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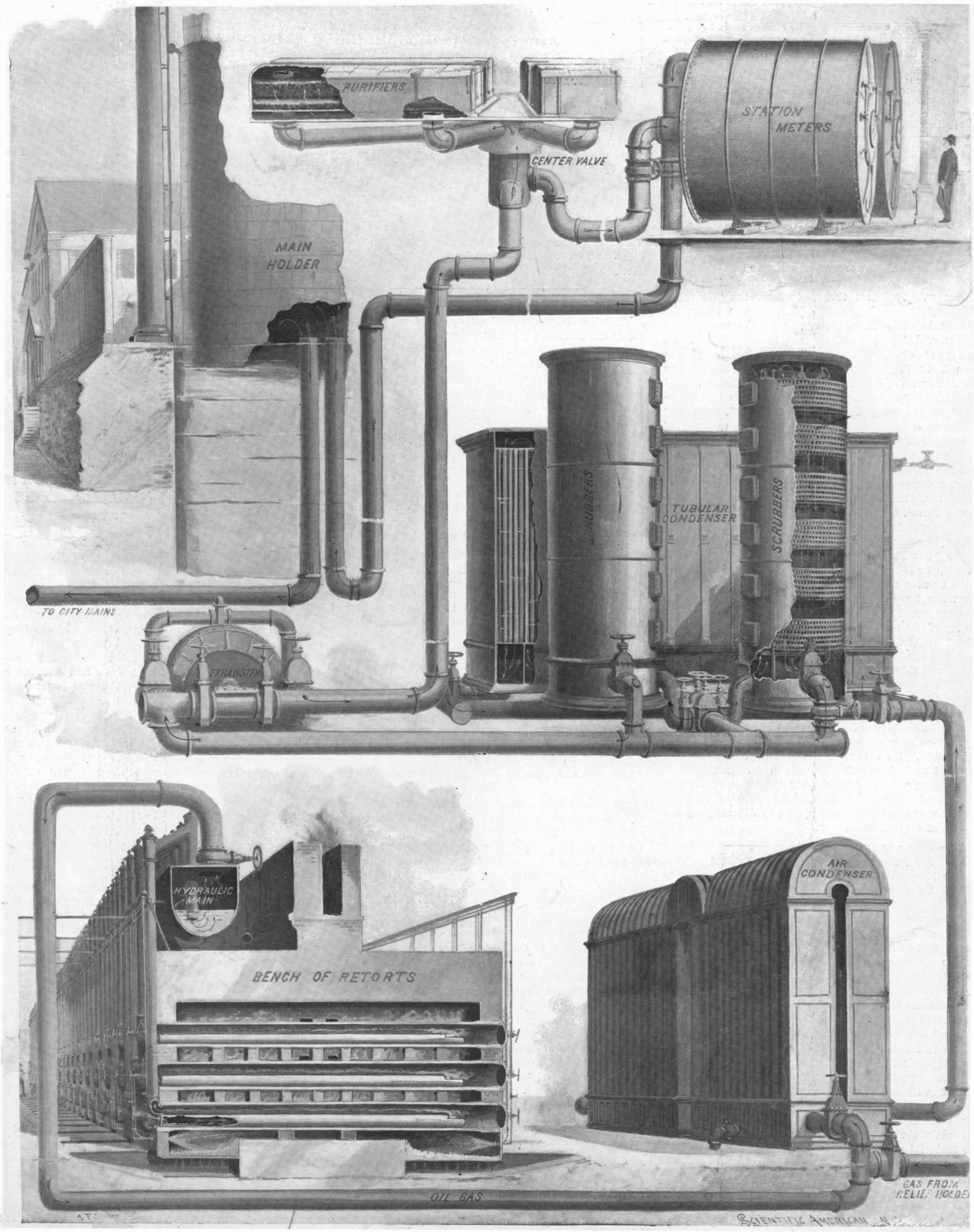

THE MANUFACTURE OF WATER GAS.—II.—[See page 102.]

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NEW YORK, SATURDAY, FEBRUARY 16, 1901.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

SUPERPOSED TURRETS FOR OUR LATEST BATTLESHIPS.

It might seem to any outsider who closely followed the action from time to time of the Naval Board on Construction in the matter of the designs for our latest battleships, that it was very far from knowing its own mind; so frequently has it decided on certain plans only to modify them in favor of others totally different. We refer now to the seven latest battleships whose construction has been authorized by Congress. The first three of these, the "Georgia," "Pennsylvania" and "New Jersey," were at first designed to carry their battery of 8-inch guns on the quadrilateral plan which is seen in the ships of the "Oregon" class. Shortly after this action of the Board, Congress sanctioned the construction of two battleships, the "Virginia" and "Rhode Island," and the Board, having in mind the satisfactory performance of the superposed turrets in the "Kearsarge," endeavored to secure unanimity of action in favor of using the superposed turret on these two vessels, and also on the three ships of the "Georgia" class. After a long discussion, in which neither side would give way, a compromise was effected by which it was decided that the "Georgia" class should carry the superposed turret, and that the "Virginia" and "Rhode Island" should be constructed with their 8-inch batteries arranged on the "Oregon" plan. Meanwhile the "Kentucky," another superposed turret battleship, had been tested, and the results so strongly confirmed the high opinion of this type of construction in the navy, that the Naval Board on Construction has thrashed out the question once more, with the result that a majority of the members are in favor of making the two ships authorized this year, and also the "Virginia" and "Rhode Island," conform to the general plan of the three ships of the "Georgia" class.

"'Tis a consummation devoutly to be wished;" for if this be done, the United States, in a few years' time, will possess a perfectly homogeneous fleet of seven battleships of the largest displacement and carrying the most powerful batteries of any ships in the world. No other navy would possess a fleet of seven identical vessels that would compare with it in fighting power. Judged from the point of view of the naval tactician, it is scarcely possible to overestimate the value of such a fleet in determining the issues of a great naval war.

AN ALUMINIUM TRANSMISSION LINE.

The Niagara Falls Power Company has about completed its second power transmission line between Niagara Falls and Buffalo. The new line parallels the old line as far as Tonawanda, where it diverges and runs over a new right-of-way to Buffalo. It possesses special interest because of the fact that the new cables are made of aluminium. The three-phase current is transmitted by three cables, each composed of thirty-seven strands. The old line consists of six copper cables, each of which has nineteen strands. One advantage gained in the use of aluminium is that the cables being so much lighter, the span between poles, which in the old line is about 75 feet, averages 112½ feet in the new line. On the completion of the aluminium line, the voltage of the current that is transmitted will be raised from 11,000 to 22,000 volts. When the line was first built, the electrical plant was designed with a view to this doubling of the voltage whenever the time was ripe to carry it out and hence no material changes will be necessary.

A POINT IN BOILER CONSTRUCTION.

A recent issue of our contemporary, The Locomotive, contains some practical advice as to the fitting of the tubes of water-tube boilers. After explaining the nature of the forces tending to draw the tubes from the drum, tube-plate, etc., the writer states that he has found in his experiments that tubes set in plates thinner than those customarily used in water-tube boilers, and merely expanded without being flared or beaded, do not begin to draw out until the pull is from 5,000 to 7,000 pounds. After making allowances for the greater thickness of the usual headers or tube-sheets of water-tube boilers, Mr. Allen concludes that the factor of safety, so far as the pulling out of the expanded tube is concerned, is from 5 to 7. This is assuming that there is no stress thrown on the tube beyond that which is due to the direct pressure of the steam. While this all-important condition is probably very nearly fulfilled in the case of long tubes, it is not usually fulfilled for the nipples which are frequently used for connecting the different parts of the boiler. Moreover, we can reckon on this factor of 5 to 7 only when the material and workmanship are of the best. The tubes must be of proper thickness and the rolling must be carefully and well done.

Another important condition is that the design and construction must be such that the stresses are properly distributed among the tubes that enter any particular sheet or drum, each tube carrying its own proper share of the load. Unequal distribution of load will occur when the tubes are expanded into a flat, unstayed sheet, which forms one side of a box or drum. In this case the pressure tends to bulge the tube sheet, with the result that there is an extra stress upon the outside tubes tending to draw them. This should be guarded against by arranging a sufficient number of staybolts to keep the tube-plate perfectly flat.

VIBRATION FROM UNDERGROUND TRAINS.

The new underground railway in London has already embarked on a sea of litigation, which promises to be very tempestuous. Householders whose property is located above the route of the tunnel are complaining of the excessive vibration which is set up by passing trains. Judging from dispatches from the other side, the trouble is a serious one for the railway company, as the rights of property holders are very securely guarded by English law The matter has raised a fear in some quarters that the same trouble will be experienced with our own Rapid Transit Subway, although we think the fears are probably unfounded. The vibration from the London trains is due to the extreme weight of the electric locomotives which are used to haul the trains. These weigh something over forty tons each, and the great concentration of load on the drivers might easily produce excessive vibration, especially if the rail joints are poorly designed or constructed. The trains of the New York Subway will probably be operated by motors carried on the axles of the two end cars, as in the new electrical train of the Manhattan Elevated Railways, or else each car will carry its own motors and form an independent unit. In either case there will be no such great concentration of weight as occurs in the London Central Railway. At the same time, it will be well for the engineers of the subway to give special attention to this question of vibration, and make some full-sized tests to determine what system of roadbed will provide the smoothest and most silent track.

THE ANNUAL REPORT OF THE COMMISSIONER OF PATENTS.

A perusal of the Annual Report of the Commissioner of Patents shows that the affairs of the Patent Office are in a thoroughly satisfactory condition, and that its business is steadily increasing, the total number of patents and reissues being the greatest in the history of this institution. In the year 1900 there were received 39,673 applications for patents, 2,225 applications for designs, 82 applications for reissues, 2,099 for registration of trade-marks, 943 for labels and 127 for prints. Including designs, there were 26,418 patents granted, 81 patents were reissued, 1,721 trade-marks registered, besides 727 labels and 93 prints. The total expenditure for the year was $1,260,019.62; the receipts exceeded the expenditure by $90,808.91. The total balance to the credit of the Patent Office in the Treasury on the first day of this year was $5,177,458.55. The number of patents issued in proportion to the number of citizens was greatest in the case of the District of Columbia, in which one patent was issued to every 1,110 inhabitants. Then followed Connecticut, Massachusetts, Rhode Island, New Jersey and New York, the ratio in the last-named State being 1 to every 1,918. The State to which the least number of patents was granted in proportion to its inhabitants is South Carolina, in which only one out of every 28,517 inhabitants received a patent. With regard to foreign patentees the greatest number of patents was granted to Great Britain, which received 1,088; then came Germany with 1,070, Canada 367, France 341 Austria-Hungary 117 and Switzerland 79, the total number of foreign patents granted being 3,483. The first patent to be granted by the United States Patent Office under the present series number of letters bore date July 28, 1836, and in that year a total of 109 patents was issued. In 1840 the number of patents and reissues was 473; in 1850, 993; in 1860, 4,819; in 1870, 13,321; in 1880, 13,947; and in 1890, 26,292. There was a decline in the number of issues during the decade until it fell to 20,867 in 1894. From that time on there was an increase in the total number until it reached the figure, in 1900, of 26,499. The largest surplus of any year was in 1883, when it amounted to $471,005. The smallest surplus since 1861 occurred in 1898, when it amounted to only $1,538. In 1899 it was $113,673, and in 1900 it was $90,808. It is interesting to know that the total number of patents issued by foreign countries up to the close of the nineteenth century was 1,328,309, while the total number of patents issued during the same period by the United States was 674,944, making a grand total of 2,003,253 patents issued in the whole world.

We are glad to learn from the report before us that the examining work of the office has been kept well in hand in the year 1900. On December 31, 1900, 4,982 applications were awaiting action, as compared with 5,392 on December 26 of the previous year. Again on December 26, 1899, thirty-three divisions were examining applications filed within one month, and three divisions those filed within two months; while on December 31, 1900, thirty-five divisions were examining applications filed within one month and one division those filed within five weeks. At both dates substantially all of the divisions were taking up amended cases for action within fifteen days after the amendments were filed. Although during the past six months some of the space in the Patent Office building vacated by the General Land Office has come into the possession of the clerical staff, sufficient room for the necessary work of the office is not yet available. We heartily agree with the statement of the Commissioner that the only solution of the problem lies in the construction of a fireproof building, the whole of it to be used for the accommodation of the Patent Office.

The latter half of the report contains an exhaustive and valuable account of the American Patent Office as such. It reviews the historical and economical phases of the extraordinary growth of the American system. This portion of the report, which is too long to be reproduced in these columns, will be found in full in the current issue of the SUPPLEMENT.

ENGLAND'S LONG-DEFERRED DECADENCE?

While recently reading some of the famous "Letters of Junius" the Editor came across the following sentence in a letter bearing date December 19, 1767, in which the writer bewails the impending wreck of England's commerce: "The taxes and duties necessarily laid upon trade in order to pay the interest of a debt of one hundred and thirty millions are so heavy that our manufactures no longer find a vent in foreign countries. We are undersold and beaten out of the branches of trade of which we had once an almost exclusive possession. The progress toward a total loss of our whole foreign trade has been rapid; the consequence of it must be fatal." There is something very familiar in the foregoing, and one asks himself whether, a hundred years from now, the columns of the daily press, which are just now so eloquently reiterating these predictions of Junius, will provoke again the involuntary smile which is called forth by the above quotation. Apropos of Great Britain's decadence, there is a most thoughtful and statesmanlike article in the present number of The Fortnightly Review, whose title, "Will England Last the Century?" would be more characteristic if it read "Will England's Predominance Last the Century?" The author, who signs himself "Calchas," evidently believes that she will last the century, though not in her present commanding position. Although it is not distinctly so stated, the author is evidently of the opinion that the struggle of the century will be a scientific, industrial and commercial one. Starting out with the assumption that the decadence of France is inevitable, attention is turned to three countries which are as certainly upon the ascent, namely, the United States, Germany and Russia. Leaving out the third, whose full development cannot be reached in one century, if, indeed, in two, it is asked, as compared with the assured progressiveness of these three expansive powers and the settled decline of France, at what point between decided decadence and spontaneous development does England stand? The British are judged to be a nation in jeopardy, but not in decadence. The efficiency of the nation has been vitiated by the sense of ease that has followed an unexampled prosperity; but in the opinion of the author the drowsiness will disappear when the comfortable cause is gone, and the pressure of American and German competition becomes more constant and pinching. The exact want of the nation is deeper and more scientific cultivation. The

material is not exhausted and it exists to be developed; since there is a stronger smack of the vigorous barbarian than any suggestion of morbid exhaustion in the English character. "Calchas" yearns for a German Kaiser, believing that British politics do as much to paralyze national enthusiasm and to confuse national effort as the Kaiser does to stimulate the ideas and concentrate the action of his people; indeed, the writer is of the opinion that if the British nation could be taken in hand for ten years by a benevolent despot, with a genius for constructive statesmanship, no nation would prove a more profitable subject.

To any one who is acquainted with the habits of the English people of all ranks, it will be agreed that the author speaks with a true judgment of the situation when he says that the weakness of the British, as compared with their two greatest competitors, is the difference in the view which is taken of the relation between pleasure and work. The German, with his thorough, intellectual interest in his own line takes more pleasure in work than in play. The American goes with irresistible vigor into both work and play, while the average Briton thinks far too much of sport while at his job. The situation is admirably summed up in the statement that to the nation which is supreme in the scientific spirit will supremacy in the twentieth century belong, and if England is to remain an international ignoramus, and to be dependent more and more upon America and Germany for her electricians and chemists, and for all the newest appliances in her oldest trades, the wavering balance in which the future of the country hangs must drop downward. It is considered that America cannot be prevented in any case from attaining, at some period during the twentieth century, the industrial leadership of the world, and that the real task of Great Britain and her best chance of success, if she is thoroughly awakened in time, will be in the struggle with Germany for the second place.

The writer finds considerable satisfaction as regards the future in the fact that the immense lead which Great Britain at present possesses, which is considered to be in itself a solid and enormous asset, if rightly understood and utilized, should enable that country to fight a formidable defensive struggle in the endeavor to make the inevitable encroachments more gradual than the Pan-German mind imagines, and to hold its own for all sufficient periods of power and prosperity until the reconsideration of the British outlook a hundred years hence. It is pointed out that the total volume of British exports and imports is still half as much again as that of Germany, and twice that of the United States; and the reader is reminded that it takes time for the swiftest pursuer to reduce a long lead.

THE UNSCIENTIFIC CHARACTER OF CHINESE PLAY.

BY ISAAC TAYLOR HEADLAND.

Little has been written thus far on Chinese play, and what has been written has been for the most part a mere reference to children's games in the treatment of other, perhaps more important, subjects.

The games of all peoples may be divided into two general classes. First, those which arise from a natural disposition or need for exercise or entertainment, which need may be either mental or physical, and is the same among all peoples. Second, those which are the product of inventive genius for the purpose of a more scientific mental or physical development of the race. Up to the beginning of the nineteenth century there were few complicated games invented in Europe, and none in Asia, cricket dating from about the beginning of the eighteenth, and baseball from the middle of the nineteenth, century.

All Chinese games, unless we except chess—and I think we need not except even that—are to be classed in the category of natural productions. These spring from various instincts, such as the parental or protective instinct which is inherent in every boy and girl. For its development every people have dolls prepared for their girls and games for both girls and boys. One of the most interesting Chinese games of this kind is

THE HAWK CATCHING THE YOUNG CHICKENS.

The children stand one behind the other, having their largest and most kindly disposed boy or girl in front, who protects them from the hawk. The hawk comes to snatch away the chickens, but the line of small chicks swing around from side to side, while the old hen spreads her wings and keeps between her brood and the hawk.

Another instinct is curiosity—or hunting and catching—a disposition which, in the child, originates all kinds of blindfold games, and is not very different from that which induces the anatomist to dissect a body, the botanist a flower, or the cat to put her paw in a mouse-hole.

Closely akin to this is the guessing instinct, which, in China as elsewhere, has originated a large number of games, many of which are similar to those played in Europe and America, though, so far as can be determined, there is no trace of either having borrowed from the other. One of these games is

POINTING AT THE MOON OR STARS.

The children form themselves into a ring, with one of their number blindfolded in the center. As the ring moves around they sing:

I point at the moon or stars as they pass.
It may be a laddie, it may be a lass;
But, whether a laddie or lass that I sing,
His duty is clear—to come into the ring.

The ring stops and the boy points. If his finger should be directed toward the vacant space between two boys, the ring moves again, but if directed toward a boy, he takes the place of the one blindfolded.

Other instincts are those of striking, pounding, kicking, hopping, bumping, and the games which illustrate them are both as numerous and as interesting as those which are played by our own children; while other instincts, such as that of exclusion, are represented by games corresponding to our tit, tat, toe, or e-ne-me-ne-mi-ne-mo.

There are certain parts and conditions of the human body which are peculiarly adapted to being played with or to call forth games. These are the fingers, and all the various positions in which they may be placed; the toes, the five senses, and the tickling of the neck and the knee, and so we have various games corresponding to our "Little Pig went to market," "Knock at the door," "This is the church and this is the steeple," etc.

Every boy has a desire to excel, whether it be in the matter of quickness of reaction, activity, exertion, strength or ingenuity. And so, in China, as elsewhere, we have games which contribute to all these compound or complex mental and physical qualities. They pitch cash very much as we pitch quoits. Two boys hook their fingers together and pull until they break apart, after which they both exclaim "Honor!" The one who says it first is entitled to an obeisance on the part of the other as a penalty for being too slow. In the matter of the development of physical strength they have games in which there are all the elements of danger to be found in our baseball; these are the pitching of the stone lock, the use of the great stone dumbbells, and the man-wheel, which require the exercise of all the muscle the boys possess, and contribute to its development as well as our own games.

Closely allied to their games, and based on the same natural instincts and principles, are contortions and acrobatic performances. For this purpose the Chinese invoke the friendly aid of a tree limb, or, in the absence of a tree, two boys hold a carrying pole on their shoulders, and a third goes through all the contortions natural to boy life—"skinning the cat," hanging by his heels, toes, legs, arms or hands. He learns to bend over backward, picking up a handkerchief with his teeth, and two boys double up together in such a way as to make a cart-wheel and roll about the court.

All these games, it will be seen, are simply outgrowths of natural dispositions and needs. None of them represent anything like the inventions of our own complicated sports. Indeed, while the games played by Chinese children are in many cases very interesting, in few cases are they complex. They have nothing which corresponds to our complicated inventions, such as cricket, football, baseball, croquet, golf and a hundred others, which, by the way, are the result of the most modern inventive genius, and were not known or but little played in the time of our grandfathers. They are of the age of electricity, steam, photography, stenography and a thousand other kinds of scientific progress not known a hundred years ago—the distinguishing characteristic of the nineteenth century, the greatest of all centuries in the matter of scientific invention.

One of these games, played by boys from eight to eighteen, contains a moral element I have never seen in the games of any other people. It is what they call

KICKING THE MARBLE.

They have two marbles an inch or more in diameter, one of which they put upon the ground and shove with the foot. Then the other is put down, and one boy tells the other to put it north (south, east or west) of the first. If he shoves it so as to hit the other and still go in the position indicated, he wins double and is entitled to two kicks. If he simply goes in the position indicated, he wins and is entitled to one kick. When he is through, he tries to leave the two balls in such position that they will be difficult to kick. If, however, he makes the position too difficult, the other says, "I will not kick; you may kick," and he is thus compelled to play his own difficult game—or, like Haman, hang on his own gallows. The game is one well worthy of the Chinese, and one of the most widely popular games of any played in the north.

These games, like everything else Chinese, are a further proof of the practical nature of the Chinese and their almost complete lack of the inventive faculty The reason for this could easily be shown by a short review of their methods of education, which contribute to the development of memory to the exclusion of reason, imagination and invention.

SCIENCE NOTES.

Greenwich time has been adopted officially by Spain, and the hours are numbered from one to twenty-four as in Italy.

Constantinople was visited with a severe snowstorm on January 16. The tramways were stopped and traffic on the railways was interfered with.

In Winona, Minn., there have been nine hundred cases of smallpox, and some of the surrounding cities have established a quarantine against the infected city.

The official report of the financial department of the Paris Exposition shows a loss of only $400,000. The expenditures amounted to $23,300,000, and the receipts amounted to $22,900,000.

It is estimated that the amount of money that was disbursed on January 3, 1901, in interest and dividends amounted to not less than $175,000,000. About half this amount goes to savings bank depositors.

The brother of Andree, the missing aeronaut, despairing of his brother's return from the Arctic regions, has finally opened his will. The tenor of it shows that the explorer hardly expected to return.

A movement is on foot to mark the place of Commodore Perry's landing at Yokohama, Japan, with a suitable memorial. It is probable that it will take the form of a lighthouse on the dangerous Plymouth Rocks at the entrance to Uruga Bay, the beacon to be surmounted by a bronze figure of the commodore.

The year 1900 was an excellent year for fruit in Switzerland, and a manufacturing firm in the canton of Aagau decided to erect a plant for utilizing the apple crop. Machinery was put in for peeling, coring and slicing apples. The baking was accomplished by placing the slices on trays which were something like gridirons, one being placed over another in the ovens. An electric motor was used to warm the air for the baking.

Rare Egyptian papyri are to be distributed among American universities and museums. Antiquities collected by the Egyptian Exploration Fund are distributed among American institutions pro rata according to their subscriptions. Columbia University, Vassar College, Hamilton College, Yale University and the Metropolitan Museum of Art will receive papyri. They are all numbered and described and are sometimes given in facsimile in the volumes issued by the Fund.

The special agent of the United States Department of Agriculture in charge of the Experiment Station at Sitka, Alaska, reports that there is not the slightest doubt that grain can be matured almost anywhere in Alaska. He obtained samples of perfectly ripe barley, oats, wheat and rye from several points in the interior, even far north. These grains were grown and matured during 1900. With one exception they grew from seed accidentally scattered and grown wild. If the grain will grow and mature without culture, it is reasonable to suppose that it will grow and improve if properly planted. Flaxwas also grown at Sitka. It attained a height of more than three feet. Matured seed are produced, and a fiber of excellent quality. There is no doubt that flax would be an excellent crop to raise.

The British Museum has recently come into possession of a mummy which is generally believed by the experts, who have been privileged to examine it, to be the most ancient yet discovered. This addition is of unique value, in view of the fact that it conveys a more comprehensive idea of the origin of the ancient Egyptians than has ever yet been obtained from similar relics. Upon this point there has always been a wide divergence of opinion among archæologists. The mummy was taken from a neolithic grave. It is the body of a man about 5 feet 9 inches in height. Upon the scalp is a remaining lock of hair which suggests that it was originally of a fair color. The hands and feet are small, and from the intellectual formation of his head it is conceded that he must have belonged to a superior race. The result of Egyptological investigations declares that the mummy is that of an aborigine of Egypt, which was conquered by an Asiatic invasion about 8000 B. C., and which afterward intermingled with the conquering race, thus constituting the foundation of the race known as Egyptians. The grave from which the body was taken out was an oval cavity in a sandstone rock, and covered with a number of large slabs of stone. Ranged round the body were the usual flints and earthenware pottery. It was found impossible to remove the grave of the body together with the mummy, so an exact replica of the tomb was made, and the body now reposes in a case in the Egyptian gallery of the museum in exactly the same position in which it was found.

VANDERBILT LOCOMOTIVE BOILER.

Although the locomotive which is herewith illustrated belongs to the modern class of freight engines which is distinguished by great weight, large heating surface, big cylinder capacity and high tractive force, this particular locomotive does not derive its claim to distinction from any of these features, but from the fact that it makes a radical departure from previous systems of construction in the design of its boiler.

To everyone who has even a casual acquaintance with locomotive boiler design, the broad difference between this locomotive and the standard type will be evident at first sight, the ordinary, rectangular, box-like structure for holding the fuel being here replaced by one whose cross section presents the form of a true circle, the boiler shell also being changed from the rectangular to the cylindrical form to accommodate the firebox, which lies eccentrically within it.

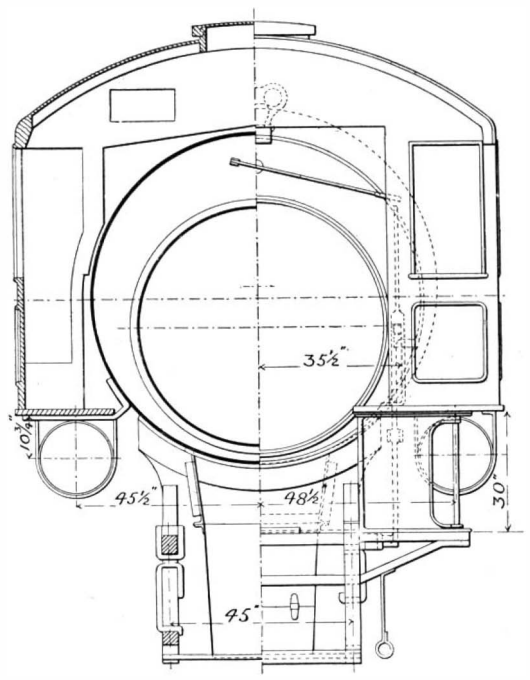
The term "firebox," as applied to that portion of the boiler which contains the fuel, has a historical value as showing that the rectangular form was the one adopted in the earliest locomotives; for it is a matter of fact that in Stephenson's first locomotives, the "furnace," as it was frequently called, was to all intents and purposes identical in construction with those in use to-day. The fact that the box-shaped form is, in spite of its many limitations, the prevailing type to-day is due rather to the conservative instincts of the locomotive builder than to any proved superiority over other forms of construction. Had Stephenson's "Rocket" been built with a firebox of the cylindrical type, it is probable, judging from the excellent results which the cylindrical type, as herewith illustrated, is showing in practice, that we should now be using the term "fire-cylinder," or some name suggestive of its circular form, to designate this part of the boiler.

It is likely that the reluctance of locomotive builders to raise the center of gravity of the locomotive conduced in earlier years to the popularity of that type, since its rectangular form permits it to be carried down between the frames, utilizing the considerable amount of space between the driving wheels.

Of late years it has been found that the center of gravity may be raised considerably without impairing the stability of the locomotive, and the success which has attended the Wootten firebox, and other types which are carried above the frames, has removed any possible objection, on this score, to the large diameter which is necessary if we are to secure, with the cylindrical firebox, an adequate amount of heating surface.

The chief structural objection to the square firebox is that it is a form which is poorly adapted to resist the stresses to which it is subjected, the flat surfaces necessitating a vast number of stay-bolts (as many as from 1,400 to 2,000 in large American locomotives), which have to be inserted between the firebox and the boiler shell to prevent distortion. Under the rather complicated strains due to variations of temperature, it is difficult to keep these stays at all times watertight, or even, in the case of boilers not of the very best design, to prevent fracture of the bolts themselves. There is also the disadvantage of the flat surfaces tending to assist the deposit of scale, with its accompanying loss in evaporative power, and trouble and cost of cleaning. The rectangular form, moreover, is an expensive form of construction, both as to first cost and subsequent maintenance; and, lastly, it is not favorable to that free circulation of the water which is necessary to high evaporative efficiency.

The locomotive which we herewith illustrate represents a very successful attempt on the part of the inventor, Cornelius Vanderbilt, to remedy these defects by adopting the cylindrical form; the main objects aimed at, as stated by himself, being simplicity and strength of construction, freer water circulation, the prevention of scale, and decreased cost of maintenance.

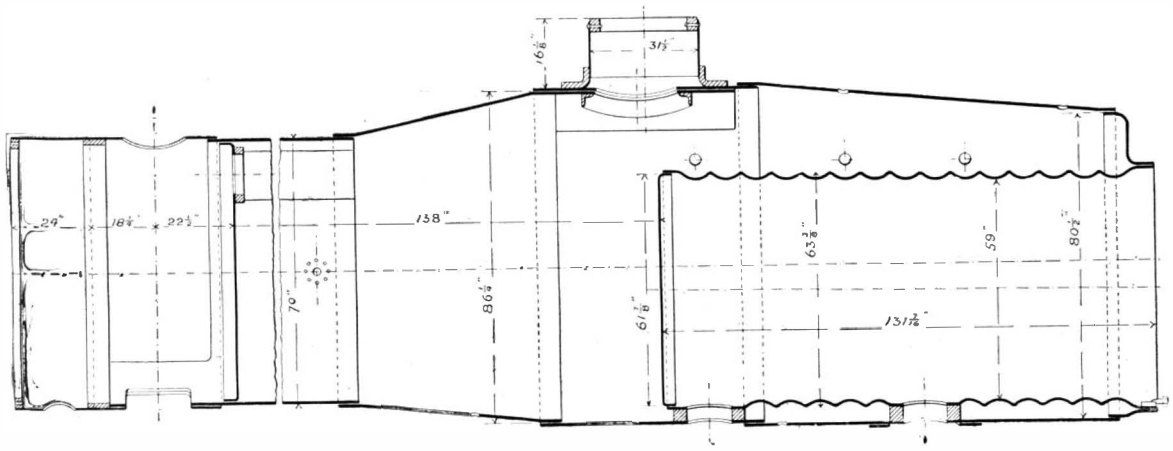


CROSS SECTION THROUGH FIREBOX.

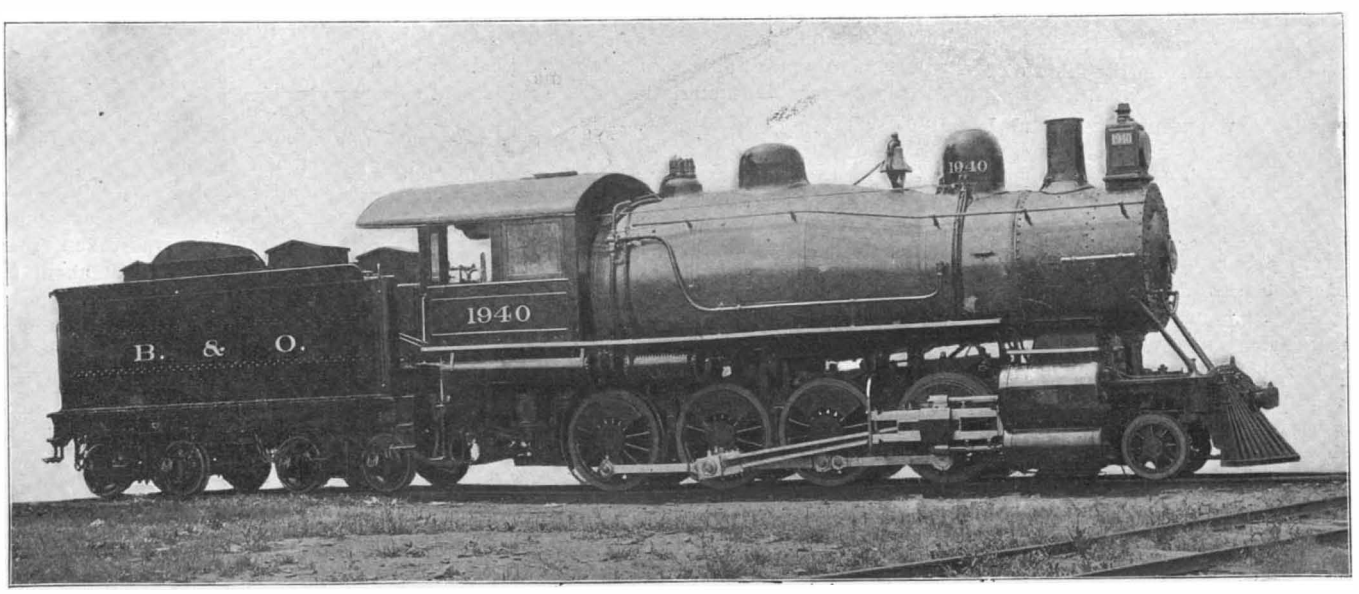
The boiler was not designed, as has been frequently stated, with the object of securing larger heating surface, the heating surface of the old and new types, in locomotives of equal weight, being approximately the same; although it should be noted that the greatly increased efficiency shown by the Vanderbilt locomotives now in operation amounts in its practical results to the same thing as an increase of heating surface.

The locomotive herewith illustrated is one of the two consolidations for the Baltimore & Ohio Railroad, which were delivered last August and have been used in regular freight service since that time. The locomotive has a total heating surface of 2,750 square feet, of which 2,615 square feet is in the tubes and 135 square feet in the firebox. There are 500 tubes, 1¾ inches in diameter and 11 feet 6 inches in length. The boiler pressure is 190 pounds to the square inch; the total weight of the engines is 193,900 pounds, 170,800 being on the drivers and 23,100 on the trucks. The engines are of the Vauclain compound type, with cylinders 15½ and 26 inches in diameter by 30 inches stroke. The drivers are 54 inches in diameter and the total wheel base is 23 feet 8 inches. All the reports thus far received of these locomotives are highly satisfactory. Two consolidations of very similar dimensions and power were delivered last July to the Union Pacific Railway, and altogether ten locomotives of this type have been constructed and put in operation. The first boiler of the kind to be constructed was placed in a freight locomotive built at the New York Central & Hudson River Railroad shops at West Albany for the New York Central Railroad, which has now been in service for about eighteen months. As showing the good effects of freer circulation in preventing boiler scale, it may be mentioned that at the end of one year's service of this locomotive it was found that there was less than 1-32 of an inch of scale formed on the outside of the firebox; whereas in locomotives of the standard type on this road, performing similar work, it was found that from 1-16 to 1-8 of an inch of scale had invariably to be taken off at the close of a similar term of service. This freedom from scale is to be attributed in some degree to the corrugated form of the firebox, which by its concertina-like movement as it expands and contracts under changes of temperature, tends to crack and loosen the scale.

In the discussion which followed the reading of a paper by Mr. Vanderbilt on his boiler at the last meeting of the American Society of Mechanical Engineers the opinion was expressed that if the new form of construction continued to show such good results in every-day service, a most important advance will have been made in the art of locomotive construction.



LONGITUDINAL SECTION.



BALTIMORE AND OHIO CONSOLIDATION LOCOMOTIVE WITH VANDERBILT BOILER.

Cylinders, 15½ and 26 inch by 30 inch. **Boiler pressure,** 190 pounds. **Heating surface,** tubes 2,615 square feet, firebox 135 square feet. **Total weight,** 193,900 pounds.

The Survival of Toads in Rocks.

Some experiments were recently made in England to test the belief that toads can live for long periods in rocks without air or food. The Rev. W. Buckland took a large block of coarse oolitic limestone and prepared twelve circular cells in it, each about one foot deep and five inches in diameter. A groove or shoulder was cut at its upper margin so as to receive a circular plate of glass and a circular piece of slate was in turn to protect the glass. He then prepared twelve smaller cells each six inches deep and five inches in diameter in a large block of silicious sandstone, these cells also being covered with glass and slate and luted around with soft clay. The object of the glass cover was, of course, to permit of the toads being seen without having to remove the lids. One live toad was placed in each cell and the covers cemented on. The weight of the toads was ascertained before sealing up the cells. Both stones were buried under three feet of earth for thirteen months. All of the toads in the sandstone cells were found to be dead and their bodies were decomposed, showing that they had been dead for a long period. The majority of the large toads in the block of limestone were alive, says The Engineering and Mining Journal, and in every instance the glass covers were cracked. The toads were weighed, and it was found that they had decreased in weight. The conclusions drawn by the naturalists were that the toads cannot live a year totally excluded from air, and cannot live two years if totally deprived of food.

A BUST of Charles H. Haswell, the first Engineer-in-Chief of the United States Navy, has been placed in the Union Club, New York. Haswell was the first officer in the navy to introduce scientific methods of engineering. He organized the Engineer Corps of the service. He was also known as the author of the first table-book for engineers. He is now in his ninety-second year.

A COMBINATION PIPE AND BENCH VISE.

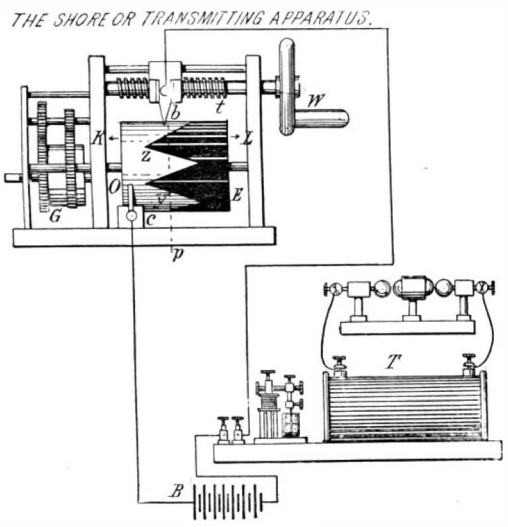
A complete and efficient bench or pipe vise, having a sliding jaw which is operated by the screw and which is adjustable to any position, is an invention for which Peter Broadbooks, of Batavia, N. Y., has received a patent.

The fixed jaw is carried by a suitable base. Through the fixed jaw a bar slides, on which a movable jaw is adjustably secured. On the bar a screw-block is fitted to slide, through the top of which screw block a screw is threaded. In the fixed jaw a rod is swiveled, which can be bound to a chuck carried on the end of the screw. Thus constructed, the apparatus is an efficient vise designed to be used in the ordinary manner.

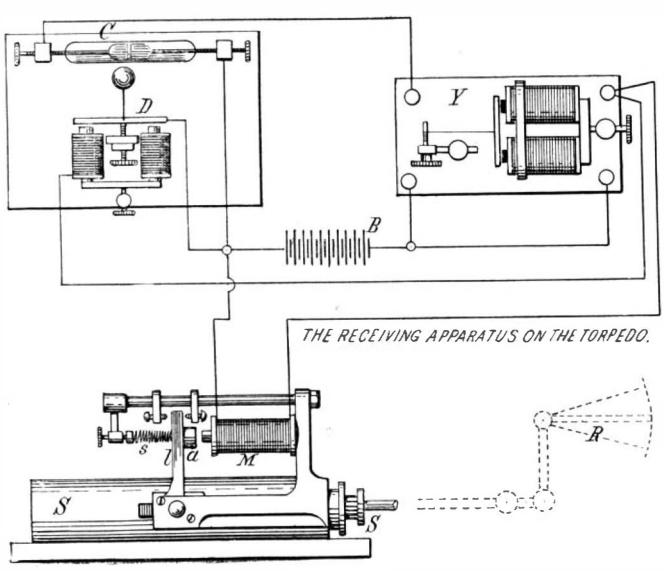
But when it is desired to use this vise for the purpose of gripping pipes, auxiliary pipe-jaws are employed, formed with flanges which are passed over corresponding flanges of the fixed and movable jaws and are held in place by set-screws. These pipe-jaws are made to interlock—that is to say, the one jaw is adapted to pass into a slot formed in the other jaw, so that the elongated teeth formed on each of the jaws may slide past one another and therefore receive pipes of various sizes.

STEERING TORPEDOES BY WIRELESS TELEGRAPHY.

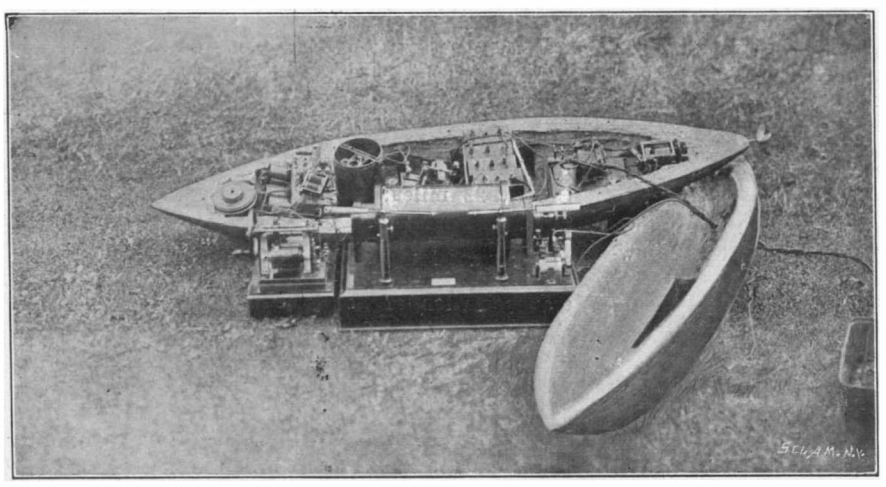
A few months ago attention was drawn in the SCIENTIFIC AMERICAN to the invention of a young English electrician, Mr. Cecil Varicas, by which it was rendered possible to steer torpedoes and other light craft by means of Marconi's wireless telegraphic system. In that article a description was given of a severe trial that had been carried out with a model launch by Admiral Colwell. Since that time the inventor has been furthering his experiments with a view to steering submarine torpedoes in the same way, and a short while ago an exacting test was made in the open sea of the English Channel, in which the inventor was able to manipulate by means of ether waves and with conspicuous success the movements of a torpedo in any desired direction while it was traveling below the surface.



TRANSMITTER.

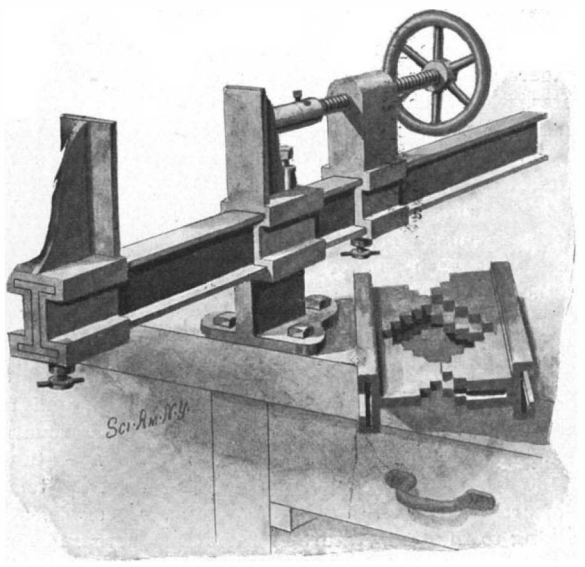


RECEIVER



TORPEDO ARRANGED TO BE STEERED BY ELECTRICAL IMPULSES.

The Varicas torpedo resembles in outward appearance the familiar Whitehead projectile. The dimensions are precisely the same, and the propeller is of equal caliber. The interior of the torpedo, however, is vastly different. The explosive and the driving engines



A COMBINED BENCH AND PIPE VISE.

are localized in the same positions, but the gyroscope is supplanted by the electrical apparatus and receiver necessary for the actuating of the rudder. The torpedo installation consists of a Marconi coherer in circuit with a relay and battery. The relay closes the circuit of a decoherer and electromagnet, which attracts an armature. The latter is made to actuate the valve of a steering engine which is connected to the craft's rudder.

The stationary apparatus upon the shore, battleship, or other point from which the torpedo is fired, comprises a periodic interrupter placed in circuit with an induction coil, which in time works a wireless telegraphic transmitter.

When this periodic interrupter makes circuit the coil works the transmitter so that ether waves are produced, and the coherer on the craft conducts, working the relay which closes the circuit of both the decoherer and electromagnet. This causes the valve of the steering engine to move, so that the rudder is also turned in a certain direction.

When the interrupter breaks circuit the ether waves cease, and the coherer is decohered by the decoherer and ceases to conduct—the same as is now done in the Marconi system of wireless telegraphy—causing the relay to break the circuit of the electromagnet on the steering engine so that it releases its armature. The rudder is then reversed to the opposite direction by a strong spring. By this it will be seen that so long as the interrupter on shore makes circuit the rudder is pointed in a certain direction, but directly the circuit is broken the rudder assumes the diametrically opposite position.

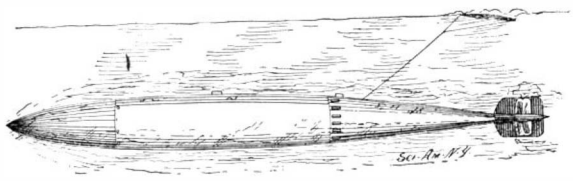
From this it will be recognized that if the alternate making and breaking of circuits is continued with regularity, answered by corresponding regular deviations of the rudder, the craft must travel in a direct straight line. On the other hand, if either the making of the circuit is longer than the period of breaking, or vice versa, the rudder is maintained in one position for a longer period, so that the direction traveled by the craft is in a curve.

One of the illustrations represents the shore section with various connections with battery coil, etc. The variable periodic interrupter consists in a drum, *O E*, over the periphery of which are secured two tubes of conducting and insulating material cut so as to fit into one another in triangular zig-zags, *z r*. The whole drum is rotated by clockwork, *G*, at a uniform velocity.

The sliding contacts, *B C*, press on the drum as it is in rotation. *C* is fixed and serves to maintain a continuous electrical connection with the conducting half, *O z*. The other contact, *b*, is movable in a direction parallel to the axis of the drum by means of the screw, *t*, which can be turned by the handwheel, *W*. As the drum rotates this contact is brought into the position shown by the dotted line, *p*, so that it traverses the insulating and conducting portions for equal periods. By moving the contact toward *K*, however, the successive periods in which it will pass over the conducting portion will be greater than the successive intervals of the insulating portion, the difference increasing as the contact is removed from the equi-periodic line, *p*. But, on the other hand, if the contact be brought on the other side of the equi-periodic line, *p*, toward *L*, the reverse happens. That is to say, the successive intervals of break become longer, and those of make shorter, the difference increasing the farther the contact is removed from the line, *p*, so that by turning the wheel, *W*, in either direction intervals of make and break can be equal on the successive intervals of either, or make made greater than the successive periods of break or vice versa.

The recovery apparatus employed on the craft is shown. *C* is the Marconi coherer in circuit with the relay, *Y*, and battery, *B*. The relay is made to close the circuits of the decoherer and the electromagnet, *M*, which electromagnet attracts its armature, *a*, fixed to the valve arm, *l*, of the steering engine, *S S*. This armature is acted upon by a spring, *s*, which tends to pull it from the electromagnet, *M*. When this electromagnet attracts its armature it turns the valve in a certain direction, and the steering engine by aid of the levers (shown in dotted lines) also turns the rudder in a certain direction, but turns it in the opposite direction upon the release of the armature, *a*, acted upon by the spring, *s*.

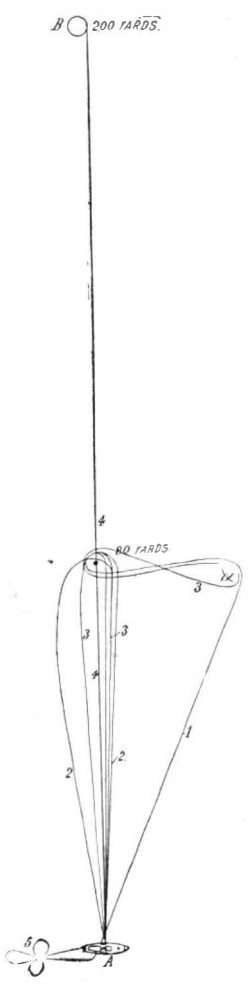
When the variable periodic interrupter, *O E t*, on shore makes circuit the coil works the transmitter, *T*, which produces ether waves, making the coherer on the craft conduct, causing the relay to close the



TORPEDO WITH RECEIVING FLOAT.

circuit of the decoherer and electromagnet, which last turns the valve of the steering engine, causing it to turn the rudder, *R*, in a certain direction.

When the variable periodic interrupter on shore breaks circuit, the coil and transmitter cease to produce ether waves. The coherer on the craft is decohered by the decoherer, which causes the coherer to cease to conduct. The relay then breaks the circuit of the electromagnet, which, consequently, releases its armature, *a*, and the spring, *s*, then actuates the valve of the aforesaid steering engine in the opposite direction, so that when the interrupter on shore makes circuit the rudder on the vessel to be steered turns in a certain direction, but when the circuit is broken it turns in the opposite direction. By equalizing the periods of make and break, therefore, the movements of the rudder neutralize one another, so that the craft must necessarily travel in a straight line. But by the handwheel, *W*, of the interrupter on shore in either direction, the successive intervals of make may be made greater than those of break, or vice versa.



COURSE OF THE TORPEDO.

With regard to the torpedo, the inventor has designed an ingenious contrivance for arresting the ether waves from the transmitter in their progress through the air and conducting them to the instruments within the torpedo, which is submerged to a depth of about ten feet. On the upper surface of the projectile, near the stem, is a small recess containing a bobbin of fine wire with one end attached to a metal float which fits into the recess, forming part of the outer casing of the torpedo. When the projectile enters the water, from the tube, this float is detached by the concussion and rises to the surface, at the same time unwinding the bobbin. This float serves the same purpose as Marconi's high mast. The waves are received and conducted through the wiro to the bot-

tom and thence to the apparatus stored in the chamber within the projectile.

One of the diagrams illustrates the results of a trial to which the instrument was subjected, which was of a very exacting character. The shore apparatus was stationed at *A*. The propelling engines of the craft were set in motion, and it traveled in the direction indicated by the figure 1. Thence it was carried to a point immediately opposite the transmitting apparatus and brought back to the starting point as shown by the figure 2. It was then dispatched on the complicated journeys 3 and 4, and brought back once more to the shore instruments. Then to test the absolute and immediate subserviency of the craft to the manipulations of the transmitter, it was submitted to the series of circular sweeps marked 5. This was a very trying ordeal to the craft, but it performed the evolutions readily and perfectly. It was then dispatched seaward, traveling in a directly straight line to the point, *B*, where it described a circle, indicating that it had reached the limit to which the ether waves traveled, which in this instance was 200 yards. Of course, this distance can be indefinitely increased by improving the sensitiveness of the instruments and strengthening the potentiality of the current transmitted.

The value and possibilities of this invention are incalculable. It can be manipulated so easily, readily, and variously that it would be impossible for an enemy to locate its direction of travel. Then again it is impossible for it to miss its aim, whereas with the gyroscope the movement of the target nullifies completely the discharge of the torpedo, which is consequently lost. It is also much cheaper than the ordinary torpedo. The Whitehead torpedo costs $10,000, while the complete cost of a torpedo equipped with the Varicas instrument costs only $3,000. Of course, there is the cost of the shore apparatus, but this is only an initial expenditure. The instruments placed in the torpedo are approximate in weight to that of the gyroscope, which is an important consideration, since increase in weight would signify a proportionate increase of the power of the propelling machinery. The invention has been inspected by several military and naval experts from all countries, who have expressed the opinion that it is by means of wireless telegraphy that torpedoes will be controlled in the future. The Swedish government has already commenced the introduction of a similar means of steering torpedoes into the defenses of its country.

MANUFACTURE OF WATER-GAS AT THE FORTY-FOURTH STREET STATION, NEW YORK.—II.

In our issue of January 19, we described a portion of the Forty-fourth Street plant of the Consolidated Gas Company for the manufacture of water-gas. The article referred to described the Lowe apparatus, in which illuminating water-gas is produced, and also the Gasogene plant, for the manufacture of non-illuminating water-gas. It was shown that the products of these two plants are led to a relief holder, from which they are conducted to the condensers of an oil-gas plant. The oil-gas from this plant and the mixture of illuminating and non-illuminating water-gas, after being combined in these condensers, are passed through the successive stages of scrubbing, purifying, etc., and finally collected in the main gas-holder.

OIL-GAS PLANT.

The first element of the oil-gas plant consists of a row of eighteen benches, containing six retorts, in which the oil and steam are decomposed. Each bench contains six retorts arranged in tiers of three. The retorts are cylindrical in section, and extend entirely from the front to the back of the bench. They are set in fire-brick walls, and the whole of the masonry, including the arches, etc., is built of the best firebrick. The retorts are closed at each end by cast-iron mouthpieces provided with movable lids. Each bench of six retorts is heated by two furnaces, one on each side, into which a supply of oil is sprayed under air pressure. The liquid fuel consists chiefly of the tar, pitch and various oils which are collected in drip tanks to which they flow by gravity from the hydraulic mains, the scrubbers and the condensers. From the drip tanks the refuse oil is pumped to a general collecting tank, from which it flows to the burners at the retorts. Within each retort is a 6-inch, wrought-iron pipe, which is closed at one end and has a semicircular section cut away from the upper half of the opposite end. To the closed end of each of these pipes is led a small supply pipe, by which the oil and steam are introduced. The mixture is vaporized and partially decomposed within the pipe, and the resulting gases, escaping from the opposite end of the pipe, flow back above it to finally leave the retort by means of a vertical standpipe. Our sectional view, taken through one tier of retorts, shows the front of the retorts with the long line of standpipes extending above it. The gases pass from the standpipes down into the hydraulic main, where the tar and heavy oils are condensed and collected. The standpipes terminate in what are known as dip pipes, which are carried down a few inches below the surface of tar and liquor, as shown in the engraving. The liquor is maintained at a predetermined level by means of an adjustable gate, and the gas, after passing through the liquor, is led to the bottom of the air condensers. Here it is joined by the mixed gases from the relief holder, already referred to. In passing through the retorts, the oil is decomposed into a fixed oil-gas which is practically the same as the Pintsch gas so largely used for the lighting of street and railway cars. The gas mains which lead from the relief holder and from the oil-gas retorts are provided with gates, which enable the operator to mix the two gases in the proper proportions to give an illuminating gas of the desired candle power. The air condenser consists of two wrought-iron bases, each section of which is 6 feet wide and 30 feet in length. From the base there extends a series of vertical rectangular sheet-steel pipes, each pair of which is connected by a bend at the top. The pipes are so arranged as to operate in sections of four, the route followed by the gases in passing through the condenser being such that a given volume, in passing from one end to the other, has to travel through a linear distance of 500 feet, and is exposed to a total cooling surface of 15,000 square feet. Here the gases are cooled from a temperature of 180 deg. to one of approximately 100 deg., the temperature of the issuing gases varying, of course, according to the temperature of the atmosphere and the amount of gas that passes through in a given time. In the process of cooling, any oil which may not have been thoroughly fixed in the retorts is deposited, and falls to the base, from which it drains off to a drip tank.

From the outlet of the condenser the mixed and cooled gas is led to the base of a tubular water condenser, where it passes up and down through a series of tubes that are surrounded with circulating water. Here the gas is cooled down to a temperature of 80 deg. F., and any unfixed oils that may remain are deposited. From the condensers the gas passes to the scrubbers, which are constructed on the same general principles as those already described, the cylinders in this case being divided by a vertical diaphragm, whose object is to cause the gases to travel up through one-half of the condenser and down through the other half. In these condensers care is taken to use only a limited amount of water on the already cooled gases, as an excessive amount would be liable to absorb a certain portion of the illuminants. The gas is drawn from the scrubbers by the suction of a powerful centrifugal exhauster, and forced through a big valve known as the center valve, from which there radiates a series of horizontal pipes, which lead to the base of the purifiers. The purifiers are large cast-iron boxes measuring 24 feet square and about 4 feet in depth. Each box is provided with a wrought-iron cover, which, when it is in place, is seated in a water seal that renders the purifier gas-tight. The interior of each of these huge boxes contains two sets of gratings or grids, upon which is thickly strewn a purifying material, which consists of wooden chips and shavings that have been thoroughly saturated in oxide of iron. The gas filters up through this material, and the action of the oxide of iron serves to remove the remaining impurities, which consist chiefly of sulphur in the form of sulphureted hydrogen. From the purifier the gas passes to two large station meters, where it is measured, and a record obtained of the actual amount that is being manufactured hour by hour. From the meters the gas is led to a large gas-holder, with a capacity of 2,000,000 cubic feet, and from the gas-holder it passes, under a pressure of from 3 to 7 inches of water, to the city mains.

Although the Forty-fourth Street station has a capacity of 8,000,000 cubic feet per day, it only requires an area of slightly over two acres to accommodate the plant, a fact which is favorably commented upon by the many foreign experts who have at various times visited the station. Thanks are due to Dr. Elliott, chief chemist of the Consolidated Gas Company, and to Mr. F. C. Crowell, the superintendent of the Forty-fourth Street station, for courtesies extended during the preparation of these articles.

To Determine the Height of Liquid in a Cask.

In order to ascertain how far the liquid reaches in a keg, says Deutsche Destillateuren Zeitung, the following simple method may be employed:

Take a glass tube, bent at right angles, whose long leg is equal to the height between the bunghole and the upper floor, while the shorter one need only be a few inches in length. The shorter end is now connected with the bung by a piece of rubber hose, the longer one is placed in a vertical position and the bung is opened. According to the law of communicating vessels, the liquid will rise in the tube to exactly the same height as in the cask, so that the level of the fluid can be ascertained with great accuracy

Automobile News.

The Grand Palais of the Exposition is being utilized for a vast automobile and bicycle show, in which all the leading French and foreign makes are represented. The Exposition has been organized by the Automobile Club of France, under the direction of its commissioner-general, M. Rives. The exhibits have been divided into two classes: I. Automobiles of all kinds, motocycles, and vehicles using mechanical traction. II. Bicycles of all descriptions. A great number of accessories form part of the exhibits in each class. According to the regulations, each of the automobiles is required to make the trip from Paris to Versailles to show that it is really capable of working. A retrospective exhibit is one of the interesting features, as well as a hall set apart for explaining the working of the different systems to persons interested.

According to the Auto-Velo, the Automobile Club of France has not as yet formally announced its choice of the chauffeurs who are to defend its colors in the Gordon Bennett Cup race, but if certain indications, almost official, are to be believed, two of these have been already chosen. These are Charron, who won the cup race last year, and Levegh, the winner of the Paris-Toulouse race. For the third, a list of the most prominent conductors will be made, and the committee will decide by vote. Neither Charron nor Levegh has as yet received any notification as to the choice, but it is probable that neither will refuse the honor. As to the Belgian Club, it will likely send with Jenatzy a machine of quite a new variety, in which a combination of petroleum and electricity will be used. According to Jenatzy, this machine makes the unusual speed of 72 miles an hour, but even if 60 miles an hour is allowed, it will prove a formidable competitor. Fournier, the well-known motocyclist, who, mounted with Charron in the Gordon Bennett race, has tried this new machine, confirms its extraordinary speed.

Consul Hughes, of Coburg, writes as follows: Dr. M. Kallmann's report on the competition of electrically propelled vehicles in Berlin is highly instructive. The battery taking the first honors weighed only 121 pounds per kilowatt-hour, while the heaviest weighed 286 pounds per kilowatt-hour. The mean weight of the thirteen vehicles taking part in the competition was 165 pounds. Upon the assumption of a yearly total mileage of 9,500 miles, he calculates the annual maintenance cost of a battery at only 48d., or, say, a cent per mile. The smallest consumption of energy per ton mile at the mean speed amounted to 91 watt-hours for a passenger car, a far better performance than previous records are able to show. At the highest speed, the consumption increased to 135 watt-hours. However, in the majority of cases, the demand did not vary greatly with the speed, which leads to the conclusion that, in order to obtain the greatest commercial economy of energy, the electrically propelled car should be driven at the highest speed consistent with public safety. By the high speed the consumption of energy per car mile is not considerably increased, while the number of passengers which may be transported in a given time naturally increases with the speed. With regard to the motor best adapted for the weight to be propelled, the capacity should amount to approximately 1 kilowatt per ton of the rolling weight.

A number of interesting experiments have been recently made in the Italian Army with regard to the application of automobiles in military maneuvers. These tests have been carried out at Turin, under the direction of the officers of the Etat-Major. To this end, the government had previously ordered from a Paris firm a heavy steam automobile of 50 horse power, capable of transporting, besides the combustible and water necessary for a course of 20 miles, 4 tons of material at a mean speed of 6 to 8 miles an hour on level road. It has been found that with this load the automobile could easily mount grades of 8 and 10 per cent while making 4 to 5 miles an hour. In other cases, besides the 4 tons of load which it carried, it could draw 10 wagons, representing a total of 27 tons, on roads not exceeding 4 per cent grade. The experiments made by the Etat-Major have been carried out on a large scale, and the automobile carrying its full load has made several times the trips Turin-Pino Chieri, 22 miles; Turin-Orbassano, 21 miles; Turin-Suse, 32 miles; Turin-Suse-Mont Cenis, 42 miles, etc. From these trials it has been proved undeniably that steam automobiles will render great service for the transportation of heavy loads. As to the light machines, especially for the transportation of personnel, the officials have found that petroleum and electric vehicles will prove of great value in military operations, although the latter must be for the time excluded from the active service of the troops on account of the difficulty of finding charging stations along the route. These tests are being continued by the Etat-Major, and the results are quite favorable to the use of the automobile in the army.

Correspondence.

Our Armored Cruisers.

To the Editor of the SCIENTIFIC AMERICAN:

As a reader of the SCIENTIFIC AMERICAN I have been very much interested in the articles appearing in the paper at different times on the various navies of the world, and especially on the development of our own navy. It is very satisfactory to think that, ton for ton, the American ships are equal, if not superior, to the ships of any other navy of the same date and class. I think this especially true of the battleships of the "Georgia" class, which are without a peer in any navy. But it is doubtful if the same can be said of the armored cruisers of the "St. Louis" and "California" classes.

In the article on the English navy in the SCIENTIFIC AMERICAN of December 10, 1898, the difference between a protected and an armored ship was explained. "Any ship having a vertical water line belt of armor" was classed as an armored ship, and for this reason I think the "St. Louis" should be classed as an armored and not as a protected cruiser. If we compare the "St. Louis" with the "Varese" of the Italian navy, it is found that the "Varese" has so much more armor protection that I almost agree with you that the two ships are not in the same class. The "Varese" has the same number of 6-inch rapid-fire guns as the "St. Louis," and one 10-inch and two 8-inch guns in addition. The "St. Louis" is better supplied with quick-fire and machine guns, but still it is to be feared that the "St. Louis" would cut but a sorry figure in a stand-up fight with the "Varese" with equally efficient crews. Of course, the speed of the "St. Louis" would enable her to run away; but if the displacement of the "Varese" (7,400 tons) were raised to that of the "St. Louis" (9,700 tons), a difference of 2,300 tons, or about 31 per cent, would not the extra displacement allow boiler and engine power enough to raise the speed of the "Varese" from 20 to 22 knots? If such were the case, what chance would the "St. Louis" have then? In the "Maine" it is expected to raise the speed from 16 to 18 knots by adding 1,000 tons to the displacement, or about 8.7 per cent.

Another ship to compare with the "St. Louis" is the Japanese "Asama." The two have practically the same displacement, coal capacity and speed, but in armor and guns the Japanese outclasses the American completely. The "Asama" ought to be a match for two ships like the "St. Louis."

In the article describing the "St. Louis" (SCIENTIFIC AMERICAN, December 22, 1900) she is compared with the English "Monmouth" without much advantage to either, as each possesses qualities lacking in the other. It has been stated several times in the SCIENTIFIC AMERICAN that the English ships were very much undergunned in comparison with our own and other navies. If so, I do not think they should be adopted as a standard with which to compare our own ships.

If the "Asama" be compared with the "California," it is seen that the two ships have the same speed, the same battery of 8-inch and 6-inch guns, practically the same belt armor, and about the same protection for the most of the battery. Probably the continuous casemate armor of the "California" affords more protection than that of the "Asama," which has the further disadvantage of having four 6 inch guns mounted on the main deck with only shield protection. The "California" also has a more effective battery of quick-fire and machine guns. These are undoubted advantages in favor of the American ship. But they fail to account for the enormous difference of 4,000 tons in the displacement of the two ships. The Japanese have obtained nearly the same results in a ship of only 9,750 tons as we have in a ship of 13,800 tons. I do not see where we have any reason to boast. I think the fundamental principle of naval construction is that, other qualities being equal, the most efficient ship is the one which can give and take the most pounding; and the naval constructor who turns out such a design has beaten his rivals by just that much. It has been stated in the SCIENTIFIC AMERICAN that a quart of efficiency could not be obtained from a pint of displacement, but in our new armored cruisers it looks like getting a pint of efficiency from a quart of displacement. The data for arriving at the above conclusions have been gleaned from the columns of the SCIENTIFIC AMERICAN.

If my ideas on the subject are wrong, I would like to learn it through the same medium which brings me to the real reason for writing: That in some future issue of the SCIENTIFIC AMERICAN you would devote the space to a comparison of the American with the Italian and Japanese ships mentioned. I think such an article would prove very interesting to a large number of your readers.

F. I. BROWN.

Kittery, Me., January 4, 1901.

[The following reply has been received from an expert to whom the above letter on our armored cruisers, and the one published in our preceding issue on the same subject, were referred.—ED.]

These correspondents are right in denominating the "St. Louis" an armored cruiser. The term "protected cruiser" is used officially in connection with these vessels for the reason that the appropriation under which they are to be constructed was for three protected cruisers. The Board on Construction determined to embody in the vessels such features as make them second-class armored cruisers, and the disposition of weight represented in the design was forced upon the Bureau of Construction and Repair.

Speaking generally of comparison of our own vessels and those of foreign design under construction, it may be said that the difficulties in the way of a strictly true and impartial comparison are extremely great because of the inaccuracy of information as to details of the foreign vessels which is available to any one writing as your correspondents do. The displacement given in all publications touching upon such vessels is generally the trial displacement, and "trial displacement" is, at best, a very indefinite term, inasmuch as the weights to be carried on trial must be definitely known in order to make the use of trial displacement, for purposes of comparison, of any value. The trial displacement fixed for vessels of the United States navy involves a considerably greater proportion of the maximum weights to be carried, in the deep sea-going condition, than is the case with many of the foreign-built vessels of war, and this is especially true in the case of vessels designed and built by private shipbuilding concerns abroad. The disposition of weight in any design is necessarily determined by a compromise among several opposing interests, and in the case of vessels designed for the United States navy, it very often happens that the disposition of weight finally fixed upon is not that which the designers themselves regard as the most desirable.

Among the features affecting the total weight and the distribution of weight which may possibly account for some of the differences noted by your correspondents between recent designs for vessels of the United States navy, as compared with those of foreign navies, it may be said that the designers for the propelling machinery for these vessels require weights such that about 11 horse power are developed per ton of engineering weights, whereas, in the case of the vessels quoted, the horse power per ton of weight is very materially greater. The space required for machinery has also had an effect in determining the lengths of the vessels, and through affecting the length has made necessary material increases in armored protection for the water line area. The quantities of ammunition carried by our own vessels are understood to be very considerably in excess of those in either of the vessels quoted by your correspondents. The weight and space devoted to the accommodation of officers, petty officers and crews of our vessels are materially greater than in the case of the other vessels under comment; and it may also be pointed out that there is a considerable expenditure of weight involved in the provisions made for our efficient systems of ventilation, heating, and electrical installations, as well as in such less noticeable details as ice plants, cold storage, laundries, et There are other elements which may be less readily brought into the comparison, such, for example, as the differences in freeboard and total height of structure in the several cases; scantlings and general strength of the structures, and space and weight devoted to the accommodation of the complements and stores and supplies carried for their use.

A New Edition of the Cyclopedia of Receipts.

A few years ago the publishers of this paper issued the first edition of "The Scientific American Cyclopedia of Receipts, Notes and Queries." It was well received by the press, and came quickly into the favor of its purchasers. It has been used by those unfamiliar with the arts with great success. To those who are unacquainted with the book, we may say that it consists of a careful compilation of the most useful receipts which have appeared in the SCIENTIFIC AMERICAN, together with much additional information. Nearly every branch of the useful arts is represented, and almost every inquiry relating to formulæ will be found answered in its pages, making it of the utmost value in either house or factory. It is much more than an ordinary receipt book, as it gives all the standard and special formulæ, thus enabling the reader to find a receipt which fits his peculiar need. The alphabetical arrangement with abundant cross references makes it an easy work to consult. The Appendix contains the very latest formulæ, 900 in number, and in response to many requests the publishers have decided to print a small edition of the Appendix for those who have an earlier edition of the Cyclopedia. They have also prepared a very full table of contents, which will give an admirable idea of the scope of the book.

Engineering Notes.

The canal bill which was introduced in the Prussian Diet of January 12 calls for an appropriation of 389,000,000 marks, or $97,250,000.

A large corundum mill, said to be the largest in the world, is in operation at Raglan, Ontario. Fifteen tons of corundum are turned out a day, using one hundred tons of rock.

Many railroads, including the Chicago, Great Western, and the Chicago & Alton and Erie Railroad, have ceased to permit news agents and peddlers upon the trains, as it was found to be a nuisance to the traveling public.

The St. Petersburg Car Works have just finished for the Trans-Baikal line of the Siberian Railroad a fine train of five cars, which cost over $50,000. One of them is given up to first-class passengers, two to second-class passengers, the fourth is a parlor car, and the fifth a diner. They are all connected by vestibules. The furniture is mahogany, and the parlor is provided with a piano.

The men who were at work on the top of the Williamsburg tower of the new East River Bridge, New York, had a thrilling experience on January 19, when a sudden snow squall struck the city. The wind raised part of the wooden flooring and blew the boards in every direction. The men lay down and held on to everything within reach. Some of them had to discard their gloves in order to maintain a firm grip, and, in consequence, had their fingers frostbitten. After the flurry of snow subsided the men came down the rope ladder and work was suspended for the day.

The cycling industry of England is at present in a critical condition. The majority of the companies have not paid any dividends during the past year, and the outlook portends worse business in the future. It is estimated that no less than $100,000,000 are sunk in the cycle industry in England. During the past four years no less than fifty companies aggregating a capital of $25,000,000 have disappeared. The main reason for this crisis is over-capitalization, combined with reckless, dishonest trading, while the cycle, although a popular means of locomotion, is being rapidly supplanted by the motor car. The cycle firms at present in a flourishing condition make this industry only a ramification of an extensive business, so that any loss incurred by cycle manufacture is compensated by the financial success of other specialties.

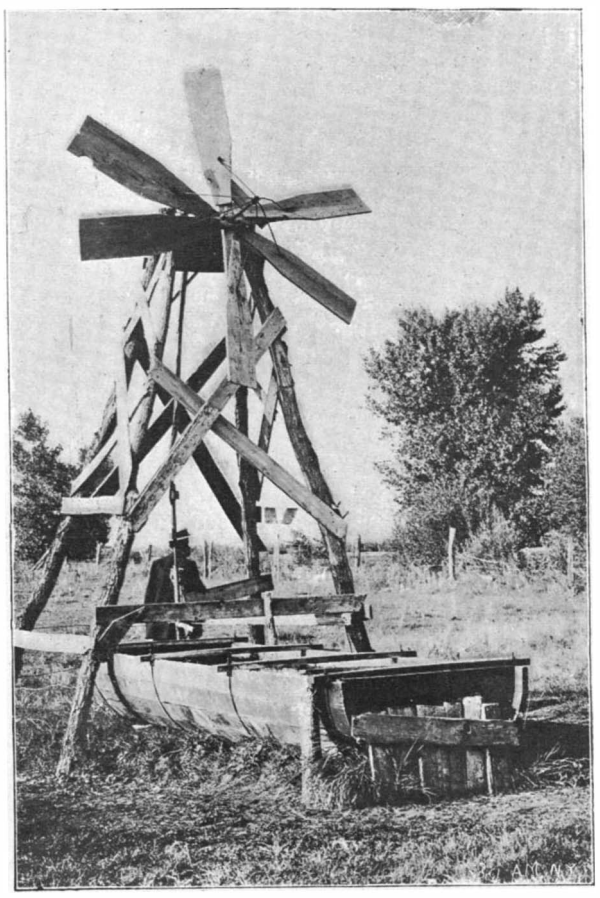
Moscow was formerly connected to Nijni-Novgorod by a waterway, but through neglect this means of intercommunication has long since been closed, owing to the filling up of the channel with sand, etc. Attempts, however, are to be made to reconstruct it. The river Moskwa a few years ago was a useless waterway, but a steamer trading company built a series of locks and dams, and have since developed a vast traffic, amounting to about 17,000,000 poods per annum, between Moscow and Kolomna. Above the latter point to Rjasan, where commences the navigable portion of the river Oka, which flows to Nijni-Novgorod, the passage of the river is obstructed by sand. It is proposed to remove this sand as much as possible, and to erect dams and locks so that a sufficient depth of water may be obtained throughout the whole of this section of the river. By this means a continuous waterway will extend from Moscow to Nijni-Novgorod. The cost of the scheme will amount to about $3,250,000.

Belgium is suffering from the effects of an acute industrial crisis, which threatens to severely interfere with the prosperity of the country. The high price of coal has necessitated the closing of numerous manufactories, and the consequent increase in the number of the unemployed. The miners, owing to their strong organization, have been enabled to enforce their demands regarding increased wages, and it is anticipated that grave trouble will result when the break occurs in the price of coal, since they will not be disposed to acquiesce to a corresponding reduction in their wages. The diamond cutters also promise considerable trouble. They have united and demand an eight-hour day without any reduction in their wages. The glassworkers have also caused severe disruption in their trade, and the result of their strike has been to direct a heavy blow at what is probably the strongest industry in Belgium. The discontent in this trade has been caused by the employment of non-union men. Owing to the strong unanimity which exists among the employes in Belgium the unions are very rich and powerful, and are in a position to defy the masters for a long time. The larger manufacturers are resisting the workmen's demands, but the smaller manufacturers, who are not in a position to maintain inactivity for any great length of time, are removing their works to other countries, where the workmen's organizations are not so potential. Unless some arrangement is shortly concluded between the masters and the men grave and extensive trouble is apprehended.

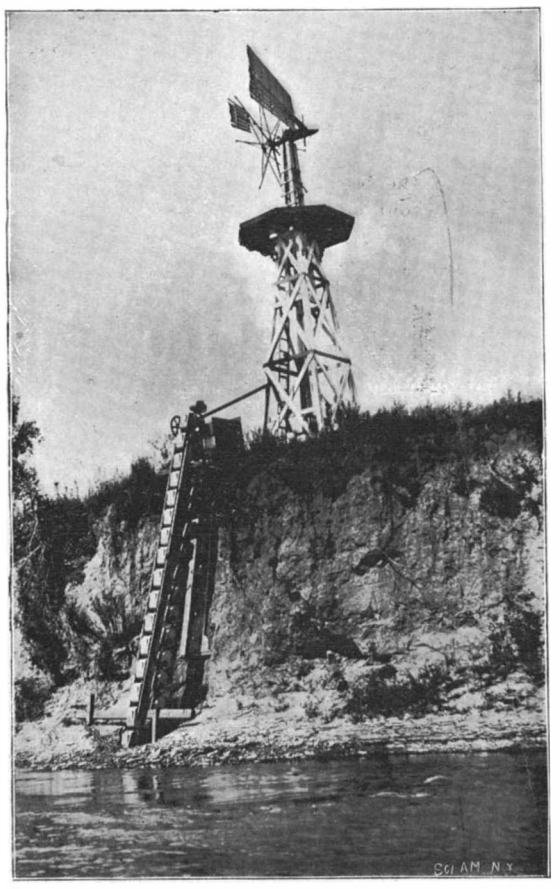
INGENIOUS WATER-WHEELS.

BY WALDON FAWCETT.

Probably the most ingenious water-wheels in the world are those that are used for irrigating purposes in the State of Nebraska, in which State, as in other portions of the Great Plains region of the West, the principal source of wealth lies in the soil. The entire section is characterized by exceptional fertility, and the agricultural possibilities would be simply boundless were it not for the insufficiency of rainfall. The strange forms of water-hoisting apparatus to be found in the West are largely the product of that necessity which has ever been the mother of invention. Frequently the farmer has found that a water-lifter of some sort was needed in each field, or at every well on the farm; but the aggregate cost of such an installation, combined with high freight rates, has precluded the possibility of the use of factory-made windmills and other too-costly devices. However, ready makeshifts of one kind or another have solved the problem. Native lumber is cheap, and inasmuch as no excessive amount of work is required, an irrigating equipment that meets every need can be supplied at a very moderate outlay.

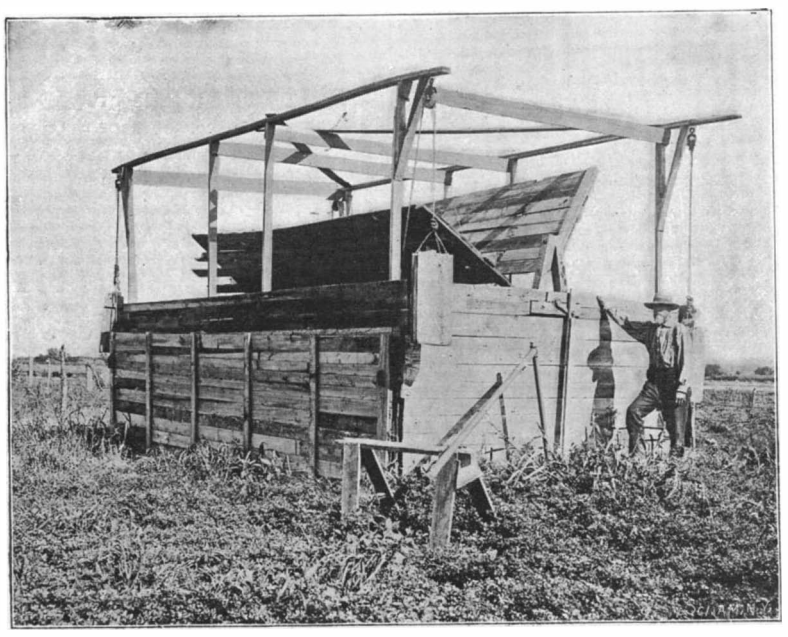


NOVEL WINDMILL, NEBRASKA.



WATER ELEVATOR ON BLUE RIVER, NEBRASKA.

There are in use on the farms west of the Mississippi almost innumerable different forms of water-lifters. These include the windlass, hand pump, windmill, horse power, gasoline, petroleum, and steam engines, endless chain buckets, current wheels of all sizes, Archimedes screws, jacketed screws, running at high speed, etc. The endless chain and bucket, of which there is a great variety of designs, is an economical and successful water-lifter that is in extensive use, possibly partly because it can be readily taken down and set up again and is not easily injured. This class of apparatus is especially adapted for short lifts. An ingenious water elevator is in use on the farm of John W. Karr near Benkelman, Neb. The apparatus was put up at very moderate expense, the chief component parts being an old link-belt elevator and a second-hand horse power with the necessary tumbling shaft. The well from which the water is taken is about 8 feet in diameter at the bottom, tapering to 5 feet above, and is tightly curbed with boards. The lift of water is not more than 14 feet, and the two horses have no harder work in lifting 27 cubic feet of water per minute than they would have in plowing. The mill has a capacity of fully 40,000 cubic feet of water per day, and this serves to irrigate more than a dozen acres of ground. A similar but larger water elevator is that of William James, near Crete, Neb. By purchasing the ordinary style buckets and chains and adapting them to his own power, this farmer managed to rig up a water elevator capable of discharging 2,000 gallons per minute, the lift being 26 feet. Horse power and steam power are used according to the amount of water needed. As an example of what may be accomplished by means of these quaint devices, it may be noted that Mr. James first began to irrigate by hauling water from the creek and sprinkling it on the land. Finding this work slow and laborious, he built the elevator above referred to and soon had fifty acres under successful cultivation.



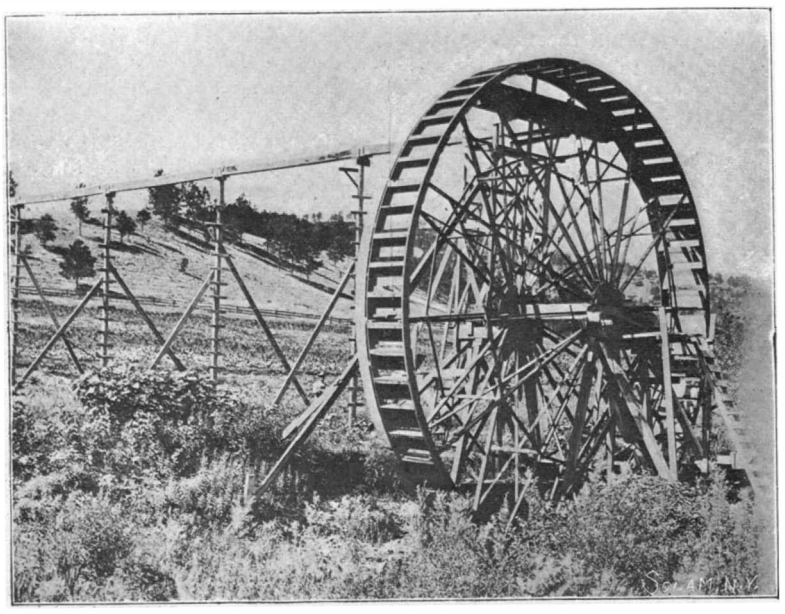
JUMBO WINDMILL AT CUSHMAN PARK GARDENS, NEBRASKA.

In localities where there are live streams with good currents, the current wheel is very common. Though changed and modernized in many ways the general plan is the same. The force of the current causes the wheel to turn, and in so doing a certain amount of water is caught in boxes or receptacles, carried to the top, and there discharged into a trough. Boxes, paint kegs, barrels, etc., are sometimes pressed into service and attached to the wheel in place of buckets. The larger current wheels which in some cases cost several hundred dollars each, are capable of doing extensive work, and are really engines of economic importance. For instance, the current wheel designed and built by David Hunter near Sutherland, Neb., consists of eight swinging troughs, each of four gallons capacity, hung to the eight paddles. These are emptied in succession as they come to the top. In Sioux County in the same State and on a branch of Hat Creek may be seen a well-built current wheel, which is 30 feet in diameter and capable of irrigating 15 to 20 acres. Farther north, at Hot Springs, South Dakota, there is a magnificent current wheel, 35 feet in diameter, which is said to yield to its owner a cash money rental of several thousand dollars annually. In the case of this apparatus the stream, although small, is very swift.

Although the name might suggest a separate designation, there are many reasons why windmills, where used for irrigating purposes, should be classed with the regular water-wheels already described in detail. In Nebraska is found the heart and center of the windmill movement. The famous Platte Valley, with its broad expanse and shallow wells, is a veritable windmill area. From Omaha west through the State, a distance of half a thousand miles, the traveler is never out of sight of one or more of these unique and interesting devices. There are almost a score of different types of home-made windmills in general use in the West, including what are known as the Jumbo, merry-go-round, battle-ax, and Holland mills, each of which may have four, six, or eight blades, and an endless variety of turbines.

The subject of novel water-lifters in their relation to irrigation enterprises in the West should perhaps not be dismissed without a word regarding a phenomenal class of wells found throughout a large portion of Nebraska, especially south of Platte River. These wells are known by various names, "blowing," "roaring," "breathing," "singing," or "weather" wells, according to the widely separated communities in which they occur. In some sections of the State, notably in Jefferson County, mounds of

30-FOOT CURRENT WHEEL ON BRANCH OF HOT CREEK, NEBRASKA.



35-FOOT CURRENT WATER-WHEEL NEAR HOT SPRINGS, NORTH DAKOTA.

earth are heaped up around the curbing and pump to check the wind, and frequently when snow is used instead the mass is speedily riddled by numerous blow-holes.

There are periods when these wells blow out for consecutive days and an equal period when they are reversed. This is tested with the flames of candles and by dropping paper, chaff, feathers, etc., into the casing to see it blown out with some force or else drawn in. When the wells are blowing audibly the water rises to a higher level than before, and when the conditions are reversed and air is drawn in, the water is lowered. In the case of many wells a reverse of the current is noticed as it is morning or evening and according as the temperature is high or low.

Experience has taught the people that the blowing of their wells is premonitory of an approaching storm, hence the name "weather" wells. The citizens have elaborated many explanations, some of them as interesting as ingenious, but the generally accepted theory is that the phenomenon is due largely to atmospheric pressure. An elaborate investigation to determine the exact character of these wells will, it is expected, soon be undertaken, under the auspices of the United States government.

THE TRUNCATED MAN.

This remarkable person, who was exhibited in Paris at the time of the Exposition, is one of the rare examples of a human being who has been from birth deprived of his arms and legs; he was born in France in the department of Morihan (Brittany), his father and mother being in easy circumstances and living upon a small farm. Both the parents are of good constitution and physically normal. Their son, now about twenty-five years of age, has no apparent trace

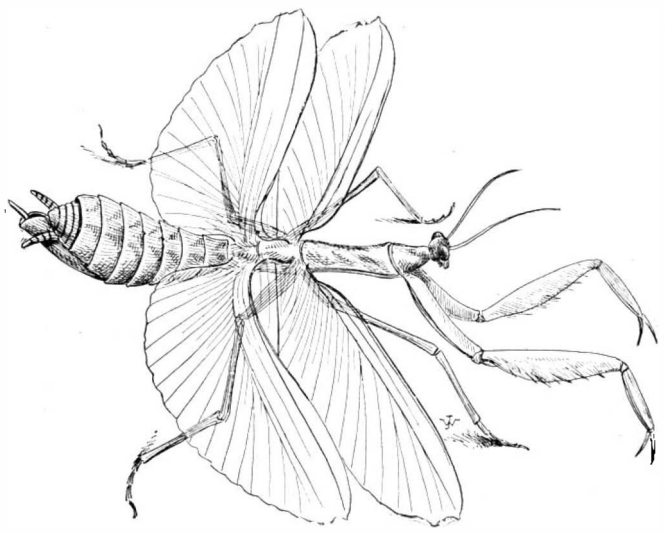
THE MANTIS RELIGIOSA—NATURAL SIZE.

of arms or legs, and hence is generally known by the name of l'Homme Tronc, or Trunk Man. Outside of this remarkable peculiarity, the rest of his body does not present any marked variations from the normal; the head is somewhat large in proportion to the body; the capillary system is but little developed, and the head shows a premature baldness. His parents have always taken great care of him, and he lives in a normal way (apart from the use of his members), as none of the essential organs of life are wanting; he eats, drinks, and digests like another person, but if left to himself he would undoubtedly die, as it is impossible for him to move his body in order to procure food. It may be thought that his condition would react upon the mind, and that he would be of a sad disposition and place but little value upon existence; on the contrary, he seems to be satisfied with life. The writer questioned him upon this point and he responded that he was quite contented with existence; he does not suffer from want of occupation, as might be supposed, as he has different kinds of work to keep him busy. One of his chief occupations is that of making small tables and chairs, and other objects, by nailing together pieces of wood which have been previously cut out for him. One of the engravings shows him engaged in this work. He takes a nail in his mouth, plants it in the wood and drives it in very adroitly; he also threads a needle with his mouth, and can take up a glass or metal cup which is given him to drink and empty it without spilling a drop. He seems to be sufficiently intelligent, without being particularly so. At the time of the Exposition he was put on exhibition in a small hall near the grounds. For two of our engravings we are indebted to Lectures pour Tous.

THE MANTIS RELIGIOSA IN ROCHESTER, N. Y.

BY N. HUDSON MOORE.

Some two years ago a farmer living in one of the nearby villages, brought into the city of Rochester some curious growths which he had found on his



MANTIS—NATURAL SIZE.

growing corn. They were identified as egg-cases of a Mantid, and were supposed to be those of the common southern variety, Stagmomantis carolina, although it was several hundred miles farther north than any specimens of this insect had been found before. The following year many more of these cases were found. Indeed, in one part of the city, near a school-house, there were so many of them that the children gathered them as playthings, and a small paper-bag full of these cases was given to a nature student for purposes of observation.

These particular cases were gathered during the winter and kept in a warm room. By Easter Sunday the young Mantids were pushing their way out, and, unfortunately for lack of proper food—flies being scarce—several hundred of these valuable insects perished. In the meantime it had been discovered that these insects did not conform to the descriptions of S. carolina, and some of the cases were sent to Cornell Experiment Station, where the young were raised. To determine accurately what species of Mantid these newcomers were, some adults were sent to Mr. Scudder, an expert, for identification.

Like everybody else he supposed at first that it was the carolina variety out of its range. But, he says, after trying to run it down to Stagmomantis, he turned at last to the Old World tables, and found at once that it was a Mantis, and by comparing specimens, the common European variety, Mantis religiosa.

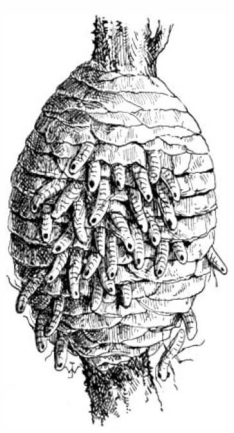
Unlike most of our European importations in the insect world, notably the cabbage butterfly and Hessian fly, this most recent addition to our fauna is a valuable acquisition. It is insectivorous and destroys large numbers of grasshoppers, caterpillars, mosquitoes, and flies. It is a most interesting insect to observe, even the egg-case itself being quite a notable affair. This is whitey-brown in color, and has a regularity that is very beautiful. Up the center of one side runs a braided effect, which seems entirely wonderful when you consider how the case is made.

The female selects some twig or stem suitable for her purpose, and emits the "foam-like" material which dries and forms the case. She holds it in position and moulds it into shape with her hind legs and the tips of her outer wings. When you hold it in your hand and observe its structure this seems hardly possible, and the eggs are not put in hit or miss, but in a definite manner.

As may be seen from the illustration the case is formed of many scale-like bands overlapping each other. They do not lie absolutely flat, but stand up a little. Underneath these scales the eggs are placed each in its cell, well protected and quite concealed from view. In our first sketch the young Mantids are seen emerging each from his own cell. They bear no resemblance at first to the mature insect, each coming out wrapped in a casing, and looking like a mummy in its grave clothes. It must take a vigorous effort for each little creature to expel itself, and it then remains quiet for several hours till this first skin is shed. After this is accomplished it appears with its full complement of legs, and looking like a tiny edition of the adult Mantis. Over one hundred and fifty were counted as they came from the case, those eggs deposited last hatching first.

It would seem as if each female had done her duty in making and filling one of these cases, but the same one has been known to make two, and one specimen made three, the last one being small and quite irregular, and then she died.

Like other members of the order Orthoptera (which includes the walking-sticks and grasshoppers), these insects are often difficult to distinguish from the leaves or bushes when they lie in wait for their prey. The Mantis away from its leafy surroundings is showy and large. Its body is long and slender, the first segment of the thorax being of unusual length. Its front legs are powerful members, armed with stout hairs which assist in holding its prey.



EGG CASE—NATURAL SIZE.

Some of the adults are brown, some a leaf green, apparently without regard to sex. They often remain in the same position for hours, with the front legs raised in the attitude of prayer—hence the name—waiting for the first unwary insect which comes within reach. If the insect does not come within seizing distance they crawl, or rather sidle slowly toward it, and then make a quick pounce, holding the insect firmly in the strong front claws, while it is eagerly devoured. Grasshoppers seem a particularly agreeable diet, and one Mantid will easily dispatch three or four at a meal, beginning at the head and working backward, discarding only portions of the hind legs, wing-tips and some of the internal organs.

We had two of these Mantis in a cage for observation. They lived there peaceably for several days, fed on a diet of flies and beetles. Just before leaving them for the night several fresh flies were added and matters seemed all serene. Whether a quarrel came up in the night, or whether the fly diet proved unsatisfactory one may not say, but the next morning the green Mantid was monarch of all she surveyed, and in one corner of the cage were a pair of brown forelegs. She probably

The Toilet.

Taking an Airing.

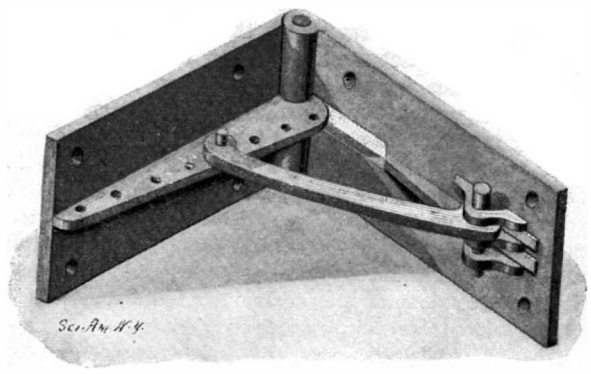
Making Toy Furniture.

THE TRUNCATED MAN.

found them too tough. Notwithstanding their pacific name these insects are fierce fighters, and it is in battle chiefly that the female uses her wings. Then she raises them and springs upon her foe. The loss of a head, or a leg or two, or even a portion of the body does not quench the fiery nature of a fighting Mantid, but they may go on battling in this condition for hours. The females are the larger and hence have an advantage over the males, often devouring her mate as he advances to court her.

The Mantidæ are a venerable family, the name Mantis meaning prophet. According to Anacreon they foretold the coming of the spring, and holding up their forefeet in prayer, were ever supplicating the gods.

Almost all Oriental nations have legends about this singular insect, and in South Africa they are known as the Hottentot's God. The Hindoos venerate its



A LOCKING-HINGE.

supposed powers of sanctity and soothsaying, and indeed wherever this insect is found are also found superstitions which make the killing of one a crime. If one is found in a position of danger it is always carefully removed out of harm's way. Even the "unspeakable Turk" recognizes what greatly resembles an attitude of prayer, and accordingly treats it with respect and attention, believing it a fellow-worshiper with himself.

The only sound we have observed it to make is a sort of scraping. This is caused by rubbing the wing with the hind leg, and seems to be somewhat of the nature of a call to battle.

It is not likely that it will ever be absolutely determined how this valuable addition to our insect inhabitants was brought to Rochester. This city is one of the greatest nursery centers in our country, and young trees and plants are imported in great quantities. Whether the insect came in its adult state, or whether some egg-cases were the means of its introduction, will probably never be known.

It must have been here several years before it was first noticed, for it is found in considerable numbers, and is slowly increasing its area. It has crossed the Genesee, and we found this fall a number of cases in one of our parks, placed as high as four feet from the ground. The egg-cases are made in August, survive the winter and are hatched out the following May, so the greater part of the insect's life is spent in the egg. While it is in the adult state, however, its industry is untiring.

It is interesting to note that in a large nursery near Philadelphia another Mantid has become established. This is an Oriental variety, and a native of China and Japan. Its value is known, and it is carefully protected so that it may increase.

There is no reason why the Mantis religiosa should not gain a firm foothold in this country. Geographically it is five or six degrees south of what is its northern limit in Europe. Every creature which helps even in a small degree to keep down the many insect pests like grasshoppers, mosquitoes, and flies, should be encouraged, and we are prepared to welcome this stranger within our gates and make him feel at home.

Telephoning Without Wires.

M. Gautier announces that the first step has been made in the discovery of wireless telephony. He ascribes the discovery to M. Maiche, the French inventor, and the experiments were carried out in the forest of St. Germain. The transmitter was placed in a house on the outskirts of the forest, and it was connected with the earth in the same manner in which lightning rods are connected. Two iron posts, ninety feet apart, connected by wire, were planted in the ground about a thousand yards distant. Voices and other sounds at the transmitter were clearly heard at an ordinary telephone receiver attached to one of the posts. M. Maiche claims that the communication is in a straight line and not by wave current, but by a circuit current, thus enabling a given spot to be aimed at. If the receiver is not placed exactly in the direction given at the current, there will be no transmission, and receivers on either side of the line of transmission will not be at all affected.

A NOVEL HINGE.

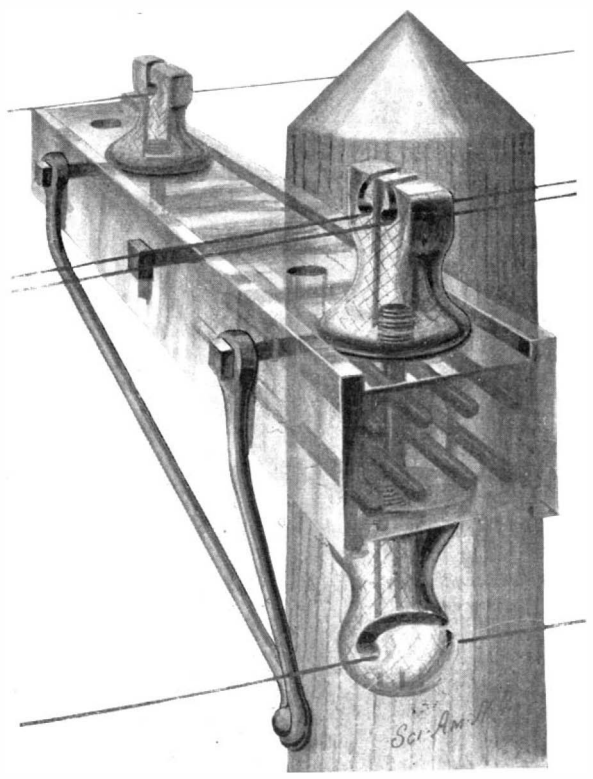
In order that a door may be locked at any point desired, Thomas Wright, of Rome, Ga., has invented the hinge shown in our illustration. One half of the hinge is provided with three superposed lugs, between the upper two of which one end of a lever is pivoted. The other end of the lever carries a pin which can be inserted in one of a series of holes formed in a strip on the other leaf. By inserting the pin in the proper opening of the strip, the door is held open at the proper angle.

Electrical Resistance Metal.

Among the work recently carried on at the Government Physico-technical Institute of Charlottenburg (Berlin) is the study of a new alloy composed of copper, zinc and aluminium, which appears to possess specially good properties for standard electrical resistances. The alloy has somewhat the appearance of brass, and is made by a manufacturer at Achenrain, in the Tyrol. A metal, to be of value in electrical resistance work, should have a high specific resistance and the coefficient of change of resistance with temperature should be as small as possible; the metal should not form a thermo-electric couple with copper or brass sufficient to interfere with the measurements. The tests made with the new alloy show that its specific resistance is high, lying between 51.70 and 54.08 microhm-centimeters, according to different samples. The temperature coefficient between 18 and 25 deg. centigrade is very small and negative (the metal decreasing in resistance with a rise of temperature); the coefficient lies between the limits —0.00001 and —0.000002. Measurements of the electrical resistance made between —4 deg. and + 60 deg. show that the alloy has a maximum of resistance in the neighborhood of 20 deg. centigrade; at low temperatures the coefficient has a small positive value, and at high temperatures a small negative value. The thermo-electric action with copper is very small, this having been found to equal 0.56 microvolt between 20 deg. and 45 deg. centigrade and 0.60 between 20 deg. and 65 deg., for a difference of one degree between the temperature at the joint; this value is exceptionally small, and is less than that of manganin, which is one of the best resistance alloys, the latter giving 1.3 microvolt under the same circumstances, while constantin gives as high as 40 microvolts. As to the change of resistance with time, which is another factor of a resistance metal to be considered, this can only be determined after a sufficient period has elapsed. On the whole, the experiments show that the new alloy possesses valuable properties for the construction of electrical resistance standards, especially for laboratory measurements requiring great accuracy.

A NEW FORM OF INSULATOR.

Insulators made of glass or other fragile material often fall apart when broken and drop the wire. To



THE WOOLBERT INSULATOR.

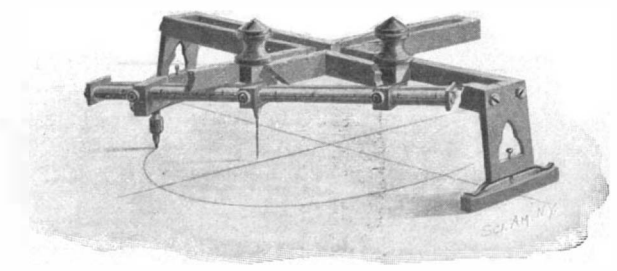
remedy this evil, Henry W. Woolbert, Box 690, Pittsburg, Pa., has patented a glass insulator comprising two blocks or heads, the upper of which is formed with two incut openings for two wires, and the lower of which is formed with a single incut opening for receiving a single wire. Embedded in each block is a woven wire frame and wires or metal strips. The blocks are secured to a glass arm in which sustaining-wires or metal strips are placed. The device employed for securing the blocks is a screw-threaded glass bolt, through which wires or metal strips are passed.

By this construction the metal supporting devices are completely insulated from the electric wire. Should any of the glass parts be broken or cracked, the supporting devices will still hold them together.

AN INSTRUMENT FOR DRAWING ELLIPSES.

An ingenious instrument has been devised by Gertrude M. King, of Nantucket, Mass., for describing ellipses with a pen, pencil or cutter.

The instrument consists of a slotted frame, in the shape of a Maltese cross, supported by springs on two standards, so that it can be pressed toward the drawing surface and can return automatically. Beneath the Maltese cross a scribing beam is attached, consisting of two parallel arms, serving as runners for three blocks. The center block, held in place by a screw, covers a needle. The left block can be adjusted along the scribing-beam and clamped by a thrumb screw. The right block, carrying the drawing tool, is also adjust-



AN ELLIPSOGRAPH.

able, and can be clamped in any position. The left and center blocks are provided with slide-blocks arranged to move longitudinally in the slots of the Maltese cross.

In using the instrument, two lines are drawn at right angles upon the paper. The right block is then adjusted so that its distance from the left block is equal to one-half the minor axis of the desired ellipse; and the center block is then adjusted until its distance from the right block is equal to half the major axis of the ellipse. The instrument is then arranged with the center point over the intersection of the major and minor axes of the ellipse. The scribing beam is moved with the right hand, while the instrument is pressed with the left. By varying the pressure a light or heavy mark is made. When the pressure has been released, the Maltese cross is carried up by the springs of the standard, so that the drawing tool is removed from the paper.

Count von Zeppelin Honored.

Count von Zeppelin recently delivered a lecture before the Colonial Society in Berlin. He was authorized to announce that the Order of the Red Eagle had been conferred on him, and read a letter in which the Kaiser, after describing Count Zeppelin's achievements as constituting an epoch-making advance in aerial navigation, stated his intention to support the inventor in further experiments by placing the advice and experience of the Balloon Division of the army at his disposal whenever he might desire. Count Zeppelin has certainly earned his decoration, and it is gratifying to see an inventor of a machine for aerial flight so honored, as he necessarily had to brave ridicule for years. Count Zeppelin was very candid in his lecture. He did not disguise the drawbacks of the system—the enormous size of the airship, carrying such a quantity of gas, and the delicate nature of the material of which the ship was constructed—but the fact remains that his airship has successfully attained a great height, carrying with it, in addition to the crew and ballast, provisions sufficient to last over ten days.

Count Zeppelin also has the distinction of having taken part in the famous cavalry raid, in 1870, which was the first blow in the Franco-Prussian war.

The Scientific American an Educator.

For more than half a century the Scientific American has been recognized as an educator for the old as well as the young. It is particularly gratifying to feel that the youth of the land are being reached and benefited. The following letter was received recently from Mr. G. B. Royer, of Elgin, Ill.:

"A long story short is this: My son, eleven years, over one year ago could not be interested in his school work. We had tried every means. Just why, I cannot say, but one year ago I ordered the Scientific American in his name. He was interested, became studious, and did so well that his teacher called to ascertain what had been our remedy. I thought I could not afford the paper for the coming year, and my son has earned the money, and wishes to have his Scientific American continued another year. Please send January numbers."

Judgment in Technical Matters.

In the course of a paper recently read before the Technical Society of the Pacific Coast, by Mr. George W. Dickie, of the Union Iron Works, San Francisco, the author put in an eloquent plea for the exercise of more judgment by technical experts who are appointed to supervise, for the firms or the government that they represent, the construction of work in manufacturing establishments. Mr. Dickie says that he does not know a single university that has a chair of common sense, and that, in trying to account for this omission, he can think of but one reason, and that is the impossibility of finding a man to fill such a chair. The author of the paper protests against the hard-and-fast interpretation which inspectors almost invariably put upon their "book of instructions," and complains that, too often, suggestions offered by the manager of the contracting works, looking to improved methods of executing the details of the contract, are received in an attitude of suspicion, and that these suggestions, in spite of obvious mutual benefit to both parties concerned, are often rejected merely because they do not conform to a literal interpretation of the contract. Mr. Dickie quotes the instance of a small marine boiler, which his firm was building for the Treasury Department, under a very strict specification. Finding that it would be better to weld the plate forming the sides of the combustion chamber—because the riveted seam, as shown in the drawing, came in the way of the stays—he recommended a change, and, the inspector agreeing with him, the plate was welded instead of riveted. A slight waste in heating resulted in the plate being 1-32 of an inch thinner at the weld than in the body of the plate. At the completion of the job, the inspector, finding that the plate was slightly thinner at this point, rejected it under instructions from Washington, although, as a matter of fact, the welding had raised the strength from 67 per cent of the plate, if riveted, to 92 per cent, as welded. This is quoted as an instance, not of the desire of the inspector to cause a loss to the contractor, but simply of a failure on his part, or on the part of his superiors, to apply sound judgment to the question before them.

We agree with Mr. Dickie that, in such cases as the above, considered by themselves and apart from the general principle of inspectorship over contracted work, there is a lack of good judgment; and, no doubt, there are cases when, if the inspectors were allowed a freer hand and the exercise of individual judgment, there would be a saving of cost and vexation to both parties to the contract. On the other hand, it would be a very easy matter to run to extremes, and entirely neutralize the value of inspectorship by giving to the inspector a license for the exercise of his judgment which would enable him practically to supersede a written contract. Such extreme cases as the one quoted above must be regarded as the accidental defects in the working of a system which, broadly considered, is admirable. As between an inspectorship which is rigidly bound to a literal interpretation of a contract and an inspectorship which is entitled to interpret the contract according to its own individual judgment, we think that the former is certainly the preferable extreme. Mr. Dickie's article, which is published in full in the current issue of the SUPPLEMENT, makes out a strong argument in favor of a middle course, in which the inspector, while guiding himself broadly by the contract, is ready to depart from its literal text where one or both parties to the contract would be benefited and the interests of neither assailed.

A Locking Device for Automobiles Wanted.

Quite a number of accidents have occurred with automobiles by reason of unauthorized persons attempting to operate them while they are left at the curb. Some makers of horseless carriages have provided various forms of locking devices, which seem to work admirably, but in most cases there is no reason why a person who is familiar with the particular type of automobile could not operate the carriage. Of course, in certain types of electrical carriages, special locking devices have been provided, which are controlled by a key similar to a door key, but for many other types of horseless vehicles there is really no guarantee that the carriage will not be tampered with. Some carriages are provided with means by which the switches or valves cannot be operated until the driver resumes his seat; but, of course, a device of this kind is only valuable to prevent the carriage starting accidentally, as, for example, when it was run into by another vehicle. The subject is an interesting one, and affords a considerable field for invention. All carriages should be required by law to have some safety device by which the public will be protected from the dangers of a carriage set into motion by unauthorized or mischievous persons.

The Current Supplement.

The current SUPPLEMENT, No. 1311, has a number of articles of unusual interest. "Primitive Huts of Ostia" and "The Farnese Theater at Parma" are very attractive illustrated articles. "The American Patent System" is a subject of a most important paper by Commissioner of Patents Duell, and it contains very valuable information and statistics. From it we find that Mr. T. A. Edison has received, between the years 1872 and 1900, 742 patents; Francis A. Richards, 619, and Elihu Thomson, 444 patents. "The Prepared Mustards of Commerce" gives a number of formulas. "The Bureau for Testing Paper at the Paris Chamber of Commerce" is accompanied by a number of engravings. "Compulsory Rotation or Positive Driving" is by Prof. C. W. MacCord. "On the Need of Education of the Judgment in Dealing with Technical Matters" is by George W. Dickie. "The Panhard-Levassor Automobile" is accompanied by a most elaborate series of engravings showing the details of mechanism of a racing machine. "The Engineering Works of the Suez Canal" is a valuable treatise. "The Burning of a Baku Oil Depot" is of particularly timely interest, owing to the recent conflagrations.

Contents.

(Illustrated articles are marked with an asterisk.)

RECENTLY PATENTED INVENTIONS.

Mechanical Devices.

FRUIT-PICKER.—GERHARD L. THUNEN, Oroville, Cal. This fruit-picker consists of two pivoted members, one of which is spring-controlled and constitutes a cutter. The device is to be secured to the first two fingers of the hand in a convenient position over the palm. The cutter-blade is operated by the thumb, so that the stem of the fruit can be readily cut.

APPARATUS FOR FORMING PLATE OR SHEET GLASS.—LAWRENCE H. DOLAN, Pendleton, Ind. By means of this apparatus it is possible to form curved, corrugated or flat sheet and plate glass without the use of a blowing-tube, or without the necessity of pouring the molten glass upon a bed-plate or into a mold. The principle of the invention consists in drawing a wide or narrow sheet or plate of glass from a reservoir containing molten glass; controlling the temperature of the glass as it is in process of formation into a plate or sheet, upon an appropriate forming plate supported upon a frame; and providing means for truing the side edges of the glass sheet or plate and also means for detaching the cooling plate or sheet from the mass of glass in the reservoir.

BOX-MAKING MACHINE.—CARL ENGBERG, St. Joseph, Mich. The machine forms boxes from an endless sheet of paper, metal or other material, and is so constructed that the box blanks are successively cut, their sides and flaps folded into position to form the box body and united by staples, and the finished box discharged from the machine. The box-blank is formed by dies between which the stock is passed by the action of an intermittent feed. A folder receives the box-blank from the device, which folder comprises a form and a reciprocating cross-head. Stapling devices on opposite sides of the folder drive staples through the box sides and flaps.

HOISTING-MACHINE.—EDWARD C. REITER, Rockville, Conn. The purpose of the invention is so to arrange a hoisting-machine that, when the drum is not rotating, the load on the hoisting-cable can be supported and held at any desired point without danger of lowering the load. The mechanism by which this result is attained consists essentially of a crown-wheel carried by a frame mounted to rotate on the hoisting-drum shaft, and a gear-wheel mounted to deflect and to engage two rows of teeth on the crown-wheel. The movement of the drum causes the deflection of the wheel.

CARVING AND ENGRAVING MACHINE.—ATTILIO STIRIA, Manhattan, New York city. The object of the invention is to provide a reproducing machine for carving wood, according to a given pattern, but of different proportions. A triangular frame is hung at one apex by a universal joint. One of the sides of this frame is provided with two rectilinearly-moving slides, carrying respectively the tracer and reproducer-tool. A graduated arm is pivoted to another apex of the triangular frame and is adjustably connected with the tracer slide. An extensible link is adjustably connected at one end with a graduated arm at a point between its pivot and the tracer-slide, and is connected at its other end with a reproducer-slide. The tracer can be readily moved over the pattern by reason of the universal joint. As the slide carrying the reproducer-tool moves in accordance with the movement given to the tracer-slide, an exact reproduction of the pattern is made on the face of the wooden block.

RAISIN-SEEDER.—FRANK H. PETERMAN, Manhattan, New York city. The raisin-seeder has an impaling-pin cylinder, an endless woven fabric, and guides to direct the fabric to and from a portion of the cylinder to engage the impaling-pins and to travel with them during part of the revolution of the cylinder. A deflector between the impaling-pins and the guides disengages the fabric from the impaling-pins. The deflector serves to direct the removed pulp to a receiving-box. Thus the seeds are forced out, without unduly tearing the raisins.

BREAK-LEVER LOCK FOR GUNS.—JASPER L. ACKERMAN, Monon, Ind. In a previous patent granted to Mr. Ackerman, a means for locking the lever of a breech-loading gun was described by which the break-lever was prevented from being opened unless the owner of the gun so desired. In that device a bolt entering the lever was actuated by a rotary barrel turned by a detachable key. In the present invention the same result is accomplished by causing an external slide to lock the lever either through a bolt or by direct engagement, or both, and by so organizing the slide that the safety of the hammerless gun is secured.

CLOTHES-WASHING MACHINE.—WILLIAM M. THOMAS, East Chicago, Ind. This machine for washing clothes is characterized by its simple and inexpensive construction and by its rapid and efficient operation. The machine is so made that all parts can be duplicated or readily repaired, and that the clothes cannot be torn during the operation. The water can be drawn from the tub while the clothes are in the machine, and fresh water supplied. All parts can be readily removed when the machine is to be cleaned.

Miscellaneous Inventions.

APPARATUS FOR FLUE-DUST CONDENSATION.—RUDOLPH RUETCHI, Argentine, Kan. The invention relates to appliances for mechanically precipitating and collecting the solid matter contained in the fumes arising from metallurgical plants. The fumes pass through a cooling device having narrow chambers, spaced to form a circulating air-space. With the cooling device, a mixing device is connected into which the fumes from the cooling device pass to equalize their temperature. A suction-fan is connected with the mixing device; and cooling and precipitating cylinders are each connected with a discharge-pipe leading from the fan. Each cooling and precipitating device has a circular water-jacketed channel into which opens the discharge-pipe from the fan. The channel itself leads into a water-jacketed discharge-pipe which carries off the exhaust-gases. Valved-discharge hoppers receive the solid matter from the channel and discharge-pipe.

TEMPORARY BINDER.—CHARLES V. HENKEL, Manhattan, New York city. This invention is a temporary binder designed especially for holding the leaves of a perpetual ledger, that is to say, of an account-book, the leaves of which are removable, so that the same book serves indefinitely for a number of prolonged accounts. The binder has a body on which two clamping sections slide toward and from each other. Guide members are fastened by one end to the corresponding clamping sections, these guide members having a permanent sliding engagement with each other so that they form an unbroken holder for the leaves regardless of the positions of the clamping sections. Each clamping section has an opening, such openings serving to receive the free ends of the guide members to permit these free ends to pass the inner faces of the clamping sections, when the clamping sections are moved together.

DIAL FOR SPRING-SCALES.—FLORENTINE L. KELLOGG, Santa Barbara, Cal. The weighing-scale comprises a casing, a platform, a spindle, projecting from the casing, a pointer on the end of the spindle, and a fixed bearing on the spindle, having a screw-fitted outer end. A dial is mounted to turn upon the bearing and the pointer plays over the dial. A washer on the bearing engages the dial. By means of a nut screwing on the bearing the washer can be forced with more or less pressure against the dial.

HAT-STRETCHER. JOHN F. KENNEFICK, Cripple Creek, Colo. The hat-stretcher comprises sections having outwardly projecting top and bottom walls and vertical rollers mounted to rotate between the walls. By reason of this construction strain is exerted in all directions.

TOE-CLIP.—ARNOLD M. BALDWIN, Santa Cruz, Cal. This bicycle toe-clip is so arranged in relation to the pedal that it will fit over the instep of the rider, thus providing a good purchase for an upward pull on the up-stroke of the pedal. A wear-plate is furnished with the clip, which wear-plate is designed to relieve the pedal from undue wear by rubbing of the rider's foot.

DEVICE FOR TEACHING ARITHMETIC.—THOMAS E. BORDEN AND ALFRED A. WALLACE, Minturn, Cal. By means of this device a large number of examples can be readily formed. In a support or frame, rollers are journaled wi[illegible] a series of tapes bearing numbers[illegible] these numbers varies progre[illegible] another toward one en[illegible] ferent tapes will afford[illegible] arithmetical problems of increa[illegible] The device can be used for problems in[illegible] fractions.

SEE-SAW, MERRY-GO-ROUND, AND LAWN-SEAT.—FRANK L. WRIGHT, Nyack, N. Y. The inventor has devised a see-saw so constructed that the teeter-board has not only a vertical pivotal motion, but also a horizontal motion, a ball and socket connection being provided between the teeter-board and its support to secure both motions. By hinging or pivoting legs to the under side of the board a lawn-seat is formed.

PORTABLE PHOTOGRAPHIC DARK-ROOM.—ALBERT WERNER, Arena, N. Y. Mr. Werner has devised a very convenient dark-room which will probably be extensively used by traveling photographers. The dark-room comprises a main box, having a flexible hood secured around an opening in the top of the box. Sleeves of flexible material are secured around openings in opposite sides of the box. The box is provided with openings in its sides, normally closed by slides. Auxiliary boxes, open only at one side, can be inserted in these openings when the slides are removed, so as to extend outwardly from the main box. These auxiliary boxes are used only for developing large plates.

METHOD OF MAKING SILICO-FLUORIDS.—WILLIAM C. SELLAR, 119A Mount Street, Berkeley Square, London, England. Calcium fluorid or fluorspar is fused together with dry calcium chlorid, the resulting cooled mass being then ground in a dry state and mixed with silica or a suitable silicate. The inventor has found by experiment that the yield of silico-fluorids is much greater when calcium chlorid is added and that within certain limits an increase of the calcium chlorid relatively to the calcium fluorid increases the production of silico-fluorid.

BUTTON.—FRANCISCO CLARK, Durango, Mexico. The invention is an improved button of the type in which a hinged head is employed so as to secure a simple and efficient construction in which the head is capable of assuming two different positions—an inserting position, in which it is readily movable, and a securing position in which it is practically locked. The improved button comprises a main head having a shank, a hinged head connected with the shank, and a locking-plunger mounted to slide lengthwise on the shank.

FASTENING DEVICE FOR BUTTONS.—JOSEPH NEVINS AND JOHN E. WHITE, Manhattan, New York city. The inventors have provided a fastening device applicable to any shank-button, which device can be covered with the same material as that from which the garment is made. For example, upon military uni-

forms it is advisable to conceal bright buttons on occasions; and these buttons the device is especially designed to hold in place. The fastening device is so constructed that the button is not liable to work loose.

CARTRIDGE-CARRIER.—Dr. Edward T. Gibson, U. S. A., Fort Harrison, Helena, Mont. The invention provides a body-band having pockets for supporting frames or cases for cartridges, which are so arranged on the band that a large supply of ammunition can be carried. The body-band for carrying the cartridges is to be worn suspended across the body from the left shoulder as a bandoleer, portions on the front of the soldier's body being brought to an angle to each other, so that the soldier can extract his ammunition with greater ease than was possible with bandoleers hitherto constructed. The body-band is, therefore, a combined belt and bandoleer.

STOVE.—Ernest C. Cole, 3218 Western Avenue, Chicago, Ill. A casing has a top plate above the firepot and a hot-air chamber above the plate. Opposite pipes in fixed relation to and extending through and supported by the top plate open into the chamber above the plate. These pipes depend from the plate, extending into the firepot, and point in the same circumferential direction to produce a rotary blast action over the fire. By the use of this invention the pipes are not so apt to burn off as when a single tube is employed.

NON-REFILLABLE BOTTLE. — John S. Haggerty, Astoria, Queens, New York city. The neck of the bottle is provided with adjacent enlargements. At the bottom of the neck a valve can be seated. A plug or stopper secured in the neck extends past one enlargement and into the next. The plug or stopper has a longitudinal bore and an exterior enlargement at its upper portion, in which enlargement marginal recesses are produced at the top and bottom. The two series of recesses are alternately placed.

ELEVATED RAILWAY.—John W. Gonce, Kinderhook, Ala. This elevated or suspension railway is particularly adapted to fill the wants of communities where there is not enough traffic to justify the construction of a surface railway. The road can be cheaply constructed over level or hilly country, and requires very little repair. Either single or double tracks can be employed, so designed that a uniform tension can be maintained in the tracks and supporting-cable, during the varying changes of the seasons. This result is secured by deflecting the track laterally at intervals from a straight line.

EXHAUST-MUFFLER FOR AUTOMOBILES AND STATIONARY ENGINES.—Loomis Automobile Company, Westfield, Mass. The Loomis muffler for deadening the exhaust of hydrocarbon-motors is made of aluminium and asbestos. In this muffler the exhaust is first cushioned upon itself so that it shall have its own free action, and is then expanded twice in small mufflers and three times in large mufflers. Between each expansion, apparatus is placed to change the gas to a stream. Upon its final expansion into the atmosphere, the gas is still further changed in its nature to a practically steady stream. Various sizes of these mufflers are running on Loomis automobiles, and the noise is so reduced that in the large mufflers used upon delivery wagons, each valve of the engine can be plainly heard as it seats itself. Upon the smaller carriages the driving chain makes a greater noise than the exhaust. These mufflers are thoroughly well made and are noteworthy for their neat machine work; for they must be perfectly gas tight in order to obtain the results.

Note.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

NEW BOOKS, ETC.

Kant's Cosmogony. As in his Essay on the Retardation of the Rotation of the Earth and his Natural History and Theory of the Heavens. With introduction, appendices of Thomas Wright, of Durham. Edited and translated by W. Hastie, D.D. Glasgow: James Maclehose & Sons. New York: The Macmillan Company. 1900. 12mo. Pp. cix. + 205. Price $1.90.

Kant's work in the field of speculative philosophy has so completely overshadowed his scientific labors that the true value and startling originality of his "General Natural History and Theory of the Celestial Bodies" have been fully appreciated only by a few modern physicists. The originality of Kant's cosmogonic hypotheses, it is true, may be disputed; the brilliant work of Laplace has to a certain extent eclipsed the Konigsberg philosopher's labors. None the less the theory propounded and explained in the present translation has received the scientific approval of men of the critical acumen of Thomas Huxley and Lord Kelvin. We have not compared Dr. Hastie's translation with the original, but from its lucidity of expression we fancy it is somewhat less difficult reading than the obscure exposition for which the German in which Kant's philosophical works are couched is notorious. Dr. Hastie's introduction is a shrewd analysis and estimate of Kant's cosmogony, and is in part composed of opinions of Kant's work delivered by the world's foremost physicists past and present.

Business and Personal Wants.

READ THIS COLUMN CAREFULLY.—You will find inquiries for certain classes of articles numbered in consecutive order. If you manufacture these goods write us at once and we will send your name and address to the party desiring the information. **In every case it is necessary to give the number of the inquiry.**

MUNN & CO.

Marine Iron Works. Chicago. Catalogue free.

Inquiry No. 1.—Wanted the name and address of a manufacturer of double and single gasoline burners of the kind in which a little gasoline is allowed to run into a small cup attached to the burner to produce heat in the same before using.

"U. S." Metal Polish. Indianapolis. Samples free.

Inquiry No. 2.—Wanted the name and address of a manufacturer of porcelain placques with pictures inside similar to buttons now used with photographs on same. The are the size of a small saucer.

WATER WHEELS. Alcott & Co., Mt. Holly, N. J.

Inquiry No. 3.—Wanted the name and address of a manufacturer or dealer in fancy wood marquetry for inlaying purposes.

Yankee Notions. Waterbury Button Co., Waterb'y, Ct.

Inquiry No. 4.—Wanted the name and address of a manufacturer of portable gasoline motors mounted on wheels,

Handle & Spoke Mchy. Ober Mfg. Co., 10 Bell St., Chagrin Falls, O.

Inquiry No. 5.—Wanted the name and address of a manufacturer of spring motors of one or more horse power.

Rigs that Run. Hydrocarbon system. Write St, Louis Motor Carriage Co., St. Louis, Mo.

Inquiry No. 6.—Wanted the name and address of a manufacturer of acetylene gas engines for automobiles.

Inventions developed and perfected. Designing and machine work. Garvin Machine Co., 141 Varick St., N. Y.

Inquiry No. 7.—Wanted the name and address of a manufacturer of aluminum sheets suitable for strainers.

By mail, $2—Goldingham's new book, "The Design and Construction of Oil Engines." Spon & Chamberlain, 12 Cortlandt St., New York, U. S. A.

Inquiry No. 8.—Wanted the name and address of a manufacturer of aluminum rivets.

The celebrated "Hornsby-Akroyd" Patent Safety Oil Engine is built by the De La Vergne Refrigerating Machine Company. Foot of East 138th Street, New York.

Inquiry No. 9.—Wanted the name and address of a manufacturer of automatic speed controllers for hand power elevators.

The best book for electricians and beginners in electricity is "Experimental Science," by Geo. M. Hopkins. By mail, $4. Munn & Co., publishers, 361 Broadway, N. Y.

Inquiry No. 10.—Wanted the name and address of a manufacturer of rapid photographic instruments that will photograph, develop and finish entirely in the shortest possible time, of half a minute, if possible, for making abstracts of legal records in a county seat.

La Porte Watch School, La Porte Ind, Catalogue free.

Inquiry No. 11.—Wanted the name and address of a manufacturer of duplicating apparatus to copy and make duplicates of records.

Inquiry No. 12.—Wanted the name and address of the manufacturer of the Merritt Typewriter.

Inquiry No. 13.—Wanted the name and address of a manufacturer of autographic supplies.

Inquiry No. 14.—Wanted the name and address of a manufacturer of small hand power ice making machines for domestic use, making from 50 to 100 pounds at a time.

Inquiry No. 15.—Wanted the name and address of a manufacturer of apparatus that can be attached to any ordinary printing press, and render the latter useful as a color printing machine.

Inquiry No. 16.—Wanted the name and address of a manufacturer of a complete plant for cleaning carpets, or machinery therefor.

Inquiry No. 17.—Wanted the name and address of a manufacturer of small burners such as are used on brazing and soldering forges, using gasoline.

Inquiry No. 18.—Wanted the name and address of manufacturer or dealer in large colored photographs of scenery of Switzerland, the Alps and the Rocky Mountains.

Inquiry No. 19.—Wanted the name and address of a manufacturer of a dredge wherein the shovel opens and shuts like a clam shell, to be used for handling gravel.

Inquiry No. 20.—Wanted the name and address of a manufacturer of thermometers for measuring temperatures from 300° to 1000° Centigrade.

Inquiry No. 21.—Wanted the name and address of a manufacturer of pearl button machinery.

Inquiry No. 22.—Wanted the name and address of a manufacturer of machinery tools and material for manufacturing traveling bags, dress suit cases, etc.

Inquiry No. 23.—Wanted the name and address of a manufacturer of a small liquid air plant suitable for butcher shops, etc.

Inquiry No. 24.—Wanted the name and address of a manufacturer of parts and complete models of small steam engines and locomotives.

Inquiry No. 25.—Wanted the name and address of a manufacturer of acetylene lamps suitable for parlors and household use.

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Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(8049) E. T. W. asks: Suppose a telegraph wire was allowed to rest on iron from one end of the line to the other, would that interfere in sending messages? A. No message can be sent over a telegraph wire which rests on iron. The wire must be insulated from the earth at every pole or support. The insulators are either glass or porcelain.

(8050) E. C. H. asks: 1. Can the armature of a small shunt-wound dynamo be connected to collector rings so as to generate an alternating current? A. A direct current dynamo may have collector rings connected to opposite points on its armature coils, and the current taken off these rings will be alternating. The output of the dynamo will not be affected by the change. Of course, the field must be excited from an external source of current. 2. What does the word "cycle" mean when used with reference to electricity? A. The word "cycle" in an alternating current refers to the number of complete reversals per second.

(8051) D. E. R. asks: 1. In what respect is a motor run by a battery different from one run by a dynamo? A. A motor run by a battery does not differ in any respect, electrically, from a motor run by a dynamo. As the current from a dynamo is usually of a higher voltage, the motor run from a dynamo must be wound to a higher resistance than the one to be run by a battery. 2. What should be the ratio of the size of wire on the armature to that on the field magnet? A. There is no definite ratio between the wires used on the armature and those of the field. The sizes to be used in any case are selected with reference to the number of turns required and the space in which the wire must be put upon the core. No rule can be given. The sizes are the result of the calculation in working out the design. 3. What should be the ratio of the field magnet's size to the armature's? A. The armature of a dynamo or motor is usually designed first. The field magnet is made of such a size that there will be surface of cross-section sufficient to produce the number of lines of force required to produce the voltage needed for the machine. The calculation of the number of turns of wire needed on the field and the size of wire which can be used follows, regard being had to economy in the weight of copper used, the amount of current to go through the field, etc. 4. Does the number of parts into which the armature is divided have any extra effect on the motor? A. The number of coils on the armature of a motor affects the steadiness of the pull of the motor, the more coils, the steadier the torque of the motor.

(8052) H. B. asks: Can you give me a method (simple) for treating wood so that it is impervious to sulphuric acid? A. Soaking wood in hot paraffin for a short time and brushing off excess will render wood impervious to acids to a certain extent. If a tank or wooden vessel to hold acids, the paraffin treatment may be perfected by brushing the hot paraffine on the surface inside and also on the outside, and then go over the surface with a hot iron: a sad iron or tailor's goose is a very efficient tool to drive the paraffine into the wood. A plumber's blowpipe is also very convenient for such work, but must be handled with care, so as not to fire the paraffine. You might try the application of a mixture of paraffine 2 parts and gutta percha 1 part used hot. A heavy coating of asphalt has been used for this purpose.

(8053) C. F. H. says: In Scientific American, August 11, 1900, a formula is given for photographic paper; the weights are given as parts; would the formula be correct if I should make it as follows, reduced 1-16?

	Parts.		
Water	1,000	62½ oz.	1,000 min.
Ferric oxalate....	15	7½ dr.	15 grn.
Oxalic acid.....	3	1½ dr.	3 grn.
Nitrate silver.....	3	1½ dr.	3 grn.

The second column is the way parts can be converted; 1,000 minims is a trifle over 2 fluid ounces, there being 480 minims in one ounce.

(8054) W. G. R. writes: I want to make a solenoid of insulated copper wire, that will pull to best advantage on an iron core 6 inches long and ¼ to ½ inch in diameter. Coil to be about 2 or 3 inches long. Current is alternating, 7½ amperes, 115 volts, 60 cycle. With this current I want to pull iron core about ¾ of an inch with a force to lift a 2-pound weight. Also, if it can be made to lift 4 or 6 pounds? What wire and size are necessary for solenoids? A. Your proposition to make solenoids to pull an iron core to lift 2 pounds with an alternating current is not feasible. The alternating current cannot be used in an electromagnet for lifting purposes. A direct current is needed. If you decide to use a battery for the lifting, you can wind No. 16 or No. 18 magnet wire to the length you need and till the magnet will lift by experiment what you require. The winding will depend in part upon the battery you use.

(8055) C. S. W. writes: Mr. Hopkins' recent article in your paper about the metal thermometer, does not state how to place the steel and brass strips in relation to the scale, in order to have the reading from left to right. If the expansion bar is placed to the right of the pointer should the steel strip be to the right of the brass strip or the reverse? A. As the brass strip expands more than the steel, it is obvious it should be nearest the roller, with the present scale. If the compound bar is reversed, the scale may be reversed to match it.

(8056) W. H. R. asks: 1. Please tell me where I can find descriptions and results of tests of earth and sea water batteries? A. We have not at hand any tests of earth batteries. One is described in Supplement No. 1300, price ten cents, in article on electric clock. Sea water batteries are described in Carhart's "Electrical Batteries," price $1.50 by mail. 2. Can you tell me where I can find any literature on the unipolar dynamo? A. The unipolar dynamo, so called, is discussed in Hawkins' and Wallis' "Dynamo," price $3 by mail, and in Crocker's "Electric Lighting," vol. i, price $3 by mail.

(8057) W. C. E. writes: I wish to make water motor described in Scientific American, and would like to ask what will be the water pressure from a tank having a head of 24 feet? A. You will have 10 pounds pressure per square inch with 24-foot head.

(8058) D. S. writes: Our town is located in the "Black Swamp" district of Northwestern Ohio, almost flat, with large ditches, well underdrained, but in the spring of the year these ditches are nearly filled with water, so that the soil is liable to be completely saturated for a few weeks almost to the surface, and it passes through our cement walls into our furnace cellars. I write you to learn whether or not you can tell me how to make a cement that will be absolutely impervious to water. We desire to build a parsonage with a cellar and a furnace cellar. Can it be done without building the bottom of the cellar close to the surface, so that it shall be above the level of the saturated soil? Perhaps a well-cemented cellar bottom and walls might be a certain distance below the level. A. Cellars made in wet soil may be made tight with Portland cement concrete bottoms and sides. They are made better if built in dry weather, with a coat of asphalt put on hot when the concrete has become dry. For sanitary reasons as well as architectural effect houses should be raised several feet above the ground level in wet or swampy districts, with embankments around the outer walls and with full-size cellars. Thus a full-sized cellar only one or two feet below the natural surface of a wet soil with the excavated part of the cellar made into an embankment, with a small addition from other sources, makes the most desirable cellar for a residence on plains and swampy lands.

(8059) H. L. G. writes: The account of a large gasometer exploding from a lightning flash has aroused in our midst a discussion as to the causes which have led up to explosions of a similar nature in the past. A contends that gas confined in a gasometer can only be exploded by a flash, not directly attributed to the gas itself, whereas B contends that gasometers have exploded by spontaneous combustion of the gas itself, without a primary cause of spark such as lightning or an electrical contact. A. Illuminating gas as inclosed in a gas holder is not of itself explosive. It is only when mixed with air to a large percentage that it becomes explosive by lightning or contact with fire. Usually where tanks or gas holders have been exploded, they have been ruptured by the stroke of lightning and the out-rushing ignited gas has made explosive mixtures with air. With covered petroleum oil tanks the space above the oil and cover is always filled with a dangerous mixture of oil vapor and air. When lightning strikes an oil tank at a time when the air and vapor mixture are in an explosive proportion a most dangerous explosion takes place. Gas does not explode spontaneously in any of its ordinary forms or combinations as used for illumination.

(8060) P. J. A. writes: I am interested in wireless telephony. Could you name some numbers of your paper that I could study up telephone transmitters, practical or impractical? A. The Scientific American Supplement, Nos. 250 and 966, price ten cents each, contain descriptions of telephone transmitters. You would, however, do better to buy Miller's "American Telephone Practice," price $3 by mail, and have the whole story up to date.

(8061) N. M. S. asks: 1. I am desirous of getting information as to the length of vibration of different colored rays of light. If light vibrates the molecules of a body, why will it not vibrate the body as a mass? Is there any known molecular body or bodies which light will vibrate, or also that have properties of being magnetized? Do you know of any book or books which I could get on light on this line, e. g., vibration, waves, etc.? A. All higher text-books of physics treat of light as a vibration and give tables of wave lengths. We can recommend Barker's "Physics," price $3.50 by mail. The vibrations of light are too minute and rapid to set ordinary matter into motion. They, however, do affect selenium. 2. Is there a chemical solution which will stop rays of heat and let light pass out? What is it? A. Yes; a solution of common alum in water is quite impervious to heat and allows light to pass with ease. So also iodine dissolved in carbon bisulphide forms a liquid nearly black. It stops light waves and allows heat waves to pass. Glass stops most of the ultra-violet waves, but quartz allows these to pass. Rock salt allows heat waves to pass.

(8062) F. T. asks: 1. Will the motor described in the December 8 and 15 copies give

the same result if the field and armature were cast? A. If cast iron of the same size as the wrought iron parts were used, the magnetism would be cut down about one-half, and the motor reduced in power to the same degree. 2. What size propeller for high speed would it run if put in a model boat? A. A very small one, perhaps four inches. 3. What would be the number of the wire on field and armature if a motor were made one-half as large, and how many feet of same on same? A. We have no data for the motor except as published. It would be a very small toy if reduced to half size.

(8063) J. L. C. writes: Kindly inform me the most practical dimensions, etc., of an induction coil suitable for gas engine ignition upon motor bicycle. A. SUPPLEMENT No. 1281, price 10 cents, gives valuable data for a coil for igniting a gas engine by means of a battery.

(8064) L. A. T. writes: Please give, through Notes and Queries, the process of case-hardening of tools such as taps, dies, etc. A. Heat the surface to be case-hardened sufficiently hot to melt yellow prussiate of potash (potassium ferro-cyanide) powdered and sprinkle on, and again insert in fire and heat to "cherry red," when treat to bath of clear cold water. Remove scale with sandpaper or emery-cloth. The forge is as good a place to harden small or single subjects as a regular carbonizing furnace. In factories where much carbonizing is done, a cheaper article, "bone dust," is employed. The subjects are placed in an iron box and filled with bone dust, then placed in the furnace, and when sufficiently hot treated to the water bath. Parings of horse or ox hoofs, or the hoofs of any animal, to which is added common salt, make a very cheap and effective carbonizer.

(8065) C. W. B. writes: Please give me the rule for finding the horse power of an engine. Also state what proportion of the power of the engine is required to operate the ordinary slide valve. A. To obtain the horse power of a steam engine with any reasonable accuracy without taking an indicator card, the cut-off of valve and the exact pressure in the steam chest should be known. Sometimes engines are run with the steam partly throttled, which with the length and friction in the steam pipe will give less pressure in the steam chest than is indicated by the gage at the boiler. From the known cut-off the mean pressure may be taken from the steam tables or rule for mean pressure in Haswell's "Engineers' Pocket-Book." We give the mean pressure for the points of cut-off in ordinary use, viz., 3-10 = 0.692; ⅜ = 0.766; 4-10 = 0.787 of the initial pressure. Then the diameter of the piston in inches by the mean pressure per square inch by twice the stroke in feet by the number of revolutions per minute equals the total foot-pounds. The total foot-pounds divided by 33,000 equals the horse power. The power required to operate the slide valve varies from one to two per cent of the power of the engine.

(8066) E. P. asks: 1. Please tell me whether a person on a private ground-circuited telephone line should hear the conversation on other private, ground-circuited telephone lines, if he were not connected at the switchboard? It is this way with our telephone lines. A. Whenever telephone wires run side by side, what is said over one line will be heard over the other. This is true whether the line is a grounded line or not, unless the wires are crossed at intervals. 2. Would a return circuit wire be the best way to remedy the trouble? A. A metallic circuit with the wires twisted or crossed at regular intervals is the only way to prevent "cross talk." 3. How many amperes strong should be a dry battery 2½ by 6½ inches? A. A dry cell cannot be said to have any amperes. At least the current varies so rapidly that it can hardly be measured before it has changed. The voltage is about 1.3. The internal resistance varies very rapidly. The amperes therefore vary with equal rapidity.

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(Continued on page 110)

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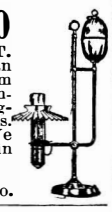

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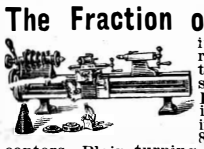

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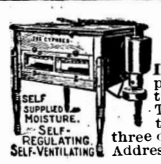

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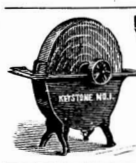

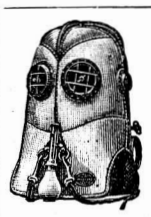

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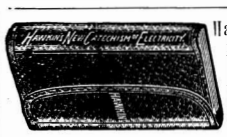

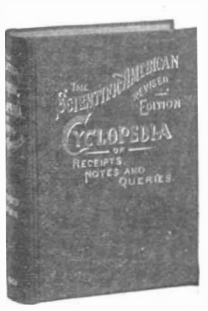

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