William II. At the outbreak of the war of 1870, there were but five ironclads to oppose the formidable fleets of France. The best of these was a fine broadside battleship, the "König Wilhelın," of 9,567 tons, which had just been completed in an English yard, and wasarmed with a powerful battery of eighteen 10 -inch, four $81 / 4$-inch, and six $5 \cdot 9$-inch breech-loading guns. Besides the "König Wilhelm" there were two broadside ships of 5,000 and 6,000 tons, and two small coast defense monitors. In addition to these there were some twenty-five gunboats and dispatch boats, and this little fleet of some thirty vessels was all owned by the one state of Prussia.
During the decade immediately following the war, Germany added to her navy four serviceable battileships of the belted and central citadel type so generally favored at that time, the "Kaiser," "Deutschland," "Preussen" and "Friedrich der Grosse"; and they were followed by the four central citadel and partially belted ships of the "Sachsen" class. These were all ships of from 7,000 to 8,000 tons displacement 14 knots speed, and fairly Hacement, 14 knots speed, and fairly powerful batteries of Krupp guns of the older patterns. Between 1876 and 1880 there were also built eleven small belted coast defense vessels of 1,109

Wilhelm " of 4,400 tons and 19.8 and 18.7 knots speed, launched in 1887.
When the present Emperor came to the throne, the German navy, in comparison to the magnitude and growing importance of the merchant marine, was altogether inadequate, and the young Kaiser, who is an ardent yatchsman and, like his brother Henry, a thorough sailor at heart, set himself with characteristic energy to the work of reconstruction. For the ten years of his reign he has exerted all the powerful prestige and influence of his position to bring the German people to realize the necessity for creating a navy commensurate in numbers and power with the growing commercial interests of the Fatherland. His

"Brandenburg "Class of Four Battleships.
plete new navy, the construction and cost of which was to have been spread over a period of seven years; although as finally passed the period is limited to six years. The bill provides, in addition to new torpedo boats and gunboats, for the raising of the strength of the navy to 17 battleships, 8 coast defense vessels, 9 large cruisers and 26 small cruisers. This will involve the construction of 7 new battleships, 2 large and 7 small cruisers, and new gunboats and torpedo boats, which will be built to take the place of obsolete vessels of this class that will be removed from time to time from the active list. The total cost will be about $\$ 103,000,000$ and the ships will all be in commission

Present Strength of the Navy. -On the first of January, 1899, the German navy, reckoning on the basis assumed in cur comparative estimate of the navies of the world (ScIENTIFIC American, December 31,1898) included the following ships as built or building: 19 battleships, 1 armored cruiser, 12 protected cruisers of between 2,000 and 7,000 tons displacement, and 22 small cruisers and gunboats-a total of 73 vessels with an aggregate of 299,637 tons displacement This places Germany between the United Staces Germany between the United States with 303,070 tons and Italy with 286, 175 tons total displacement. If the United States should keep up the rate of increase which has marked the last two years, during the years covered by the German Septennate bill, this country will have greatly increased its lead over Germany by the close of 1904 ; but unless Italy should increase her present rate of progress, she will fall yet further behind the northern navy in numbers and strength.
Battleships. - The most formid


## NAVIES OF THE WORLD-V GERMANY

tons and 10 knots speed, each armed with a 12 -inch gun, and some score of small unarmored cruisers and gunboats were added to the navy.
The decade 1880-90 was marked by an almost total stagnation in the construction of armored ships, only one small battleship, the "Oldenburg" of 5,200 tons and $13 \cdot 5$ knots speed, being added to the navy, if we exclude one or two of the above mentioned coast dpfense vessels which were completed in 1880-81. The new construction during this period was confined to gunboats and small cruisers. Two of the former were built, and fourteen of the latter, the cruisers being. with two exceptions, vessels of 2,000 tons displacement and less, and several of them possessing a speed of 14 knots and less. The most important of these ships were the protected cruisers "Irene" and "Prinzess
efforts have been crowned, first with partial, and lat terly with complete, success. In the first half dozen years of his reign he has seen that splendid quartette of first-class battleships known as the "Brandenburg" class added to the navy, together with the eight effective coast defense vessels of the "Siegfried" type, while in the last five years the cruiser classes have been augmented by such vessels as the "Kaiserin Augusta" the "Gefion" and the effective vessels of the "Herthe" type.
The crowning success of the Emperor's policy, however, was witnessed in the passage last year of the famous Naval Septennate Programme.
The Naval Septennate bill (so named because it is patterned after the system adopted for the army) provides for the creation of what is practically a com-
able ships in commission in the German navy are the four powerful battleships of the "Brandenburg" class. The striking feature of these ships is the power of the main battery, which includes six, in place of the customary four heavy guns. The only other warships that are thus distinguished are the Russian battleships of the "Sinope" class, which carry six 12 -inch $B$. L. rifles within a central barbette. The "Brandenburg's" guns are not so heavy, being of 11 inches caliber, but they are better distributed, and she is able to concentrate all six guns on the broadside, which the "Sinope" cannot do, although she can train four guns ahead, against the "Branden burg's" two. The zuns of the "Brandenburg" are better protected, as the breech of the guns is covered with a shield, while the Russian gunners must work in an


3--Third-class Battleship "Preussen." Also "Friedrich der Grosse."






7.- Frotected Oruiser "Hertha." Olass of Five Ships. Displacement, 5,650 tons. Speed, 22 knots. Normal Coal Supply, 500 tons. Armor: Gun
 Comviement. 440. Date. $189 \%$.

4.-Reconstructed and Rearmed Battleship "Koenig Wilhelm." Displacement, 9,757 tons. Speed, 147 knots. Normal Coal Supply, 700 tons. Armor: Belt,
 Date, originally built 1868; reconstructed and rearmed 1896 .

8.-Coast Defense Vessel "Heimdall." "Siegfried" Olass of Eight Ships." Displacement, 3,500 tons, Speed, 16 knots. Normal Coal Supply, 225 tons. Armor: Belt



German Naty, January 1, 1899.

| description of TYPE. |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: |
| $\left.\begin{array}{l} \text { Battleships, } \\ \text { 10 } \left.\begin{array}{l} \text { years or less, } \end{array}\right\} \end{array}\right\}$ | 9 | 10,672 | 96,048 | $17 \cdot 3$ |
| $\left.\begin{array}{l} \text { Battleships, } \\ \left.\begin{array}{l} \text { to } 20 \end{array}\right\} \text { years. } \end{array}\right\}$ | 1 | $\ldots$ | 5.200 | 13.5 |
| $\begin{gathered} \text { Battleships, } \\ \text { Old } \begin{array}{c} \text { or } \\ \text { Refitted. } \end{array} \end{gathered}$ | 9 | 7,434 | 66,910 | 14.0 |
| Totals.............. | 19 | $\ldots$ | 168,158 |  |
| $\begin{gathered} \hline \left.\begin{array}{c} \text { Coast } \begin{array}{c} \text { Defense } \\ \text { Vessels. } \end{array} \\ \hline \end{array} \right\rvert\, \end{gathered}$ | 19 | 2,081 | 39,639 | $12 \cdot 6$ |
| Armored Cruisers. $\ell$ 9,000 tons and up. | 1 | 10,650 | 10,650 | 190 |
| $\left.\begin{array}{l}\text { Armored Cruisers, } \\ \mathbf{7 , 0 0 0} \text { to } 9,00 \text { tons. }\end{array}\right\}$ | $\ldots$ | $\ldots$ | $\ldots$ | $\ldots$ |
| $\left.\begin{array}{c}\text { Armored Cruisers, } \\ \text { Below } \boldsymbol{\tau}, 000 \text { tonè. }\end{array}\right\}$ | $\ldots$ | $\ldots$ | $\ldots$ | $\cdots$ |
| Totals............ | 1 | .... | 10,450 | $\ldots$ |
| $\left.\begin{array}{l}\text { Protected Cruisers } \\ \text { 10, } 000 \text { tons and up. }\end{array}\right\}$ |  | $\ldots$ | - | $\ldots$ |
| $\left.\begin{array}{l}\text { Protected Cruisers } \\ 7,001 \text { to } 10,000 \text { tons }\end{array}\right\}$ |  | $\ldots$ | $\ldots$ | $\ldots$ |
| Protected Cruisers 1 4, (20 to 7,000 tons i | 9 | 5,315 | 47,835 | $20 \cdot 1$ |
| $\begin{gathered} \text { Cruisers, } \\ 2,000 \text { to } 4,00 \text { tons. }\} \end{gathered}$ | 3 | 2,225 | 6.675 | 21 $\%$ |
| Totals .......... .. | 12 | $\ldots$ | 54,510 | $\ldots$ |
| $\begin{gathered} \text { Small Cruisers } \\ \text { and Gnaboats. } \end{gathered}$ | 2 | 1,205 | 23,510 | 16.0 |
| Grand totals. | 73 | . | 299,437 |  |

open barbette, and would be at the mercy of well-timed shrapnel. One pair of guns is mounted on the main deck aft, another pair on the same deck amidships, while the forward pair is carried on the forecastle deck, at a height, probably, of about 22 feet above the sea The belt is continuous and tapers from $153 / 4$ inches amidships to $113 / 4$ inches at the ends; the gun positions carry $113 / 4$ inches of armor, while the speed and coal capacity of 16 knots and 750 tons are only moderate. The power of the main battery is secured at the ex pense of the secondary rapid-fire battery, which is comparatively light. It consists of six $4 \cdot 1$-inch rapid-fire guns, mounted in broadside within the superstructure, and eight $3 \cdot 4$-inch rapid-fire guns carried on the super structure and bridges and in the bow on the main deck. The vessels of this class are the "Brandenburg," "Kurfurst Friedrich Wilhelm," "Weissenburg," and " Worth."
The other five battleships of the first class are the powerful vessels of the "Kaiser Friedrich III." clas now under construction. Three of these, the "Kaiser Friedrich III.," "Kaiser Wilhelm II." and "Ersatz König Wilhelm," are launched and well advanced toward completion, while two others have been commenced. These ships are in many respects a class entirely by themselves. possessing features which distinguish them sharply from the latest battleships of other navies. They represent the latest ideas of the German llesigners as to what are the requirements of a modern lirst-class battleship, and as such they are to be com! !ared with our "Maine," the British "Magnificent," the French "Charlemagne," the Italian " Re Umberto" or the Japanese "Fugi." The displacement, 11, 130 tons, is moderate, being about the same as that of the "Charlemagne," 1400 tons less than that of the "Maine," 1,000 tons less than that of the "Fugi," while the "Re Umberto" and "Majestic" exceed it by 2,700 and 3,700 Umberto" and "Majestic" exceed it by 2,700 and 3,700
tons respectively. Bearing in mind the moderate size of the "Kaiser Friedrich III.," it is evident that her armament is extremely powerful. The German dislike of bulky ordnance is seen in the fact that the ship does not carry a larger caliber than $9 \cdot 45$, four of this size placed in $93 / 4$-inch turrets constituting the wain battery These guns, however, are of the rapid-fire type and fire a 474-pound projectile with a mazzle energy of 17,340 foot-tons and a penetration of $231 / 2$ inches of steel. The secondary battery includes thirty rapid-fire guns; namely, eighteen $5 \cdot 9$-inch rapid-firers, each in separate turrets and casemates, and twelve $3 \cdot 3$-inch rapid-firers mounted behind shields, while this is supplemented by a score of one-pounders and machine guns.
The important problem of distribution has been well worked out, the larger guns being carried at four differ ent stages above the water. The lowest are the two $9 \cdot 4$ inch in the after turret on the main deck and the four $5 \cdot 9$-inch in casemates, two forward and two aft on the main deck. On the spar deck above are six $5 \cdot 9$-inch in turrets on the broadside and eight $5 \cdot 9$ inch in case mates, four forward and four aft. Forward in a turret on the superstructure deck and 30 feet above the water is the remaining pair of $9 \cdot 4$-inch rifles, and ten $3 \cdot 4$-inch rapid-firers are carried at the same height in broadside and astern on this deck, while another pair of $3 \cdot 4$ inch guns is mounted on the upper bridge at a height of 46 feet above the waterline. The concentration of fire is two $9 \cdot 4$-inch, eight $5 \cdot 9$-inch and six $3 \cdot 4$-inch ahead ; four $9 \cdot 4$-inch, nine $5 \cdot 9$-inch, and six $3 \cdot 4$ inch on either beam and two $9 \cdot 4$-inch, eight $5 \cdot 9$-inch and four $3 \cdot 4$-inch astern.

A glance at the plan and longitudinal section, for which, in common with the other diagrams, we are indebted to Brassey's Naval Annual, shows how difficult it would be for a successful shot to wreck more than one or two gun positions at a time. The belt armor varies fron $113 / 4$ to 6 inches; the main turrets are $93 / 4$ inches and the smaller turrets and casemates 6 inches thick. The vessels are driven by triple screws, steam being supplied by a combination of cylindrical and Thornycroft boilers. The speed is to be 18 knots. Altogether we must con fess to a strong liking for these vessels. Their tremendous rapid-fire batteries, the unusual end-on fire, the wide separation of their guns, their admirable protection, and the great height at which the guns are carried should render them exceedingly efficient ships, if wel handled.
The weak feature is the unprotected bases of the case mates and turrets. In this respect the "Brandenburg" would be at a great disadvantage in a stand-up fight with our own "Maine" or the British "Magnificent." But one cannot have everything, particularly in a battleship.
In the class of " battleships from ten to twenty years old" (see table) Germany possesses one ship, the "Olden burg," launched in 1884, of 5,200 tons, $13 \cdot 5$ knots, 13 -inch belt, and carrying eight $9 \cdot 4$-inch guns within a central redoubt of 8 -inch armor.
The class of "battleships old and refitted" includes nine ships of between 6.770 and 9,757 tons, most of which have been reconstructed and rearmed and trans formed into useful fighting ships. Our readers who follow closely the progress of naval affairs will re menuber that this is the policy which Lord Charles Beresford so strongly recommends in connection with the many old broadside battleships built some thirty years ago and armed with muzzle-loading guns, which still remain on the active list of the British navy, and we think that Germany has shown good judgment in carrying out the change on her early ships. The most notable instance of this change is the thirty-one year old "Koenig Wilhelw," of which we present an illustration. Originally she was three masted and fully rigged, while her armament consisted of heavy slow firers of an obsolete pattern. Her mizzeninast has been removed altogether, the fore and mainmasts have been cut down, the yards removed and fighting tops fitted. The old guns have been replaced by a numerous battery of twenty $5 \cdot 9$ inch and twelve $3 \cdot 4$-inch rapid fire guns, while five torpedo dischargers have been fit ted. She carries a 12 -inch irou belt and 6 inches of armor on the gun positions, while the $3 \cdot 3$-inch guns are protected by shields. In her reconstructed state she is listed as an armored cruiser; but, on account of her low speed, we have thought best to place her and the other reconstructed or rearmed vessels in the battleship class.
The "Kaiser" and "Deutschland," built in 1874, of 7,531 and 7,319 tons and 14.5 knots speed, are sister ships with complete 10 -inch belts. They each carry eight $10 \cdot 2$-inch breech-loading rifles, while the secondary battery of the "Kaiser" consists of one $5 \cdot 9$-inch, six $4 \cdot 1$-inch, and nine $3 \cdot 4$-inch rapid fire guns, and that of the "Deutschland" contains seven $5 \cdot 9$-inch and nine $3 \cdot 4$-inch rapid-fire guns, both vessels having the usual complement of machine guns.
The "Preussen" and "Friedrich der Grosse," sister ships of 6,770 tons and 14 knots speed. were built in 1873-74. They have been relieved of their top and top-gallant masts and yards and their batteries have been modernized by the addition of ten $3 \cdot 4$-inch rapidfire guns and several machine and light guns. They are protected by a complete belt of 9 -inch armor, and the main battery of four $10 \cdot 2$-ineh Krupp guns is carried in two 8 -inch turrets within a central redoubt.

The four second-class battleships of the "Sachsen" class, the "Sachsen," "Baden," "Bayern," and "Wurttemberg," were built between 1877 and 1890 They are of 7,441 tons displacement and 14 knots speed. They are protected by a short belt of $153 / 4$-inch armor, which only covers a little more than a third of the length amidships, although there is a continuous 3 inch protective deck. The belt, however, extends to the level of the main deck and, in conjunction with transverse bulkheads, forms a big rectangular redoubt. At the after end of this structure a smaller rectangular redoubt rises to the level of the superstructure deck, and at each corner of the redoubt is mounted a 10.2 inch Krupp gun. Two other guns of the same caliber are carried at the forward end of the redoubt, within a pear-shaped barbette. Eight $3 \cdot 4$-inch guns are carried upon a boat deck above the after redoubt. The ship of this class were reconstructed and refitted in 1896.

Coast Defense Vessels.-Germany has nineteen of this class all told, eleven of the early "Wespe" class 1876 to 1881 ; and eight of the "Siegfried" class, 1890 to 1895 . The "Wespe" class have already been described. Although they are of only 1,109 tons displace ment, they mount a 12 -inch gun forward in an 8 -inch barbette, two $3 \cdot 4$-inch rapid firers aft, and have a continuous belt of 8 -inch armor. They also carry two torpedo discharge tubes.

In the "Siegfried" and her cfass the German navy possesses some excellent coast defense vessels, of a de-
sign which we could wish to see substituted for our own monitors. They have a serviceable speed of 16 knots, a freeboard of 18 feet, three $9 \cdot 4$-inch guns, of which the forward pair have a command of 24 feet ; they have a secondary battery of eight $3 \cdot 4$-inch rapidfire guns and they carry four torpedo tubes. Wiile the moderate draft of 17 feet 9 inches would enable them to enter any harbors, they could at any time join in a fleet action on the high seas. All this is secured on a displacement of 3,500 tons. If three 10 -inch guns in two barbette turrets were substituted for the three $9 \cdot 4$-inch, the displacement being raised to 4,000 tons, these ships would be ideal coast defenders, and infinitely superior to the obsolete monitors which we are now engaged in constructing.
Armored Cruisers.-Germany had only one armored cruiser, the "Fuerst Bismarck," constructing at the opening of the year, though a sister ship, the "Prinz Adalbert," has since, we believe, been commenced. As will be seen from the diagram on page 250 , the armament will be made up of the same caliber of guns as that of the new battleships, and she will be almost as well protected, the deck being the same, and the vertical and turret armor only from 2 to 4 inches less in thickness. The particulars are as follows: Displacement, 10,650 tons; speed, 19 knots; normal coal supply, 1,000 tons; armament, four $9 \cdot 4$-inch rapidfire, twelve $5 \cdot 9$-inch rapid-fire, ten $3 \cdot 4$-inch rapid-fire, ten $1 \cdot 4$-inch and eight machine guns, six torpedo tubes (five subiwerged). The complement will be 565 men. The ship is remarkable for the abnormally high freeboard forward and the lofty command of the guns, and she should prove to be a most effective fighter, although her speed, in view of the fact that the latest English and French armored cruisers are to steam 23 knots, is very low.
Protected Cruisers.-The largest and fastest of the protected cruisers is the "Kaiserin Augusta," familiar to many Americans because of her presence at the Columbian Naval Review at New York. She is the longest vessel in the navy and her horse power exceeds that of any other vessel. Her trial speed was 22.5 knots, and in this respect she is likely to remain for a time the crack ship of any fleet to which she may belong. The main armament of twelve $5 \cdot 9$-inch rapidfire guns is carried in sponsons on the main deck, and the eight $3 \cdot 4$ inch rapid-firers are carried partly on the spar deck and partly on the main deck. The protective deck has a maximum thickness of 3 inches. The practice of placing all of the main battery on one deck exposes it to disablement by a raking fire, and, as we shall show, the fault has been remedied in the later cruisers of the "Hertha" class.
We also illustrate the "Gefion," launched in 1893, a slightly swaller vessel than the sister ships "Irene" and "Prinzess Wilhelm," which were launched six years earlier. The particulars of the "Gefion" are given under the cut of the vessel. The "Irene" carries four $5 \cdot 9$-inch and eight $4 \cdot 1$-inch rapid-fire guns and fourteen smaller guns. Her speed is $19 \cdot 8$ knots. This vessel is specially interesting as having figured prominently in the press dispatches from Manila during the recent Spanish war.
There are also completed or building the five effective vessels of the "Hertha" class. It will be noticed from the diagrams that, within the limits of their class, they have the same characteristics as the new armored cruisers; lofty freeboard, high command for the guns, wide distribution of the gun positions, and a complete rapid-fire armament carried in turrets and casemates. These ships compare favorably with any ships of their class in the world, and in the ratio of total gun-fire per minute to displacement they are only surpassed by some of the Armstrong boats built for South American republics. There are also constructing or built three other cruisers of 15 knots speed and over: Cruiser "G," 2,650 tons, 19.5 knots speed, and the sister ships "Greif" and "Hela," 2,000 tons and 23 and 20 knots speed respectively.
Cruisers and Small Gunboats.-The vessels of this class, twenty-two in all, call for no special notice. There are six of about 1,700 tons and 16.5 knots; four of about 1,350 tons and 16 knots; two are of 1,120 tons and 13.5 knots; one boat, the "Wacht," is of 1,250 tons and $19 \cdot 6$ knots; while the smallest gunboats are of about 900 tons, with speeds ranging from 12 to 21 knots according to the date of their launch. The vessels in this class are chiefly armed with the $4 \cdot 1$-inch and $3 \cdot 4$-inch rapidfire guns.
Of the personnel of the German navy nothing is known beyond the fact that it is possessed of the physique and distinguished by the strict discipline which marks the fighting forces of Germany whether ashore or afloat. The German navy has seen next to no fighting in the half century of its existence; but, judging from the fighting record of the army, there is every reason to expect that the German sailors will, in conflict, do justice to the excellent fighting ships of which the modern navy is composed.

The projected removal of the famous Ponte Vecchio of Florence has raised such a storm that its safets is doubtless insured for many years to come.

The head was very small, and the tentacles short. It is rarely seen and must, being a slow swimmer, fall a victim to the predatory fishes which abound in these waters. Cranchia is a most interesting form on account of its phosphorescence, gleams of light playing over its body at night, making it one of the most interesting of the light-givers of the sea.

Patent Protection in Our New Colonies.
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## SOME PACIFIC CEPHALOPODS.

The deep channel of Santa Catalina, off the island of that name, is in the mythology of local fishermen the home of a school of gigantic fish which occasionally are seen disporting at the surface. These huge forms have not as yet been observed by scientific men, but that squids of large size abound, squids twelve or mor feet in length, is well known. This was first made public by the presence of a school in the deep fjord-like harbor of Santa Catalina. There were but fifteen or twenty, but they came rushing into the quiet bay fol lowed by a large school of jewfish, the latter weighing from one hundred and fifty to three hundred and fifty pounds. The squids soon ran into shallow water where the Portuguese fishermen surrounded them with a seine. The squids ranged from ten to filteen feet in length, and the entire catch, it was estimated, weighed eight or ten thousand pounds.
As they came in in the net they pre sented an extraordinary spectacle, spout ing water and ink from their funnels their broad bodies flushing and paling changing color like chameleons, while the sucker-armed tentacles darted this way and that like so many fingers. The eyes were very large, jet black and star ing. The amount of ink that can be thrown out by these animals was wel illustrated here, as the water was black ened for yards about.

The writer recently observed the in shore rush of a school of squids on the southeast coast of the island mentioned

The animals weighed about thirty pounds each and were five or six feet in length. A school had undoubtedly been charged by some predaceous fishes, and in their efforts to escape they had been driven upon the rocks and so injured, either by contact or the attack of the fishes, that they were nearly all destroyed. The great bodies were strewn over the bottom for ove one hundred square feet. But one squid was perfect showing the two long tentacles and the eight short ones complete.
A dissection of the animal developed many of its in teresting, indeed remarkable features. The so-called pen was nearly two feet in length in some instances, a beautiful object, an almost exact imitation of a pen. The ink bag was next examined, the delicate sac hold ing one or two tablespoonfuls of thick black ink, once the sepia of commerce. This remarkable pigment is the chief protection of the squid. When closely fol lowed, the animal, by muscular effort forces the ink into the siphon from which mixed with the water, it is ejected, distributing itself in a cloud that easily confuses the follower and under cover of which the squid escapes. The force with which this ink can be ejected from the siphon can be judged from the fact that upon one occasion the writer's boatman when leaning over th water was struck full in the face at a distance of three feet by the streain. In experimenting with the octopus, it was found that when seized it immediately ejected its ink, but did not con tinue it when held. When thrown over it swam rapidly to the bottom, ejecting a stream of ink that formed a black spira train like the smoke behind mimic train of cars.
In the large squids which ran ashore an interesting feature was the fact that their food wa found to be sea weed, smal pieces of fulva ground up, nipped off by the beak. The latter was as large as that of a parrot, a remarkable organ, in color and shape calling to mind the beak of a parrot, though in the squid the lower bill pro jects above the upper.
In swimming the squids move tail first, impelled by the stream of water they force from their siphon. In this manner many dash into schools of fish with the velocity of light, the long arms seizing a fish, which is soon drawn against the parrot-like beak and the ver tebra severed. The common squid of Santa Catalina is, so far as known, an algae eater. The octopus ound here has a radial spread of fourteen feet and is powerful creature, requiring the full strength of a strong man to dislodge.
One of the most interesting of the squids found at the island is the Cranchia. In specimens observed by the writer the body was large in proportion to the head, being four inches in length and three in diame ter, and covered with minute tubercles or projections.
in a gramme of earth. Inoculated on a porpoise, they produced after two days the characteristic symptoms of tetanus attending wounds.-Technische Notizen.

## Struggles of a Book Against Taxation

In June, 1833, the late Charles Knight began the publication of the Penny Cyclopedia in numbers and monthly parts. At the time it was issued there was nothing of the kind in the English language, and the value and importance of the book was very great and we must regard Charles Knight as the father of modern cheap literature, on account of this and other business ventures. The attitude of the British government at that time toward literature certainly did not tend to the multiplication of works. The Cyclopedia was begun in 1833 and was completed in 1846, and the result to the originator was a loss of $\$ 150,000$, and this loss was practically caused by the exces-
sive taxation of the British govermment, and the story of its publication is interesting now, as showing how printed matter was discriminated against in those days. The quantity of paper required to produce a single copy, which contained 15,764 pages, was two reams, which weighed 35 pounds. At the time of its commencement an excise duty of 6 cents per pound was collected on all paper. Of the entire edition, 20,000 reams paid this duty, which amounted to about $\$ 42,000$, and the remaining 30,000 reaus paid a reduced duty of 3 cents per pound, which amounted to $\$ 32,000$, so that the total duty was not far from $\$ 75,000$. In addition, a duty was charged on the mill-


TYPE OF SQUID TAKEN IN THE PACIFIC.
respected in said territory, the same as if such laws were in full force and effect. G. D. Meiklfjohn, Acting Secretary of War
War Department, Washington, April 11, 1899.
THE extremely great tenacity of life possessed by mi cro-organisms is demonstrated by the following ex periments of the French savant M. Miquel :
He took from a public park a sample of earth, dried it for two days at a temperature of $30^{\circ} \mathrm{C}$. and powdered it. The earth thus obtained he filled into ster ilized glass vessels, which were sealed and kept in a place not reached by the light. The freshly dug out soil contained $6,500,000$ bacteria per gramme which were reduced to $3,900.000$ by the pulverizing and drying After sixteen years the glass tubes were opened and there were still found to be $3,580,000$ micro-organisms

States Patent Office under the laws of the United States relating to the grant of patents and to the regis tration of trade inarks, prints, and labels, shall receive the protection accorded them in the United States under said laws; and an infringement of the rights secured by lawful issue of a patent or ky registration of a trade mark, print, or label, shall subject the per son or party guilty of such infringement to the liabili ties created and imposed by the laws of the United States relating to said matters
Provided, That a duly certified copy of the patent or of the certificate of registration of the trade mark, print, or label, shall be filed in the office of the Gov ernor-General of the island wherein such protection is desired: and,

Provided further, That the rights of property in patents and trade marks secured in the islands of Cuba, Porto Rico, the Philippines, and other ceded territory, to persons under the Spanish laws, shall be the same amount.

pen of squid nearly two feet long boards employed in binding the volumes and on the wrappers for the monthly parts, so that with interest and various losses caused by stocks on hand at the time the paper duty was reduced, the total amount of duty paid on the work was between $\$ 150,000$ and $\$ 160,000$, and the loss to the publisher was just about

## The Building Edition for April.

The Scientific American Building Edition for April is filled with interesting matter. A model cottage at Homewood, Long Island, is selected for the colored cover. The other illustrations show houses in various parts of the country and are fine examples of what architects are doing to-day for suburban residences. The "Castle of Vincigliata," near Florence, is illustrated and described. This castle has been most carefully restored to its pristine state and is one of the most rewarkable fortresses of the feudal lord in exist ence. There are also several pages of most interesting reading matter.

The Current Supplement
The current Supplement, No. 1216, contains very important articles, notably "Acoma and the Enchanted Mesa," a most interesting article by Mr. G. Wharton James, illustrated by original photographs. "Trade Sug. gestions from United States Consuls" are twelve in number. The "Index to Consular Reports," a new feature, is also in evidence. "The Samoan Islands" are very much in the public eye at the present time, and the article on the subject is illustrated by eight engravings. "Porto Rico, the Land and the People," by Dr. William Hayes Ward, is also a most interesting and timely article. "Arithmetic Among the Ancient Egyptians," "Liquid Fuel," and "The Logical Arrangement of the Motive Power of Battleships," by Engineer-inChief George W. Melville, U. S. N., are important articles on the various subjects. The usual notes and selected formulæ are also given


RECENTLY PATENTED INVENTIONS. Agricultural Implements. MOWELR-GUARD.-Josn C. Provt, Jr., Ogden,
Utah. This invention provides a cap for mower.guards which can be used to restore a broken guard to its original shape, and which is so constructed that it can be sprung upon the guard and carried thereby without interfering with the action of the cutter-bar. The cap con sists eseentially of a body-portion conforming with the shape of the guard-finger, and a table projectivg rear-
wardly from the body - portion. which is adappted to fill the position of a broken guard-section.

Mechanteal Devices.
knitting-Machine. - George W. Ruth, Norristown, Penn. The inventor bas devised a striping and
splicing attachment for circular-ribed-knitting machines, whereby an extra thicknees of fabric is secured at any desired point, as, for example, half way around the knee of a stocking or around the heel. The attachment provided for this purpose breaks the splicing--yarn at the proper time, the break occurring near the hole
through which the main yarn is fed, so that the end of through wiich the main yarra in fee, so thal
the splicing-yarn may be readiiy taken up.

Rallway-Appllances.
valve for air-brake systems.-Wiliam Palmer, JR., Rincon. Territory of New Mexico. It is
the purpose of this invention to provide means whereby the auxiliary reservoir can be recharged without the release of the brakes when descending heavy grades, with the chamber of an air-holder, which automaticall closes by reduction of pressure in the train-pipe, and whice opens only when th. presure is restored to the
same degree as in the chamber. By placing the engisame degree as in the chamber. By placing the engi-
neer's brake-valve in release position and admitting ine neer's brake-valve in release position and admitting the
excess preesure to the train-pipe, the air-holder chamber excess presire to the train-pipe, the air-holder chamber
will be chareed to a higher preseure than that normally carried in the train-pipe when the brake-valve is in running position; and the auxiliary reservoir can be reciarged without releasing the brakes, merely by placin tie brake-valve in running position.

Miscellaneous Invention STOCK-RACK FOR PLATFORM-SCALES.-SAM-
Re J. RIck, Scotch Grove, Iowa, The platform URL J. RIIE, Scotch Grove, Iowa. The plattorm-
scales are provided with a stock-rack, the sides of whic scales are provided with a stock-rack, the sides of which
are adapted to be connected by a cross-bar hinged to one side and hooked to the other. On the sides of the rack, end gates are hung adapted to swing inwardly and fold on the corresponding side. Eac as to permit the sides to be swung outwardly when especially large load are to be weighed.
CARbON-bRUSH HOLDER.-Renwick E. CrockRrT, Michigan City, Ind. The object of the invention
is to construct the carbon-brush holder so that the brush is to construct the carbon-brush holder so that the brush
can be entirely removed for inspection or raised from the surface of the commutator without altering the tension apon the brush. Within the body of the holder, a brusk with the brush-casing and acts in the direction in which the casing is adapted to slide. The tension device is mounted to hold the brush-casing elerated or away
from the surface adapud for engagement with the brusb
Folding support or holder for artists' TABLETS. - Wriliam C. surmoneck, Washingtun, D. C. This device is adapted for uee in the field or where
a table or desk is not available. The body of the tahlettalde or desk is in ot available. The body of the tahiet-
holder composed of leather, canvas, or other pliable material, held stretched by means of a collapsible frame formed of light metal bars which are detachable from
one another in such $a$ manner that the body of the tablet ay be left free to be folled or rolled into compact form 87 that, together with the detachable frame-por ion,
It may be packed in a case for convenience of handling It may be packed in a
or of trangportation.
elevator-dredge.-Wiliam s. Russell, Toledo, Ohio. This invention is concerned chiefly with the
upper tumbler and chaia of buckets used to reise the apper tumbler and chaia of buckets used to raise the hopper. The tumbler has flat polygonal faces, with flat
projecting block on the faces and curved seats at the projecting blocks on the facese , and curverd seats at the
anjles between the faces. Detachable wearing-plates are angles between the faces. Detachable wearing-plates are provided, having fat facess fitting the flat faces of the
tumbler-blocks, and curved overlappiug ends fitting into tumbler-blocks, and curved overlappiug ends iftring into
and locking against the curved seats of the tumbler, and adapted to receive the recesses and hubs of the buckets and links
thill-coupling.-Edward F. Colvin, Milton, Penn. Secured to the thill-iron is a pivot-bolt having polyggonal head. A clip having jaws provded with
internal sockets is adapted to receive the ends of the bolt. One of theee sockets has a rearward extension 0 receive thebolt-head aud preventaccidental dettachment thereof. A spring is arranged in the rear cf the sockets.
$\mathbf{A}$ cam or curved projection on the thill-iron head works in contact with thespring wh:n the thill-iron is elevated and is free from or out of contact therewith when the thill-iron is lowered.
focusing attachment for cameras.this invention to provide means whereby the devices used in focusing on the ground glask of a camera are rendered more compact. The inventor secures this com-.
pact arrangement by furnishing a lens in the sightopening of the hood, trough which the inage is viewed
by the photographer. This is advantageous because it pormits the eye to be brought closer to the object, so enables a hood of less length to be used than would otherwise be possible.
SIPHON-FILTER- - JosEPR G. SrTTON, Seneca, porous material, prefeereably a a naturaral stone, known as " Missori tripoli." This hlock has intersecting pas--
sazae-ways bored therein, the outer ends of the passage. saze-ways bored therein, the outer ends of the passage.
ways being closed by a plug of cement, and the dischargeways being closed by a plug of cement, and the discharge-
ende being all in communication with a specially-conendd being all in icommunication with a specially-con-
stracted oatlet-tube tigntly cemented into the block.
. stracted outlet-tube tighty cemented int the
When imersed the block becomes saturted with water
by capillary absorption until the central chambers are
filled. The siphon out
giltation therethrough.
SCraper.-Charles M. mcmoluen, Rock Glen v. Y. Po poviea scraper for use on the healing-pipe the present invention. The scraper comprises a mov able carriage which supports standards having elong te external surface of the pipes; and rods are con nected with the saddles and loosely engage the elongated
lots in the standards, whereby when the carrige slots in the standards, whereby, when the carriage is
moved, the scraper-saddes are tipped to bring the forward edgee of the saddles into contact with the externa ward eages of the esad
surface of the pipes.
conduit-threader. - Fredrick a. Pooler Los Angeles, Cal. This inventor has devised improved
means for ror drawing wire eross, cables, and the libe through
a neans for drawing wire rods, cables, and the live throug
a conduit. The invention embodies a novel form of enting back movement, and a pair of operatinp cord dapted, when alternately drawn backward, ifrst to caue the crawler-block to travel toward the head of the thread er-rod and then to pull the crawler-block into gripping engagement with the conduit wall, and at the same tim to shoot the threeder-rod forward, such movement being
continued tepe by tep until the head of the rod projectes eevond the forward end of the conduit-section with which access may be had.
Thill.coupling.-Jonn C. Bowers, Brooklyn New York city. An arle-clip having a bearing is includ couve construction of this coupling, which clip holds ling.pin, and from the ends of the coupling-pin links ar tung. A epring is held by the clip and is capable of en
gaging the eye of the thill-iron to hold it in place.
 presses the epring to hold it in engagement with the ey
of the thill-iron. While the device is in wse the coup ing-pin or bolt is securely locked in position, but can be readily locked or unlocked for removal when chang ing from a shaft to a pole.
SUSPENDER-END.-WHLLLM BLoombrag, Man-
hatan, New York city. The suspender-end is composed hattan, New York city. The euspender-end is composed
of buttonhole-tabs connected by a neck. Two clasp. supporting straps are formed integrally with the tabs and teck. Atrape, the two clasp-eupporting straps extendis rom the main part at points at each side of the center of the neck and at an angle thereto. The suspender-end simple, strong, and durable in construction.
Waistband For trousers... Max Wald Manhattan, New York city. This waistband for boys'
knee-breeches is formed of a single blank of cloth, folded to forma a lining, the lower end of which continues an upwardly-estending folded member, terminating in oownwardy-extending member, both members forming
a fold for connecting the lower edge of the lining with the lower edge of the button-fap extending in front of ome of the baton he button-fap, the elastic pieces take up the strain.
FIL'CER.-EDGAR LL STREAM, New Orleans, La. The
fiter comprises a tank, a tubular shaft mounted in the ank, and disks on the shaft. A face or periphery of perforated material is provided for the disks, and an
endeess apron of filter material has ite edges engaging he disks. A rotary brush engages the apron within the liquid in the tank will rise to the level of the brash ; the iquid will filter through the apron and run ont throue the tubular shaft. The brush will clean the apron of
seciment before it pases into the liquid to be filtered. TORCH-BURNER.-Wuriam A. Nicholas and Go Ave Burrharit, Chicago, Ill. The torch-burner Chese inventors is of the type used for brazing bicycle
ramee, and is desimned to be used to jewelerg and ele rrames, and is designed to be used by jewelers and elec
tricians as well as bicycle-manufacturers. In a casing open at both ends, an open-ended perforated nozzle centrally situated. A perforated flange ngidly supsor and ceuters the nozzle. A tubular interrupter or spreader is arranged in front of and in alinement with the nozzle and serves to break up the two divided currents
which emerge from the perforations of the nozzle and which emerge from
from the nozzele itself
Door-CHECK. - Jonn Spiris, Jersey City, N. J The invention seeks to provide a lock for a a dor, so con-
structed that the door may be held partially open for the purpose of ventilation or for the purpose of enabling on
to see a person who is demanding entrance. The lock is operated entirely from within, and when set merely to to
provide ventilation, it will not be poosible to force the door sufficiently to effect an entrance, or to tamper witt the lock from the outide
acetylene gas generator.-Jambs W. Kin IRY, Beloit, Kans. This apparatus comprises a generaLor, a cooling. chamber, and a gasometer. The gas form-
ed in the generator passes into the coolin $\eta$-chamber, and then into the gasometer. A water supply nipe connect the cooling-chamber witi the generator, and is provided with a valve controlled by the rise and fall of the gas
ometer, so as to regulate the supply of gas automatically,

## Designs.

Game-board.-Paut R. G. SJögrriön, Weetteld,
N. J. The leading feature of this design consists of a base, upon which is a rectangle formed in double lines terminating in disks at the corners, and also having disks
intermediate of the corners Within the rectongle intermediate of the corners. within the rectangle men-
tioned, other rectangles are variously disposed in tioned, other rectangles are variously disposed, in the
lines of which, disks are arranged.
Outeide of the rect angles are other figures also terminating in disks. The came cunstitutes a
means of checkers.
trace-carrier.-Frank g. Engbrrg, Kindred N. D. The carrier cinsitts of an elongated loop havin 2 at one end a neck whic
of form double hooks.
Pipe-coupling. - Jere J. hanraban, Brooklyn New York city. The coupling-section is screw-threaded cylindrical portion is secured, which is provided with projecting perforated ear. The coupling is more compact than that ordinarily employed and consequently

MONUMENT.-EDwis O. Townsend, Manhatan,
New York city. The monument provided by this de New York city. The monument provided by this de polished block of stone ornamented by moldings an carvinge.
CARPET,-Evaentr A. Crowe. Brooklyn, New Yor cits. Upon the carpet there is represented $a$ sbield en
lazoned with an ax and a mallet, the handles of whic re crossed. Foliate sprays, a horn of plenty, a pair scales, and a vase complete the desigo.
Notr.-Copies of any of these patents will be furnbhed by Munn \& Co. for ten centseach. Please sen the name of the patentee, title of the invention, and date

## NEW BOOKS, ETC

how to Gain admission to annapo LIS, WEST POINT, OR THE SCHOOL-
SHIP ST. MARY'S. New York: S. A. Nelson, 16 Park Place. 1898. Price
50 and 75 cents.
We have often been asked questions as to how ad mission may be gained to the army and navy or to the
professional schools which turn out oflicers for the two services. The little volume before un is adapted to give precieely information of this clase, and, so far as we know, the feld which it covers is a new one. Of course,
candidate for admission to either school can obtain in canairate for admission to either school can obtain in-
ormation by addressing the War and Navy Depart. ments, but there are many things which a candiata would like to know in relation to them which cannot be readily obtained, and this volume is intended to give ex
ctly this information. There is also $a$ list of the lead m military schols and colleges in the United Staes. Text-Boor of Physics. Sound. By
J. H. Poynting and J. J. Thomson. J. H. Poynting and J. J. Thomson.
London: Charles Grifin \& Company Philadelphia: J. B. Lippincott Conl
pany. 1899. 8vo. Pp. 163. 85 fig pany. Price $\$ 3$.
The present volume deals entirely with sound. T text-book is intended chiefly for the use of the studen who lay most stress on the study of the experiment part of physics and who have not reached the stage which the reading of advanced treatises on various suy.
ject is desirable. It will serve admirably as an intrin duction to Helmboltz's great work entitled " The Sen tion of Tone," which deals chiefly with the physiolo al aspect of sound, and to Lord Rayleghs Sound," at once the most systematic, original, and complete work on the subject. The present volume is non doubtedly be mastered even by those who have little mathematical training. The authors are both well heir pens is sure to be of value.
English Cathedrals. By Francis Bond. London: George Newnes, pincott Coupa
314. Price $\$ 2$.
There are already a number of excellent books upo cathedrals, including Mrs. Van Renselaer's and Bell's
Cathedral series, to say nothing oe the There are also several volumes which bear the name great church dignituries, which might just as well no
have been written, as they are confused and aboun with errore and solecisms. The present volume is of an entirely different nature, and will be warmly welcomed by the student or cathedrais, notwithstanding the fact
that the literature on the subject is already large volnme takes up the architectural aspect particularly by what might be termed the "biographical" method, and this is what is so much needed by so many studenta. The text is most valuable. It is clear and scholarly, and the illustrations, whine reprodaced on a very small scale stiI serve to if taken with the tourist int the cathed towns. The author will not spare the visitor's legs, but no one can see a cathedral without considerable march ing and countermarching.
The Shipping World Year Book. A and Navigation. Edited by Evan Rowland Jones. London: Shipping
Worid Office. 1899. 16mo. PF. 1140 . Price \$2.
The annual year book published by The Shipping World is one of great importance to all who are in any way interested either in ocean transportation or in dispatching goods of any kind. It is filled with valuable
information such as the tariff of all countries a port information, ucuch as the tarifif of all countries, a port
directory giving particulare of all Britien and foreigu ports, the rates for pilotage and towafe, the dimension of harbors, dry docks, etc. There are also many tables of dietances, etc., which are very important for seamen.
There is no question that this little book is at the head

Commerital management of english Works. By Francis G. Burton. Man chester, England: The Mechanical
Engineer. 1899. Pp. 310. 8ro. ${ }^{\text {Enginee }}$ Price $\$ 5$.
The volume before us goes into the organization commercial establishments, such as engineering works.
It deffnes the duties of the various hew they should be performed in an economicical manner Various methods of keeping books, stock, drawings, etc. are also entered into. There is little question that many large concerns could adopt the methods advocated by
Mr. Burton with pood results of course, the present Mr. Burton with good results. Of course, the present
volume is specially intended for use in Great Britain, but at the same time the methods given would prove of valis
How to Prepare for a Civil Service Examination. With Recent Ques-
tions and Answers. By Francis E.

The government of the United States is a good em-
means for entering into professional life or into inde-
pendent money-making adventures. Civil Service has
been used by many young men and wien been nsed by many young men and women as a path th
larger fleld of effort in private life. To those who wish to fit themselves for civil service examination ing these problems that the present volume has bee prepared. The examinations are eminently of a pract cal character, and much time and energy may be saved by a perusal of the book before us, as any candidate nay learn from 14 just what is necessary and whatho ecessary in brusuing up his studies. Adice ls given the chances of making one's way into the cen value to every candidat
Chemical and Mbtallurgical Hand BOOK FOR THE USE OF CHEMISTS NEFRS. Second Edition. By J. H Cremer and G. A. Bicknell. Cleve
land, O.: Published by the Author Pucket book form, leather, gilt. Pp 337. Price \$3

Chemical literature is probably the most extensive of any science, with the exception of possibly electricity
yet the number of practical works is astonishingly small, nd for this reason we welcome works like the presen which give chemists and those in need of chemical inormation exactly what is needed without going in theory. After atomic weights the reactions of metallic salts are given in a particularly concise form; then com tables showing the molecular weight, specific gravit, melting point, boiling point, and solubility of the princ istry, percentages of alcohol, specific gravity of sulphuric itric and hydrochloric acids. Then follow methods f This is useful to the metallurgis.
SALVA-W EBSTER. An English-Spanish and Spanish-English Dictionary by F. M. de Rivas. Chicago: Laird \&
Lee. 1899. Pp. 382.24 mo. Double
Index. Price 40 and 75 cents and $\$ 1$. A small Spanish dictionary handy for the desk was never more acceptable than at the present time, now The dictionary itself is a model one for its size, and it is one of the modern wonders of book-making that donble-indexed dictionary, of this size, substantially bound, can $b_{2}$ sold for such a small sum. It is admira-
bly adapted for the use of those who occasionally receive Spy adapted for the use of th

With Sampson Through the War. By Chapters by Rear-Adrniral Sampson,
U. S. N., Captain R. D. Evans, U.
S. N., Commodore C. C. Todd, U.
S. New York: Doubleday \&
McClure Company. 1899. Pp. 307 . McClure Company. 18.
The volume before us is an important contribution to the literature of the Spanish-American war, a literature which isalready appalling in size. The book is an account during the Spanish-American war of 1898, and was writtcn by a correspondent of the Associated Press. The book may fairly be said to be the authoritative work of the North Atlantic sqnadron during the Spanish-American
war, and it contains a true history of the famous Santiago points. It is ad mirably written aud is well calculated to give an excellent idea of the causes which led up to war and the war itself.
Rofntaen Rays. Memoirs. By Roentgen, G. G. Stokes and J.
Theomson. Translated and edited by
George Harker. New York: Har per Brothers. $1899 . \quad$ Pp. 76. 12 mo . The volume before us is one of the series which
the publishers are issuing, entitled H:rpers' Scientific the publishers are issining, entitled H:arpers' Scientific Memoirs. We have already reviewed two previous
volumes which presented classic papers; we now come to equally important papers which are of comparativels recent date. The original communication of Prof. Roentgen will probably always be one of the great classics of physics, and it is gratifying to have the papers admirably translated by a physicist of repute and published in a worthy form. In addition there is Sir G. G. Stokes' On the Nature of Roentgen Rays" and Prof. J. J Chomson's "A Theory of
Cathode and Roentgen Rays."
Michael Faraday: His Life and
Work. By Silvanus P Tho Work. By Silvanus P. Thompson
D.Sc., F.R.S. New York:
Macuillan Company.
Pper Macuillan Company.
308. 12mo. Price $\$ 1.25$.
The Faraday literature is much larger than might be supposed. It is seldom that a man of science is honored by such biographies as have been penned by Dr. Bence
Jones, Prof. Tyndall, Prof. Clerk Maxwell aud Dr. Gladstone. Faraday is, however, worth it all, and when the final summing up of the scientific history of the cen-
tury shall be made, Michael Faraday will be in the front rank among the little band of men whose pre-eminent achievements extended the boundaries of knowledge. Faraday is the beau ideal of the man of science, and for forty years his was the living and inspiring voice at the Royal Institution, and while there his researches in physics laid the foundations of electrical engineering. So much for the man and his relation to his time. At the present day probably no one is better qualifed to take
up the rather difficult task than Prof. Thompson, himself a brilliant physicist, and he has acquitted himself admira bly; in fact, hislucid style is well adapted to portray the great discoverer and reveal him in his true light. We cannot undertake to give even a synopsis of the chapters, but recommend any one interested either in science electricity, or even biography itself to purchase this book, whose cost is not forbidding. The excellent frontispiec
portrait is marked with the initials $\boldsymbol{s}$. P. T. If portrait is marked with the initials S. P. T. If Prof
Thompson really drew the portrait, he deserves additiona Thankg.

The Modern Theory of Solution．A Arrhenius and Raoul．Translated
and edited by H．Cons，Ph．D． New York：Harper Brothers．Ph． 1899
Pp． Pp． 133 12010．
The book before us will prove of great value to all
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In 1855．Prof．Porro，of Milan，made the first attemp at applying the camera to geodesy，and thus founded the
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（7642）J．A．K．asks for a formula for making blue prints of maps，etc．I used red prussia vater． 4 oz．；mixed them separately，and then poured to gether，but the white was of a yellowish cast instead of
white．A．We think the proportion of chemicals is to mall．Try using the following ：Iron and ammoniu ion separately and then mix another solution compose of potassium ferrocyanide and water， 4 oz ．For use miz qual quantities and float the paper for two minutes．
（7643）H．A．S．asks：1．Will an electric current meter which is made for 104 volts register th
roper amount if used when the voltage is 115 a A．A cur ent meter is not made for the voltage，but for the am peres which pass through it．It will register more cur 15 volt current，since made for 104 volts are put upon is because the flament becmes hotter and fiow．This is made lower．2．Please inform me also how to remove grease or oil from an old belt so the cement will hold in splicing．A．Soak the ends of the belt in benzine and the oil will be dissolved．
（7644）R．C．asks：Can liquid oxygen kept securely in any suitable receiving vessel？Is it with a boiling point below thodity？A．Any subecance It will boil remain in the liquid form in the open air reason woil and pass into the form of vapor．This is the in the liquid form．It boils at a zero．It absorbs heat rapidly from the air becouse of the reat difference between it and ordinary air in tempera cure，and boils away very rapidly．If held in a recepta－ cle till it had reached the temperature of the air，the inch．This be 10,000 to 2.000 pounds per square confine it it the same as saying that it is impossible
（7645）H．G．W．writes：W it for polishing？I refer to old brass which is to be re－ anished．Also is there any way to restore the finish of A．Try removing the lacquer with alcohol；after this is done，you can proceed to clean the brass．There are many substances and mistures which will clean brass， as oxalic acid，hydrochloric acid，and there are other acids which will do it，but probably oxalic acid is the best．The acid must be well washed off and the brass sonous．You will find it almost that oxalic acia is poi－ color to hard rubber．We recommend yon to try polish ing it with very fine putty powder and water and finish with a piece of silk．
（7646）C．M．writes：A friend of mine was a lightning rod on his house fastened close to the wall（fame house）by sirips 2 feet in the ground，having no plate on its end，and often read in books that all the water and gas pipes
must be connected to the rod．Please let me know if
this is right or not．Can I test the lightning rod with agneto machine，and how can I do it？Can you refe must be erected！A．Putting a lightning rod on a hous a very simple matter．Fasten it as firmls to the house possible．An air gap is of no consequence．Do na ssulate the rod from the house．Connect the wate he rod in a moist place with an ample iron plate．Carrs he rod above the house at least 4 feet，at all gables and chimneys．Tip each upper end with several points．Ir ods are as good as or better than copper．To test the oints with a magueto．briug wires from the top and the bottom of the rod to the magneto and see if the bell ring well through the rod as a part of the circuit．To test the on one wire．Run another wire from the other side of he magneto to a ground near the ground plate of the rod．The best article that has appeared in many yea pon lightning rods is by Mr．McAdie，of the United States Weather Bureau，in Supplement，No．998，pric 10 cents．The subject is well treated in Thompson Elementary Lessons in Electricity，＂price $\$ 1.40$ b mail．
（7647）A．J．A．writes：Some time ago保 gave a formula forcleaning and polishing rea shell．保 A．1．Porcelano shells are sohard sa to require the ap－ paratus of a lapidary to cut or polieh them，but they ase nerally so smooth as to require no rough crinding． hey may be polished by using a felt wheel and applyin ety power．Nacreous shells or those of the pearl culty m．iy be filed and cut without a great deal of difl－ r 1 be hed are frot roughly shaped stone，putting on the final polish with rottenstone．Ir－ goglarly shaped pieces are filed and ground，the smoothed with pumice stone and water，and finished
with rottenstone．The rottenstone is sometimes mixed with sulphuric acid full strength，or slightly diluted，to
heighten the polish．2．Rough sheils are polished b frst grinding them on a coarse stone，then smoothing hem with pumice stone and water on a buffer wheel o （7648）F．E．L．asks：Does the chain o bicycle travel faster or slower according to the size o
 ame proportion to the speed that it travels？$A$ ．Th chain on the larger sprockets travels the fastest for given gear and has the lightest work

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