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VALLEY OF THE KINGS' TOMBS AT THEBES, WHERE THE MONARCHS OF EGYPT OF THE XVIII. TO XX. DYNASTIES WERE BURIED.—[See page 362.]

SCIENTIFIC AMERICAN

ESTABLISHED 1845

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NEW YORK, SATURDAY, NOVEMBER 4, 1905.

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.

A DISCREDITED THEORY.

After reading the description of the ridiculously small results recently achieved at Sandy Hook in the test of a torpedo shell against a target representing the side of a battleship, as given on another page of this issue, our readers will surely agree with us that Congress should make no further appropriations for experiments with projectiles of this kind. The only effect produced on the trial plate, as the result of bursting 183 pounds of high explosive against it, was a slight indentation, which was due, almost entirely, to the striking energy of the shell itself. While we can well understand that the enormous energy of the gases of explosion of guncotton or nitroglycerine should have caused the idea of exploding a heavy charge against the outside of a battleship to appeal very strongly to the lay mind, we cannot understand why Congress should have authorized this latest trial of the theory, when that theory had been so completely discredited in the tests of the Gathmann torpedo shell some four or five years ago.

Let it now be set down once and forever that not 200 pounds, nor twice 200 pounds, of high explosive is sufficient to "blow the modern battleship out of existence." If the events of the naval conflict in the Far East have taught us anything at all, they have surely taught us this: that unless the charge should be so fortunate as to explode in or at the neighborhood of the magazine, a single torpedo or a single mine will not send a battleship to the bottom, or wreck it beyond the possibility of repair. If anyone doubt this, let him look at the Port Arthur fleet, the ships of which, after receiving some of them not one, but several blows, full and square from the mine and the torpedo, were so far repaired under emergency conditions, as to be able to go forth and fight that seven-hour engagement with the Japanese fleet on August 10.

Modern ship steel is so tough ; the modern system of cellular and compartmental construction is so elaborate; the modern battleship is so big; and its inertia so great, that the detonation of even 400 pounds of high explosive against the side of the ship, as in the case of the "Sevastopol," causes damage which, though extensive, is strictly local, and does not impair the structural integrity of the ship as a whole. The high-explosive armor-piercing shell, which can carry its bursting charge intact through the armor and liberate its energy within the vitals of the ship itself, is the supreme engine of destruction in modern naval warfare; and the thin-walled torpedo shell must be relegated to that museum of discredited inventions, of which the Sandy Hook proving ground contains so many costly exhibits.

ONE YEAR'S OPERATION OF THE SUBWAY.

On October 27 the New York Subway completed its first year of active service, and the statistics of travel and the verdict of the public agree in pronouncing this great engineering work, with one exception, a complete success. During the twelve months, 106,000,000 passengers have been carried, at the average rate of about 300,000 per day. The total number of passengers carried daily on the elevated roads works out at an average of about 717,000 per day, so that a reasonable estimate of the number of passengers carried by the Elevated and Subway combined reaches the enormous figure of over 1,000,000 per day.

The figures for the Subway are the more remarkable when we bear in mind that only a portion of it has been in active operation for the whole twelve months. The Lenox Avenue branch to West Farms, the section from the Brooklyn Bridge to the South Ferry, and about a mile of road north of 135th Street on the Broadway branch, have been in operation only for a portion of the year. The company expects to open the road from 157th Street to the Harlem Ship Canal by January 1, and next year also the important Brooklyn branch from South Ferry to Flatbush and Atlantic Avenues will be put in service. It is reasonable to expect that with these important additions, the total daily travel will amount to an average of 400,000 per day for the year.

It is not often that a great public improvement in transportation such as this scores such a large and immediate success, running far beyond the preliminary estimates of its usefulness. Save for some confusion in the first few days of operation, due to limited switching accommodation at the terminals, and to the restraining hand laid upon the traffic by the excellent system of block signals on the express tracks, there has been but little interruption to the steady flow of travel. This, however, quickly passed away, and the system has been running day and night, for many months, with an absolutely clock-like precision. The speeds, particularly of the express trains, have been rather over than under the estimate, and the new steel cars, introduced for the first time on this road, have been an unqualified success, running with the smoothness of a Pullman car, and coming through such collisions as have occurred, in a way that proves them to be an excellent protection to the life and limb of the passengers.

The Subway, however, has developed one most serious drawback, which during the hot summer months served to divert a measurable proportion of its traffic to the Elevated roads. We refer to the unexpectedly high temperature and its attending "stuffiness" which, in the hottest weather, rendered travel in the Subway, to say the least, extremely uncomfortable. The high temperature is due to the large quantities of heat thrown out by the motors, and developed by the constant use of the brakes. In the winter this heat served to render the Subway temperature comfortable; but as the summer months advanced, it speedily produced the uncomfortable results above referred to. The problem of ventilation is a most serious one, and it has engaged the careful attention of the engineers, and will be made the subject of a forthcoming report. It is gratifying to know that the report will propose a plan which is confidently expected to remedy this serious defect.

MR. HILDENBRAND AND THE MANHATTAN BRIDGE PROBLEM.

At the time that we published illustrations of the new Buda-Pesth bridge, it was not our intention to open the old controversy as to the respective merits of wire cable and eye-bar chain suspension bridges. That problem was very thoroughly investigated some two years ago, and formed the subject of an exhaustive debate by pretty nearly every bridge engineer, who by training and experience was qualified to speak with authority on this subject. The publication of the Buda-Pesth bridge article, however, brought a reply from Mr. Hildenbrand, our editorial comments upon which have induced this engineer to write a reply of considerable length. In his letter of transmission, our correspondent suggests that it would be only justice to him, as well as due to the engineering profession, that we publish his arguments and calculations on which the statements in his former letter were based. The letter will be found on another page, and it is inserted with the understanding that with its publication will close this somewhat belated controversy.

In reading this letter one cannot but be impressed with the courage and fidelity with which the writer pleads for what he himself must feel to be a losing cause; for although political and personal considerations have proved strong enough to reject, in the case of the Manhattan structure, the more scientific and stronger chain bridge in favor of the primitive and now discredited wire type, we are satisfied that if one could take toll of expert engineering opinion both in this country and abroad, it would prove to be almost unanimous in recognizing the theoretical and practical advantages of the eye-bar chain type. We will even go further, and state it as our conviction that the advantages of the rejected design are so elementary, obvious, and material, that if the two designs and the discussion upon them were submitted to any graduating class in engineering at our technical colleges, they would cast their vote, to a man, in favor of the trussed eye-bar chain.

Had it not been for the manifest errors in his argument to prove that the eye-bar chain must weigh over three times as much as the wire cable, we would have let Mr. Hildenbrand's letter pass without comment; but the false premises and fallacious line of reasoning followed in this portion of the letter are such a characteristic example of the "rough-and-ready" methods of argument adopted by the advocates of the wire-cable bridge, and the statements themselves are so very misleading, that this portion of the letter demands an answer.

In estimating the respective breaking strength of the chains and the wire cable, 40 tons per square inch "as accepted by the Bridge Department," is used by Mr. Hildenbrand for the chain, whereas for the ultimate strength of the wire cable, 112 tons, "the actual strength of individual wires in the Williamsburg bridge" is used. This is manifestly an unfair comparison. To place the wire on the same basis as the chain, we must use the ultimate strength of the wire as specified in the contract for the Manhattan bridge, which requires a unit strength of 100 tons to the inch in the body of the wire, and of 95 tons at the splices. This 95 tons to the inch is, therefore, the proper unit for comparison. Multiplying, then, the chain section by 40 we get 22,200 tons as the breaking strength of one chain, and multiplying 265 by 95 we get 25,175 tons as the breaking strength of one wire cable; so that the Manhattan wire cable is not 33 7/10 per cent stronger, as Mr. Hildenbrand would have us believe, but is only 13 4/10 per cent stronger, if judged, as it surely ought to be, on the common basis of contract requirement.

But the contract requirement, as drawn up by the present Bridge Department, is entirely too favorable to the wire cable; for this 95 tons to the square inch shown by the individual wires must not be taken as applicable to the mass of wires, 20 or more inches in diameter, when strung across the towers and banded into cables. It has been proved that wires assembled in a cable do not possess an aggregate strength equal to the sum of the individual wires as developed in the testing machine. That eminent bridge engineer, the late Mr. Morrison, in working out a wire-cable design for the North River bridge, investigated this subject, and found that while the average strength of five wires, separately tested, was 172,588 pounds to the square inch, the strength of straight wire strands of the same quality of steel, with the wires laid parallel, was only from 150,000 to 146,640 pounds to the square inch, the strands showing about 15 per cent less strength than the individual wires. Strands of special plow-steel wire showed only 188,000 pounds to the square inch ultimate strength, as against an average strength of the individual wires of 226,000 pounds to the square inch. Mr. Morrison, very properly, took only 180,000 pounds as the unit stress in proportioning his cables.

No falling off in strength between the test specimen and the whole bar has ever been urged against an eye-bar chain, and hence, to make the comparison a true parallel, 15 per cent must be deducted from the 95 tons to the square inch unit strength as found above.

But a further reduction of 10 per cent must be made in our estimate of the strength of the assembled wires, to allow for the great fiber stress which occurs in the wire cable due to its bending over the edge of the saddles. In the construction of a wire-cable bridge, as soon as the wires have been strung they are heavily clamped and wrapped with wire applied under considerable tension, and any movement of the wires, one upon another, is thereafter impossible. The cable as thus strung and clamped hangs in a certain curve; but when the massive floor and stiffening trusses have been attached to it, and the live load comes upon it, and it lengthens under the high temperatures of the summer season, the cable will deflect and, of course, will be bent down to a more acute angle at the saddles. The bending of the compacted mass of steel 20 inches in diameter (for the heavy clamping and the pressure of the cable at the saddle render it a compact mass) will cause the outer wires at the point of bending over the edge of the saddle to be strained to an extent which calls for an addition of at least 10 to 15 per cent to the section of the cable, in order to provide for these stresses. If, as in the case of the Manhattan bridge, no increase of section has been made, then a lower unit stress should be used in estimating its total strength, the reduction amounting, at the most conservative estimate, based on a simple mathematical examination, to at least 10 per cent. Adding this 10 per cent to the 15 per cent reduction above referred to, we get a total reduction of 25 per cent, which must be considered, if we are to place the chain and the wire cable upon an even basis, as desired by Mr. Hildenbrand. This brings the unit stress down to 71.25 tons to the square inch, and shows the breaking strength of the wire cable to be 18,881 tons, as against 22,200 tons for the eye-bar chain, from which we see the chain is 17.5 per cent stronger than the cable. Adding 17.5 per cent to the section (265 square inches) of the wire cable, in order to cancel this difference (still following Mr. Hildenbrand's method of argument), and, further, adding 10 per cent for the weight of the suspender saddles, sheathing, etc. (which Mr. Hildenbrand omits) we get a total section for the wire cable of 342 square inches, as against 666 square inches (555 + 20 per cent for weight of eyes and pins) for the eye-bar chain. Therefore, the sections are not as 1 to 3.23, as deduced by our correspondent, but as 1 to 1.95; which agrees very well with the proportion of 1 to 2, as stated in our editorial of September 30.

It is scarcely necessary to point out that, with such serious errors existing in his premises, the whole fabric of our correspondent's argument falls to the ground.

If this question were merely academic, no harm would be done, but unfortunately this exaggerated estimate of the strength of a wire cable has already postponed the construction of a great public utility for nearly three years; for, to-day, the present Bridge Department has nothing to show for its incumbency but a couple of piers built by its predecessors, and a serious lawsuit induced by its own faulty contract.

THE HEAVENS IN NOVEMBER.

BY HENRY NORRIS RUSSELL, PH.D.

In all probability we shall see a fine display of shooting-stars about the middle of this month. We cannot be quite sure about it, however. It is certain that the earth will cross the path of the meteors which follow in the wake of the lost Biela's comet; but we have no means of knowing whether they will be thickly or thinly spread along this track, and so we cannot tell how much of a shower there will be.

All that can be done is to predict the date of the possible shower, and even this is not as simple a matter as it seems. The orbit of Biela's comet—which these meteors follow—used to intersect the earth's orbit at a point which the earth reaches on November 27 of each year; and for several successive returns the shower came at about that date. But the meteor-swarm has since then passed close to Jupiter, and its orbit has been considerably altered by the planet's attraction. It is a very laborious matter to calculate how large this alteration is, but Dr. Downing, an English astronomer, has done the work. He finds that the orbit has been so changed that the place where it comes nearest the earth's orbit is more than 15,000,000 miles distant from its former position at a point which we reach on November 18. The orbit has also been shifted sidewise, so that those meteors which previously just missed striking the earth will now pass about a million miles away from it, on the side remote from the sun.

If the meteor-swarm, measured in this direction, is more than a million miles in extent, we will pass through part of it, and there will be a conspicuous shower; but if not, we will only see a few straggling shooting-stars, as we did in 1899, when the Leonids suffered the same fate. The Leonids themselves are due on the 13th or 14th of this month, but the thick part of the swarm went by several years ago, and there is no chance of a great display this year.

The Bielid meteors are more convenient to observe, for they appear in the early evening, radiating from a point in Andromeda, which is well above the horizon at sunset, so there will be no need to sit up all night to see if we are to get a shower this year.

THE HEAVENS.

The principal constellations visible at 9 P. M. in the middle of November are as follows: Beginning in the west, where the Milky Way cuts the horizon, we see Aquila with its bright star Altair. On the right, and higher up, is the still brighter Vega in Lyra. Above Lyra is Cygnus. The large cross which is the most prominent figure in this constellation is now almost erect. Still following the Milky Way we pass over Cepheus and come to the zigzag line of Cassiopeia, now almost overhead. Then follows Perseus, and below it Auriga with the very bright yellow star Capella. Below this again is Gemini, whose twin stars, Castor and Pollux, have just risen.

To the right of this, a little south of east, Orion is also rising. Above it is Taurus, one of the easiest constellations to remember, since it contains the two star-clusters of the Pleiades and the Hyades. The latter name belongs to the V-shaped group of stars of which Aldebaran is the brightest. The planet Jupiter is at present between these two groups, and far outshines anything else in the sky.

The southeastern sky contains two of the largest and least brilliant of all the constellations, Eridanus and Cetus. Above the latter, southeast of the zenith, is the little triangle which forms the head of Aries. The great square of Pegasus is almost overhead, and Andromeda lies northeast of it, toward Perseus. The uninteresting zodiacal constellations Pisces, Aquarius, and Capricornus occupy the southern and southwestern sky. Lower down is one bright star, Fomalhaut, in the Southern Fish. Higher up and farther west is the planet Saturn. Mars, which is in Capricornus, has just set, but is visible earlier in the evening.

THE PLANETS.

Mercury is evening star in Scorpio. On the 27th he reaches his greatest elongation, but, as he is very far south, he will not be easy to see, though he sets rather more than an hour after the sun.

Venus is morning star in Virgo, and rises about 5:30 A. M. in the middle of the month.

Mars is evening star in Sagittarius and Capricornus, and sets at about 9 P. M. in the middle of the month.

Jupiter is in opposition on the 24th, and is visible all night long. He is farther north now than he has been for seven or eight years, and is admirably placed for observation. Transits and eclipses of one or more of his satellites are visible almost daily, and afford one of the most interesting spectacles that can be seen with any telescope, small or large.

Saturn is in Aquarius, and sets about 11 P. M., so that he is still observable in the evening. Uranus is in Sagittarius too near the sun to be satisfactorily seen.

Neptune is in Gemini in R. A. 6 h. 43 m., dec. 22 deg. 6 min. N. on the 15th, and comes to the meridian about 3 A. M.

THE MOON.

First quarter occurs at 9 P. M. on the 3d, full moon at midnight on the 11th, last quarter at 9 P. M. on the 19th, and new moon near noon on the 26th. The moon is nearest us on the 25th, and farthest away on the 10th. She is in conjunction with Mars on the 2d, Saturn on the 5th, Jupiter on the 13th, Venus on the 25th, and Mercury on the 28th. The conjunction with Saturn is quite close.

THE SUN.

At the date of writing (October 23) two large sun-spots, visible to the naked eye, are in sight at once. No one can say with certainty how long they will last, but if they endure for another rotation of the sun (which is probable) the first of them, which is a large diffuse spot with several nuclei, will reappear at the sun's eastern limb on or about November 7, and remain visible till the 20th. The second, which is smaller but blacker, came into view on October 21, and will pass round the sun's western limb about November 3, reappear on the 17th, and stay in sight till the 30th. Both spots can be seen without other aid than a piece of smoked glass, but their outlines can be better seen with a field-glass, holding the smoked glass close to the eye.

Observatory, Princeton.

TUNNEL BORING IN ANCIENT PALESTINE.

Unmistakable evidence exists that 2,500 years ago certain Hebrew engineers (in the time of King Heze-Kiah) executed exactly the same kind of work which was carried out in the Simplon tunnel, though perhaps on a slightly smaller scale. Dr. Bertholet, a professor at the University of Basle, is the gentleman who claims to have made this discovery. The Jewish records state that King Heze-Kiah, or Ezekias, who reigned at Jerusalem 727 B. C., was much troubled at the bad state of the water supplied to the people of that city. He accordingly had a vast reservoir made at the gates of the city, to which water was fed from various springs lying at more or less greater distances from the reservoir in question. At first his project seemed doomed to failure, as there existed, between Jerusalem and the springs, from which the water was to be derived, a high chain of hills, over which it would be impossible to convey the water. It was therefore determined to open a passage for the water through the solid rock; one of the Sirach MSS. dating from this period states in this connection: "Heze-Kiah fortified his city by bringing water thereto, and he bored through the solid rock by means of bronze, and he collected the water in a reservoir."

It is true that, about fifteen years ago, an open conduit was found in the vicinity of the Holy City, but this appears to have been made by a predecessor of Heze-Kiah's, which seems to be clearly proven by an inscription in old Hebrew characters found close to Jerusalem and preserved in the Constantinople Museum. Translated, this inscription reads: "The piercing is terminated. When the pick of the one had still not struck against the pick of the other, and while there was yet a distance of three ells, it was possible to hear the voice of one man calling to another across the rock separating them. And the last day of the piercing, the miners met pick against pick. The height of the rock above the heads of the miners was one hundred ells. Then the waters flowed into the reservoir over a length of 1,200 ells."

Recent explorations have enabled this predecessor of the Simplon to be thoroughly identified; it is said to be the Shiloah tunnel, by means of which water was brought down from a source to the east of Jerusalem, and poured into the Pool of Siloam mentioned in the Bible. This conduit is 360 yards long. The distance as the bird flies between the two mouths of the tunnel is also only 360 yards, which proves that the work was not executed in a perfectly straight line—due doubtless to the difficulties which the engineers encountered in their task, which (for the period) was of a really marvelous nature. That the work was commenced from both ends of the tunnel is not only proven by the inscription, but also by the fact that the marks of the boring tools, picks, etc., may still be seen, all bearing in opposite directions. The direction of the tunnel was altered several times during the construction thereof, as there are several short galleries, which were evidently abandoned as soon as it was noted that working was being done out of line. The floor of the tunnel is finished with the greatest care, and the workings vary from five-eighths of a yard to one yard in width by from three feet to nine feet in height, more or less, according to the hardness of the rock.

In the light of modern engineering science, the following questions suggest themselves: How did these old-time engineers gage their direction, recognize and remedy their errors in alignment? What tools did they use to execute a piece of work which has remained without equal or rival for 2,500 years? To these inquiries no answer can be given; the wondering student can only turn away with the exclamation: "In good sooth, my masters, there is nothing new under the sun!"

SCIENCE NOTES.

Theoretical crystallography, approached by Steno (1669), but formally founded by Haüy (1781, "Traité," 1801), has limited its development during the century to systematic classifications of form. Thus the thirty-two type sets of Hessel (1830) and of Bravais (1850) have expanded into the more extensive point series involving 230 types due to Jordan (1868), Sohncke (1876), Federow (1890), and Schoenfliess (1891). Physical theories of crystalline form have scarcely been unfolded.

The evolutionist is spared the surpassing difficulty of the human element, yet he needs imagination. In its lowest form his imagination is that of the detective who reconstructs the story of a crime; in its highest it demands the power of breaking loose from all the trammels of convention and education, and of imagining something which has never occurred to the mind of man before. In every case the evolutionist must form a theory for the facts before him, and the great theorist is only to be distinguished from the fantastic fool by the sobriety of his judgment—a distinction, however, sufficient to make one rare and other only too common.

The science of architecture, if under this head we include the principles of building construction, and the heating and ventilation of buildings, has done and is doing much of interest and importance to the student of public health science. The air supply, especially for the modern civilized and too often sedentary form of mankind, is in the long run quite as important as the water supply, the milk supply, or any other supply. Surely, we can not be too careful of the purity of a substance which we take into our bodies oftener, and in larger volume, than any other, and which has come, rightly no doubt, and as the result of long and painful experience, to be known as the very breath of life. Human beings may survive and seemingly thrive, even for long periods, in bad air, but for the best work, the highest efficiency, the greatest happiness and the largest life, as well as for perfect health, the very best atmosphere is none too good. Hence the permeability of the walls of houses and other buildings, and the heating and ventilation of dwellings, school houses, churches, halls and other public places, require, and in the near future will receive, a much larger share of our attention than they have to-day.

Aside from their economic value, grape vines are often cultivated for purely ornamental purposes, owing to their beautiful foliage and the rich coloration they assume, the shade they afford, and their hardihood and longevity. The vine is one of the few plants that can be conveniently grown in cities or towns either as bushes or for making delightful arbors that not only beautify the home, but furnish cooling shade and luscious fruit. The more tender sorts can be grown in graperies in many regions with good profit, and when grown in pots not only serve as handsome decorations in the dwelling and on the table, but add one of the choicest of morsels to the menu as well. To quote the language of an enthusiast: "The grape is the poor man's fruit, especially one who has only a house lot of the smallest possible dimensions. He can plant vines beside his cottage and their roots will extend and profitably occupy every inch of ground underneath it, and from that small space produce all the fruit his family can consume, while the vines afford shade and protection and add beauty to his little home, occupying no space, either above or below the ground, to interfere with other interests, and producing more fruit in less time and with less labor and attention than any other thing that was ever planted."

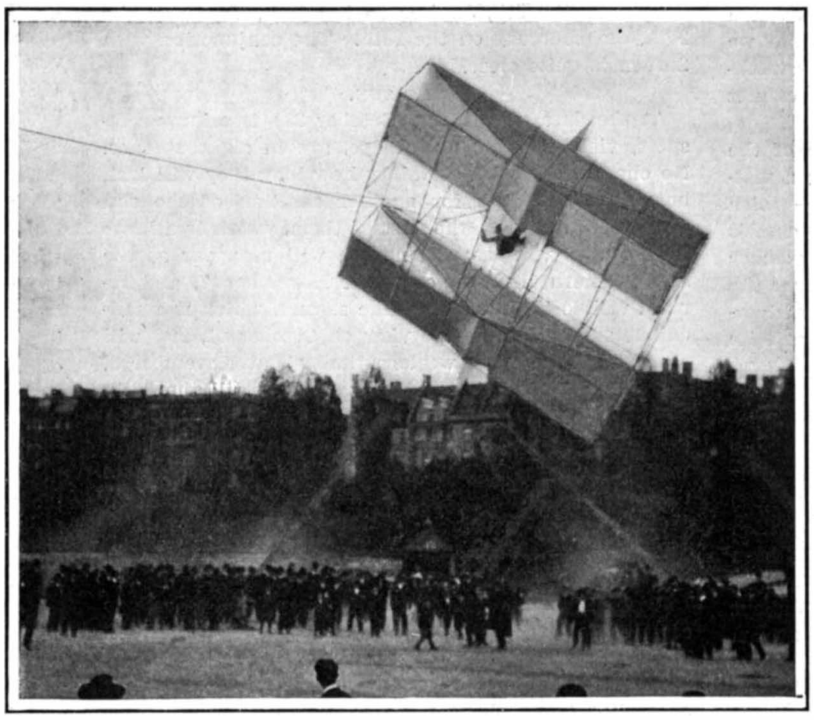
Information is being sought by people all over the country on the subject of testing of clays for the various purposes for which they are used, other than road building. Special tests are now carried on to that end. A furnace has been installed by the Department of Agriculture and actual burning tests on clays are now made. In order to further stimulate interest in the development of native clay bodies, a special circular was issued on "The Useful Properties of Clays." The aim of this circular was to give information in the simplest possible way to people who were not supposed to possess technical knowledge of clays. The circular particularly points out that for the year 1902, the last year for which the official figures are valuable, the total imports of foreign clays to this country were valued at $1,154,805, while the domestic clays produced were valued at $2,061,072. Since the country possesses unusually fine clay bodies, a great many of which up to the present time await development, any stimulation of interest among the people to develop our native clays must be of great value.

LUDLOW'S FIRST SUCCESSFUL FLIGHT.

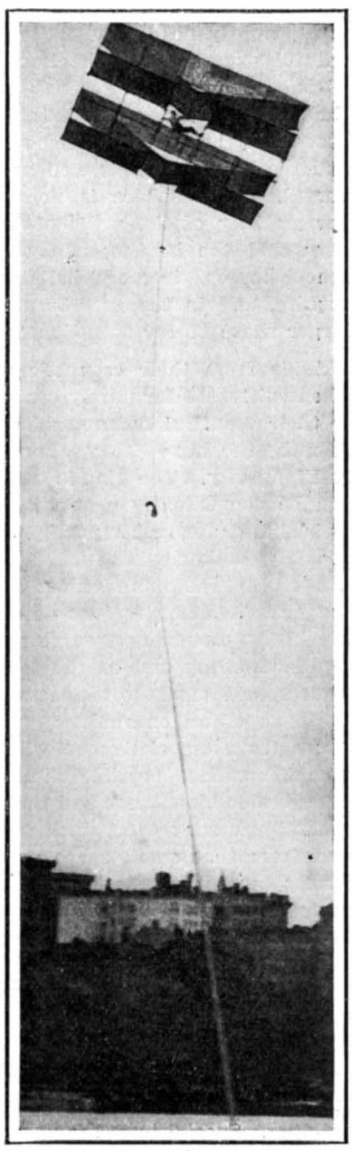
Many of the readers of the Scientific American are probably more or less familiar with the numerous aeronautic experiments of Israel Ludlow, of New York city, whose investigations in the problems of aerial flight have been large in number, sometimes apparently successful, and frequently spectacular. The latest of these occurred on Sunday, October 22, when the aeroplane carrying Charles K. Hamilton, a professional aeronaut, was successfully launched into the air from the east bank of the Hudson River, and after a flight of some minutes' duration, settled gradually into the water near midstream. Mr. Ludlow claims to be entirely satisfied with the experiment, as this, as well as the previous ascensions, was merely a test to determine the capability of the machine to *glide* to earth from a height to which it had been raised in a manner similar to that of flying a kite. In the former flights, the aeroplane was launched into the air by means of an automobile and a long rope, but as the experiments, in consequence of space limitations, were necessarily short, the flights were rather unsatisfactory, both to the inventor and to the large crowd of inquisitive spectators assembled at the river front and 79th Street, where an open dock space offers the necessary facilities. The experiment of the 22d was intended thoroughly to test the flying, or more properly the gliding properties of the machine, and for this purpose the motive power at the end of the rope, or "kite string," was a powerful tugboat, an arrangement permitting the use as a course of the unbroken sweep above the river.

The aeroplane was placed at the bank side of the dock, and attached to the towing-bits of the tug by means of half-inch Manila hemp rope. After a number of unsuccessful starts—the slack not being completely taken up before the drag acted on the machine—the aeroplane was at length flung into the air in the teeth of a strong wind, and rose almost perpendicularly under the combined influence of this and of the powerful tractive effort of the vessel. Until a height of approximately 500 feet was attained the rise was rather erratic, for as the puffs of wind struck the machine it would plunge violently from side to side. Hamilton, however, with great coolness, managed to keep the giant white-winged kite on an even keel by shifting his weight from one point to another as the occasion required, and when more than 600 feet of rope had been let out from the tugboat, the machine settled down and followed steadily in the wake of the vessel. The above-mentioned height of 500 feet is probably a fair estimate, as the aeroplane was almost vertically over the boat, with 600 feet of rope let out. Shortly after this a ferryboat crossing the course of the tug necessitated the turning out of the latter at right angles, with consequent slackening of the rope drawing the aeroplane. Before this slack could again be taken up, the aeroplane, gliding forward and downward without apparent lateral movement, gradually and steadily in the face of the wind, had settled to the surface of the river, whence Hamilton was rescued by a launch, slightly damp but as cheerful and unshaken as ever.

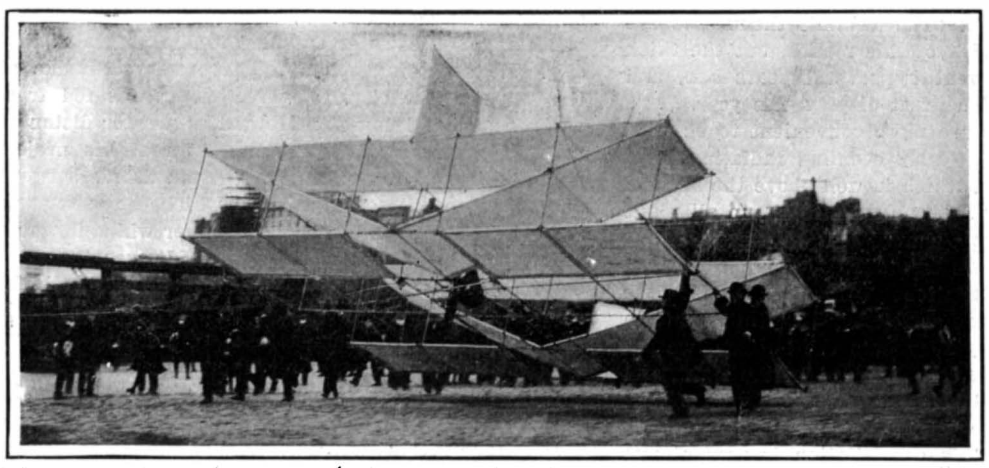
This test appears to substantiate other experiments tending to prove that an aeroplane of this type can be caused to rise, and can be kept in the air as long as the tension on the rope connecting it with the motive power be maintained. Whether or not sufficient power through a prime mover and propellers can be carried by the aeroplane itself to keep it afloat in the air, is still an open question. There can be little doubt, however, that until engines are constructed that are far more powerful and much lighter in weight than those available to-day, it is impossible to launch an aeroplane flying-machine by means of its own power. Mr. Ludlow says that judging from the successful gliding tests just completed, he feels assured that an engine can be installed upon the machine sufficiently powerful to keep it afloat after it has been launched by other means. It would be easy to guide the aeroplane, as the mere shifting of the center of gravity—accomplished by the movement of the operator's body—to one side or the other causes a consequent swerve in a corresponding direction.



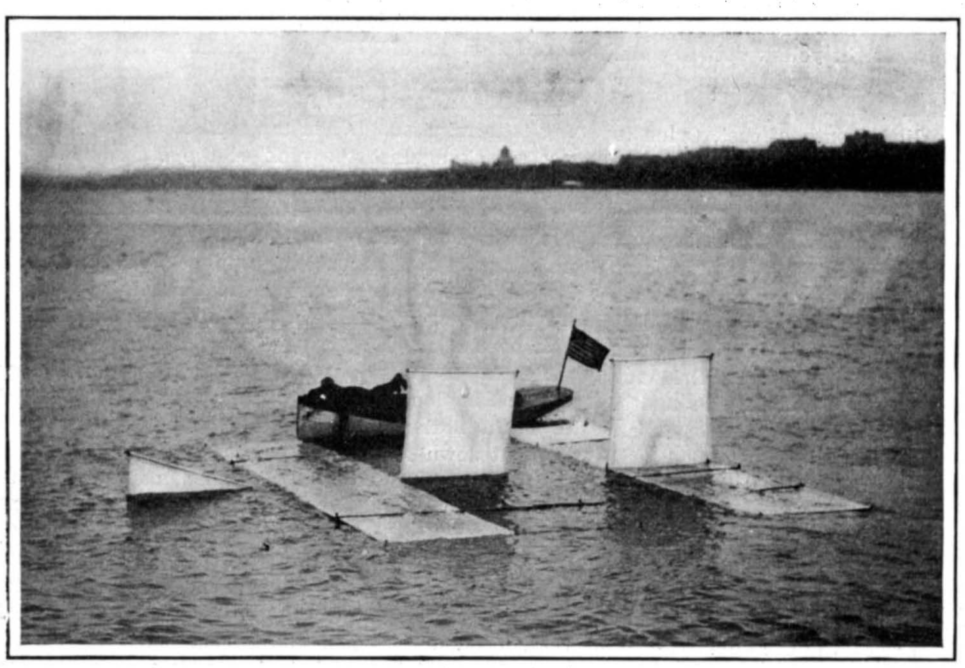
Under Way; the Aeronaut Striving to Balance the Plunging Kite-like Structure.



Nearly at the Greatest Height Attained.



The Beginning of the Flight, Just as the Pull Began to Affect the Aeroplane



After the Ascent; Rescuing the Aeronaut from the Floating Machine.

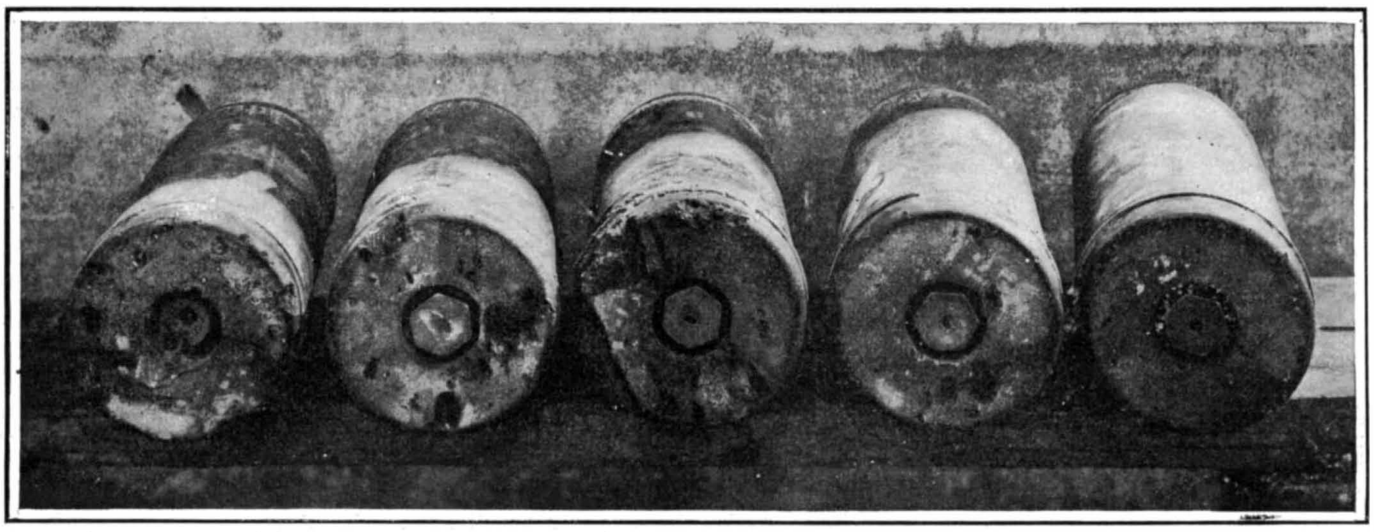
The aeroplane used in the latest test differs little from that employed in the more recent of the former experiments, and its structure is clearly shown in the accompanying illustrations. The entire body consists of elements or unit cubes five feet on a side. The frame, which is constructed of bamboo and piano wire, consists of twenty of these cubes, being five cubes broad and four long, while the height is that of one cube edge, five feet. There are two sets of supporting surfaces, one forward of the other, with an open space between. The operator's position is located in this open space. Each set consists of an upper and lower horizontal surface, with a middle surface between these, fixed at a diedral angle, resembling the position of a soaring bird's outstretched wings. The inventor declares that the air flowing through the triangular opening between the upper and middle surfaces gives direction and steadiness to the aeroplane, very much as do the air currents that pass under and between the feathers of the wings of a bird in flight. The ratio of square feet of supporting surface to pounds of combined weight of aeroplane and aeronaut is about 2½ to 1, a value nearly equal to the average proportions of many soaring birds. The movement of the aeronaut in the aeroplane, with intent to guide it, resembles in principle the action, reversed, however, of the air bladder which every fish possesses.

One of the best features is the form of truss bracing, by which it is possible to get 680 square feet of supporting surface to 125 pounds of weight. This is accomplished by running taut piano wires from each corner of the unit cubes and of the squares forming the surfaces of these cubes, to a corner diagonally opposite, and the rigidity and strength of the frame in consequence of this construction is astonishing. The diedral angle of the middle surfaces, in the event of a lateral tipping, makes the surface on the side which is down approach the horizontal, while the other side is inclined upward, and thus corrects the equilibrium, as greater air pressure is exerted on the side that is flat. The value of the dorsal fins has not quite yet been determined, but it is believed that they, as well as the rudder, tend to steady the aeroplane while in the air. The open space between the forward and rear sets of surfaces tends to decrease the effect of gusts of wind sweeping suddenly upon the machine, as these are prevented from traveling the full length of the aeroplane, the sticks of bamboo crossing this space acting as a fulcrum against which undue air currents must press.

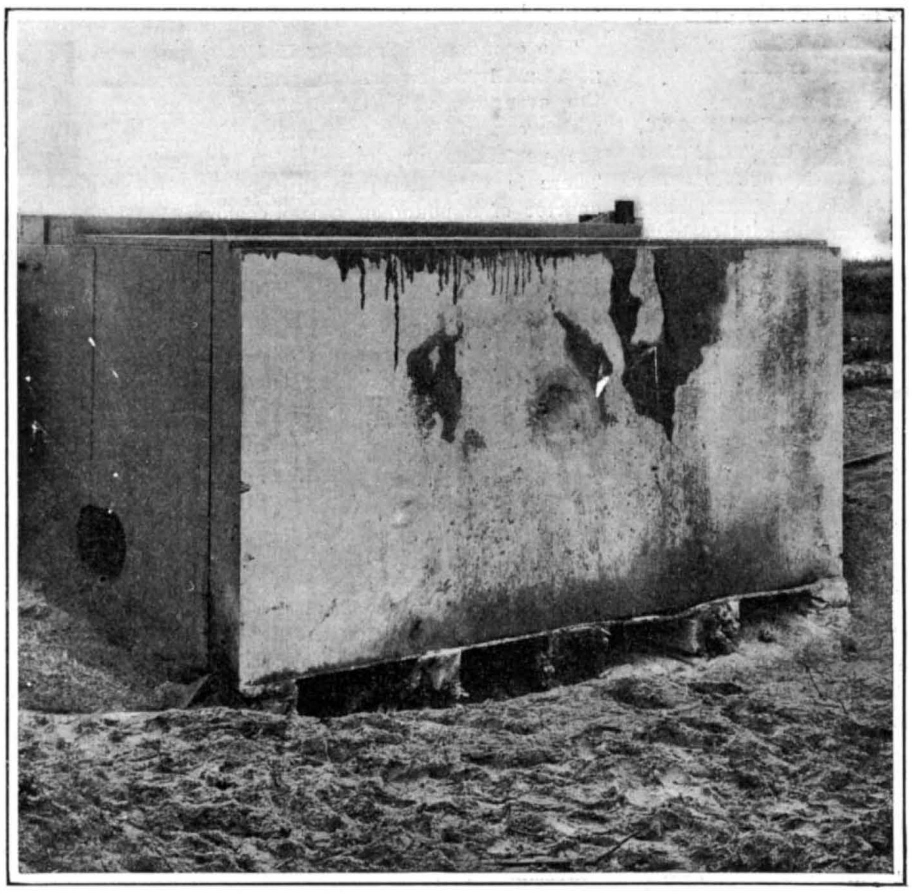
An important advance which deserves public attention is that relating to standards of purity for food products. The Secretary of Agriculture has been authorized by Congress to fix standards, and in order that they may be just and reasonable he has been authorized to call to his assistance the experts of the Association of Official Agricultural Chemists, and other experts, as he may see fit, to advise him in regard to such matters. The work of ascertaining these proper standards, in collaboration with the Association of Official Agricultural Chemists, has been committed to the Bureau of Chemistry. Already considerable progress has been made along this desirable line of investigation, and a number of standards of food products has already been fixed by proclamation. It is proposed to extend this useful work until practically all the substances used by our citizens as foods, beverages, and condiments shall have a fixed standard of purity to which all manufacturers may attain by proper care in the preparation of products of this kind.

TEST OF A TORPEDO SHELL.

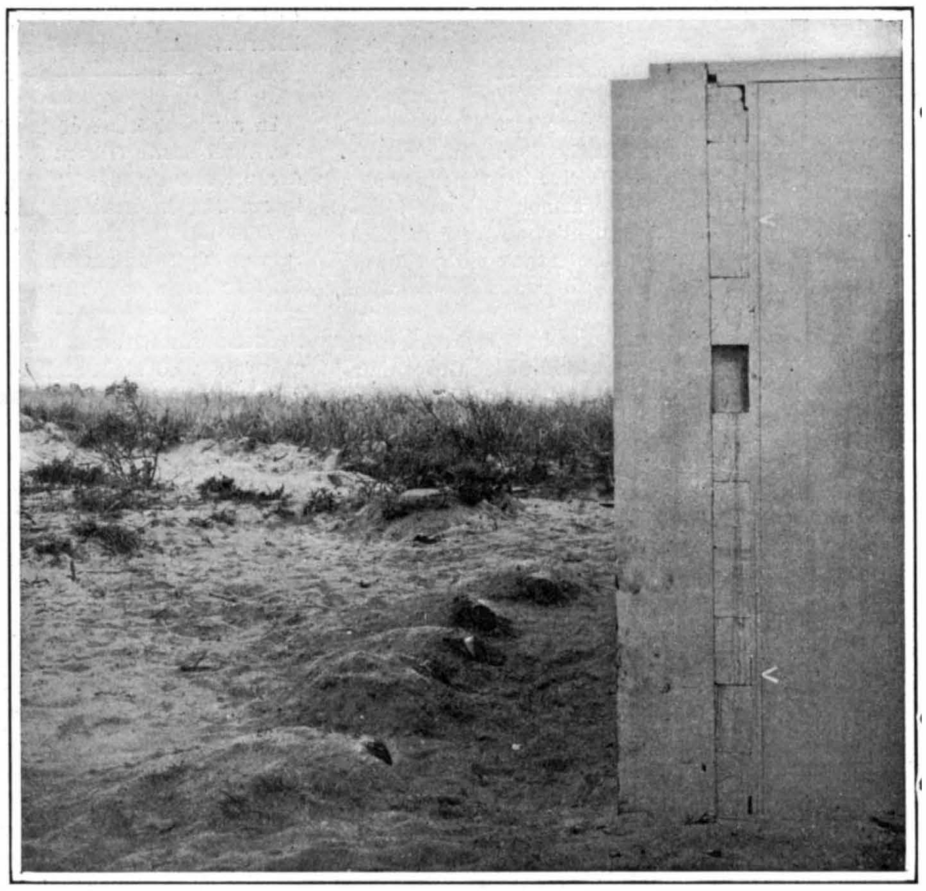
A few years ago the army officials at the Sandy Hook proving ground were called upon to test an aerial torpedo, built on the Gathmann system, for the construction and trial of which Congress, some time previous, had made a liberal appropriation. The test was described in considerable detail in the SCIENTIFIC AMERICAN of November 30, 1901; and our readers will remember that the failure of the shell was greatly emphasized by the fact that, at about the same time, the army high-explosive armor-piercing shell was tested with very flattering results.



Five Shells, Carrying Pressure Gages in the Base, Showing Scoring by Fragments of the Shell.



11½-Inch Plate After Being Struck by Isham Torpedo Shell—Practically Intact.

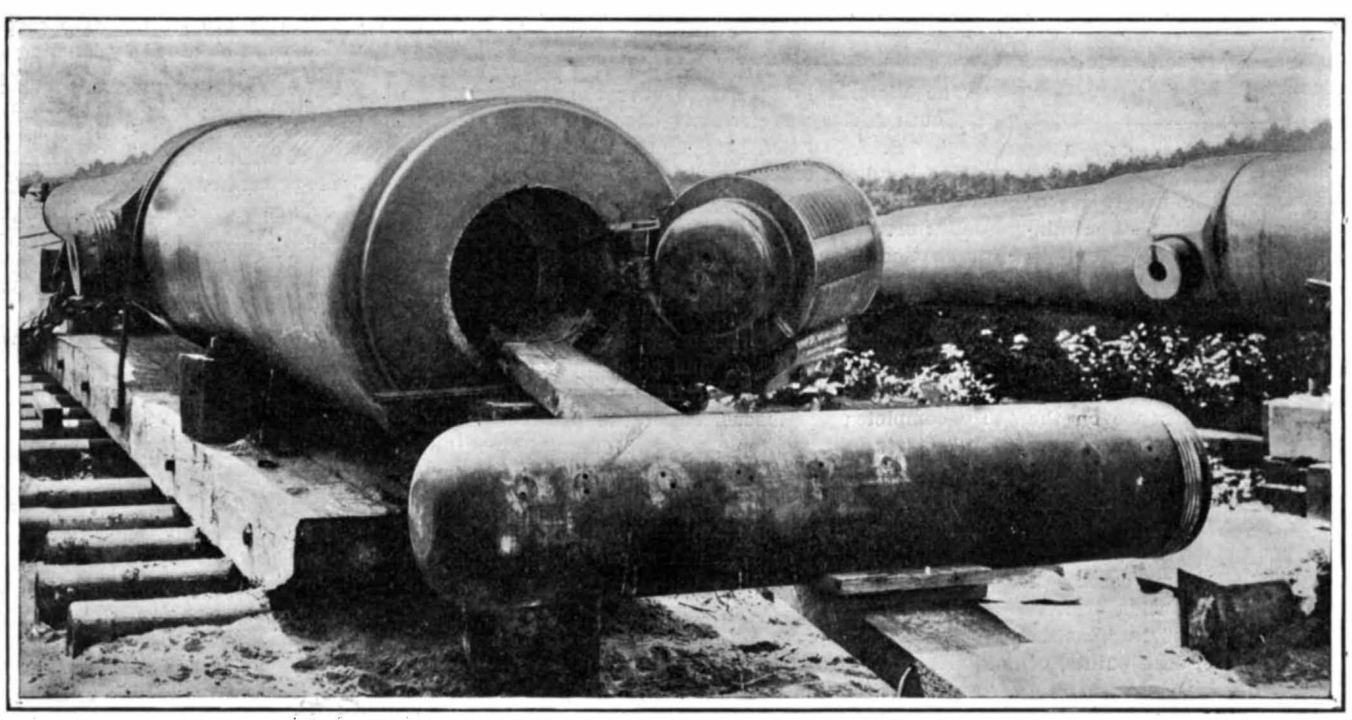


Side View of Plate, Showing the Plate-Steel Backing Uninjured.

We are now enabled, by the courtesy of the War Department, to publish the accompanying illustrations of the test of another type of aerial torpedo, known by the name of its inventor, W. S. Isham. Mr. Isham is of the opinion (or at any rate, was of the opinion) that the fundamental idea governing the design and manufacture of heavy ordnance, as carried out in our army and navy, is wrong. He believes that, instead of endeavoring to penetrate the armor of a ship with a shell having very thick walls and a comparatively small filler of high explosive, designed to burst the shell in the interior of the ship, it would be better to use a larger shell, carrying a heavier charge, and burst it against or near the outside of the vessel. He believes that the energy of the gases of explosion would be sufficient to blow the side of the ship bodily inward at the point of impact, or to create such a vertical pressure upon the water that it would be transmitted to the side of the vessel below the armor belt and crush it in. It was to prove whether these theories were right or wrong, that the shell was recently tested at Sandy Hook; and the results proved very decisively that the theories were wrong.

The target consisted of a Krupp armor plate, similar to those protecting the water line on the battleships "Connecticut" and "Louisiana." It was set up on the Sandy Hook proving ground against a backing which was an exact duplicate of the cellular structure of one of our latest battleships at the water-line, and back of the target was a heavy backing of sand, of sufficient mass to hold the target up to its work. The plate was 11½ inches thick, 7½ feet high, and 16 feet wide. Both the plate and the backing were manufactured at Bethlehem by the Navy Department. The structure was assembled at the Brooklyn navy yard, and taken complete to Sandy Hook, where it was set up among the sand hills at the proving grounds.

The Isham shell, which is 12 inches in diameter and 59 inches long, is divided into ten compartments by means of circular diaphragms equally spaced throughout its length. It was loaded with 182¾ pounds of explosive gelatine composed of 90 per cent of nitroglycerine, 8 per cent of gun cotton, and 2 per cent of camphor, the last-named substance being used as a deterrent. Each of the separate chambers in the cell is provided with a screw plug opening through which the high explosive can be poured into the shell; the plugs being afterward screwed tightly down into position, as shown in one of the accompanying photographs. The object of dividing the interior of the shell into compartments is to limit the amount of pressure on the high explosive at the base of the shell at the instant of firing. The inertia of the explosive causes it to bear upon the base of



The Isham Shell and the 12-Inch Gun from Which It Was Fired.

Diameter of shell, 12 inches; length, 59 inches; charge, 183 pounds nitro-glycerine.

TEST OF A TORPEDO SHELL.

the shell with a pressure which is proportional to its mass, and were there no dividing diaphragms there would be a risk of detonating the charge in the gun. The provision of the transverse diaphragms, however, brings the inertia effects well within the limits of safety.

In the recent test the shell, which weighed 970¼ pounds, was loaded into a 12-inch 35-caliber gun, and fired with a charge of 82 pounds 10 ounces of smokeless powder with a velocity of 1,417 feet per second at the muzzle of the gun. It struck the target, which was 500 feet distant, with a velocity of 1,400 feet per second, which would be about the striking velocity of the shell, if fired with a full powder charge, at a range of 9,000 yards. The projectile struck the target at about its center and exploded with results which were so insignificant as to be practically negligible. There was a slight indentation of the surface of the plate made by the head of the shell, which was about 12 inches in diameter and 1½ inches deep at the center.

The blast of the gases blew a depression in the sand at the base of the target which was about 5 feet in width, measured from the face, and about 26 inches in depth. The sand was also driven back somewhat from underneath the target, and the ends of the 16 x 16-inch longitudinal timbers upon which the target rested were somewhat split and broomed up. The whole target was moved 2 or 3 inches to the rear, and settled, due to the blowing out of the sand beneath, to about the same number of inches. The integrity of the plate steel structure representing the side of the battleship which formed the backing of the plate was uninjured.

In order to give an approximate test of the soundness of Mr. Isham's theory that the downward pressure of the gases of explosion would drive the water through the side of the ship below the armor belt, five 6-inch shells were buried in the sand at a distance of about 3 feet back from the face of the target, with the axes of the shells placed radially to the center of explosion. In the base of each shell was placed a pressure gage of the type used in determining powder pressures in the gun when large guns are under test. On examining these gages after the shot was fired, the base of the shells presented the appearance shown in the accompanying engraving, which represents the shells after they had been recovered from the sand. In the case of three of them the pressure gage had been struck by flying fragments of the shell and, of course, the pressures recorded were valueless. The first shell, from left to right, was struck by a fragment on the pressure gage, as shown, and revealed a pressure of 16,120 pounds to the square inch. The pressure gage of the second shell was also struck and showed 14,120 pounds to the square inch; the third pressure gage was not struck by fragments, but as it was covered with sand its low pressure of 1,800 pounds to the square inch was considered, like those of the two preceding gages, to be of no value for the purpose of the experiment. The fourth shell, whose pressure gage was struck by a fragment, showed 8,950 pounds to the square inch. The fifth shell, however, was not struck by fragments, and its pressure gage was clear of sand and any obstruction, and therefore, received the unobstructed blast of the gases. Its gage showed a pressure of 4,800 pounds to the square inch, and this must be taken as a fair indication of the downward thrust of the explosion—altogether too small to overcome the inertia of the water, and produce a horizontal component at a depth of, say, 5 to 10 feet, sufficient to burst in the side of a ship.

The failure of this shell, coming after that of the Gathmann shell, should settle once and for all the question of the value of torpedo projectiles for use against modern armored vessels.

Prize Competition for the Prevention of Lead Poisoning.

In order to find effective means for the prevention of lead poisoning to which all workmen occupied in mining, milling, smelting, and refining lead ore, or employing metallic lead or materials containing the same are exposed, a competition is proposed by the International Association for Labor Legislation, Basle, Switzerland, subject to the conditions hereinafter specified. The following prizes are offered:

1. One prize of $1,200 for the best treatise on the prevention of lead poisoning in the operation of mining and milling lead ores or ores containing lead.

2. One prize of $2,400 for the best treatise on the prevention of lead poisoning in smelting and refining works.

3. Two prizes, viz., one first of $600, one second of $360, for the best treatises on the prevention of lead poisoning in the chemical application of lead, as in white lead works, manufacture of other lead paints, of electric accumulators (storage batteries), etc.

4. Four prizes, viz., one of $360, one of $240, two of $180 each, for the best treatises on the prevention of lead poisoning in the trades of house, ship, coach painting, interior decoration, varnishing, and the like.

5. Four prizes, viz., one of $360, one of $240, two of $180 each, for the best treatises on the prevention of lead poisoning in those trades where raw and manufactured lead are consumed or handled on a large scale, as in type foundries and printing offices.

Each treatise is to contain a systematic review of the special causes giving rise to lead poisoning, in conjunction with a description of the various processes of manufacture, pointing out the dangers occasioned at every phase of procedure, including handling and transportation.

Reference to be made also to the causes due to working at places in which a prolonged occupation is liable to affect the health, to want of cleanliness, lack of proper guidance and instructions, carelessness, poor and inadequate food, irrational way of living, and unhealthy dwellings of the workmen. In connection with the statement of the causes of lead poisoning, measures for their prevention are to be proposed.

Substantial evidence should be given for the proposed preventives as regards their technical, hygienical, and economical feasibility.

The papers may be written either in English, French, or German. Already printed books cannot be taken into consideration by the jury. The ready manuscripts must be put in an envelope bearing only a motto, and lodged with the International Labor Office at Basle on or before the 31st December, 1905.

All letters, inquiries, and other matters pertaining to the present competition, are to be addressed to the International Labor Office, at Basle (Switzerland).

Dynamics of Dreams.

In a recent issue of the New York Medical Record, Dr. Axel Emil Gibson discourses on the "stuff that dreams are made of." In this lengthy article some interesting information is given. For instance, Harvey, of the vascular circulation fame, is said to have recorded a dream in which a bumble-bee stung him in his left thigh, on a place where a couple of days later appeared an ugly ulcer, and Malesherbe, the renowned French author, found himself in a dream attacked by a rowdy who stabbed him in his left breast with a dagger in an area where the following evening he felt the first attack of a severe lobar pneumonia. "The archives of medical reports," the author informs us, "are heavy with cases of a similar character, which have either received no explanation at all, or else have been explained away entirely."

The doctor calls attention to the fact that dreams depend on some other media than those known to us as the five senses. A most conclusive evidence in favor of this view is found in the circumstances that even the blind are able to see in dreams—as witness the experiences recorded by Helen Keller, "Blind Tom," the poet of "Paradise Lost," and others. Hence the conclusion seems to be unavoidable that it is only as far as physical vision is concerned that the optic nerve guides and limits the field of vision.

The author finally arrives at the deduction that dreaming and waking differ in degree and form of manifestation only, not in principle and essence. "Like waking consciousness," he avers, "the dream reveals, but does not create. The same world that surrounds the waking individual surrounds the dreaming, only the viewpoints and media of observation are changed."

Ordinary dreams, Dr. Gibson tells us, are merely undigested consciousness, being made up of longings, desires, anticipations, idle hopes, and miscarried realizations, which, occupying the mind during the day, are overtaken by sleep before having reached their fruition.

The Current Supplement.

The Victoria Falls Bridge over the Zambezi gorge in South Africa was formally opened on September 12 last by Prof. Darwin, head of the British Association, which has been touring and lecturing in South Africa. Harold Shepstone, in the opening article of the current SUPPLEMENT, No. 1557, describes the ceremonies on that occasion, and likewise gives a succinct account of the bridge, illustrating his text with two photographs. The seventh installment of Sir William White's discussion of submarines is also published. The treatise on the iron and steel hull steam vessels of the United States by J. H. Morrison is continued. He completes the discussion of the previous number and starts a new topic, "the Modern Shipbuilding Plants on the Atlantic Coast." Prof. J. C. McLennan contributes the results of his investigations of the induced radio-activity excited in air at the foot of waterfalls. V. Quittner discusses magnetic alloys. An interesting 40-ton block crane with 150-foot radius is described by the English correspondent of the SCIENTIFIC AMERICAN. As part of his paper read before the South African meeting of the British Association for the Advancement of Science Prof. G. H. Darwin gave a graphic description of the evolution of a star. This account will be found in the current SUPPLEMENT. Elie Metchnikoff, sub-director of the Pasteur Institute, gives his views on old age and senile diseases in general.

Engineering Notes.

The question is often asked whether in case of installing a certain horse-power of boilers, say 300 horse-power, it would be more economical to have three boilers of 100 horse-power each or two boilers of 150 horse-power each. By all means have the two larger units, as it will always be found that the larger boilers have less radiation, less air leakage and better combustion than a corresponding horse-power in small units. If it is necessary to have a spare unit for cleaning, let there be another one provided of the same size.

Most of the largest bridges and other steel structures which have been built in late years have been designed by engineers not connected with manufacturing establishments. The manufacturer should confine himself to his legitimate field of manufacturing structural steelwork at so much a pound. The line between engineers and manufacturers will be even more marked in the future, when the same distinction will prevail as now exists between the architect and the contractor. The manufacturers of structural work, in the future, will devote their energies to improvements in their tools and machinery and methods for handling material. Their engineering force will consist of mechanical experts, shop draftsmen and engineers, who, with a thorough knowledge of shop-practice, are skilled in putting the engineers' designs into convenient shape for the workshop.

The economy in burning fuel is a matter requiring great skill and experience, and depends entirely upon the evenness, thickness, and condition of the fire, which controls entirely the air supply, and, therefore, the perfection or imperfection of the combustion. There is very little use in "splitting hairs" over a quarter of a pound of steam consumption of the engine, while the fireman may be losing ten times this quantity of fuel from inefficient boilers or poor firing. It is too often the case that the demands for increased horse-power are met by grate surface too large in proportion to the heating surface of the boiler or forced draft, and too little attention is given to careful firing, with heating and grate surfaces in proper proportion to give best economy, and frequently a great deal of money is spent in obtaining high-class engines and condensers, whereas the principal loss is in the boiler and fire room.

Some interesting experiments upon the use of waste products for motive power have been carried on at Noisel, France. In general the portable or fixed engines which are used on the farms are obliged to use coal which must be brought to the spot at a considerable expense. It is estimated that the engines take 6 or 8 pounds of coal per horse power, costing from four to six cents. The use of gasoline or oil motors is too expensive to be practicable at present on the farms. To see whether the problem of cheap power could not be solved by the use of the different kinds of vegetable waste products which are so abundant, the present experiments were undertaken, and the various products were burned in a gas generator which in turn ran a duplex motor. Wheat straw, oats, waste hay, leaves, reeds, etc., were used. The idea in the present case is to form groups among the neighboring farmers who would possess the apparatus in common, in which case the first cost would not be a heavy one and they would then have a source of cheap power, using a 50-horse-power gas engine. In the present trials the products were collected and after drying were formed into bales weighing 800 pounds per cubic yard. The straw was chopped before baling. We give some of the results which were obtained by burning the different forms of waste material in the gas producer. The latter, which is of the Riché pattern using an upright column, only requires a little coke to keep up the operation. In the case of waste hay, it takes 2.25 pounds to produce a horse-power-hour, and the cost is estimated at $0.0112 in this case. The hay was charged in the gas-producer without taking any special precautions and was packed down with a rod. The alkaline slag which comes from the furnace may be used as fertilizer. In the case of wheat or oat straw the ash and water are somewhat less than in the former case. The horse-power-hour can be produced by burning 2.3 pounds of straw, at a cost of $0.0114, or practically the same as with hay. Reeds or moss cannot be used to advantage in the producer unless they are well dried. In fine weather they can be spread in the sun. The cost is greater than above. In the case of dead leaves (ash leaves) which had fallen in the autumn before, allowing the cost of collecting, transporting, and compressing to be $1.2 per ton, we find that the horse-power-hour comes as low as $0.0086. With buckeye leaves it is $0.0112. Sawdust, shavings, and wood splinters were also tried. Poplar sawdust takes 3.1 pounds to give a horse-power-hour, costing $0.010. These results show that by the use of proper apparatus it is possible to secure motive power from waste products at a very low rate, and this would be a great advantage on the farm, especially in regions where coal is high.

Correspondence.

Chains vs. Cables in the Manhattan Bridge.

To the Editor of the Scientific American:

An editorial review of my letter of September 13, published in your issue of September 30, criticises my statements, that an eye-bar chain will weigh about 4.84 times as much as a wire cable of equal strength, and that, therefore, the Manhattan Bridge, if built on the former design, would cost from four to five millions more than if built on the latter plan.

Some doubts are expressed in this editorial, not only as to the correctness of the calculations on which my statements are based, but also about my personal ability for making such calculations. An attempt was made to justify these doubts by relating some historical facts, from which misleading inferences may be drawn, and by comparing certain figures which, being incompletely quoted, give wrong results.

I trust, therefore, that you will accept the following corrections and additional explanations:

In the first place, I beg to state that I do not claim that any kind of wire cable bridge is cheaper than all kinds of chain bridges, but my calculations refer only to a comparison between two bridges of the same length and capacity, and having the same coefficient of safety in all their parts. In this case, a comparison between the weight and cost of two kinds of cables, consisting of different material, is extremely simple, and can be made *accurately* by "rough and ready methods" without consulting the strain sheets of secondary parts of the bridge. Whoever claims that the latter is necessary and that such a comparison is a complicated problem, known only to few engineers, is either totally inexperienced in the construction of suspension bridges, or he is willfully mystifying a clear matter, in order to avoid a direct response to the simple calculations which he is unable to contradict!

It is claimed, in your review, that I failed to convince the board of eminent engineers about the correctness of my statements. There is no evidence for this assertion. The board never questioned the correctness of the calculations nor contradicted them, and never pointed out where they were wrong, if wrong at all. The fact is, the experts never discussed the question at issue, but they merely ignored it. This can be explained by the circumstance that the eminent engineers were not engaged and paid to discuss or dispute with me questions which did not concern them; they were not engaged for making comparisons between wire and chain cables; they were not asked to determine whether the eye-bar plan was cheap or expensive, nor whether any other design would be better and more economical. They were merely engaged for giving their opinion whether the design, submitted to them, was practical, whether the bridge, after being finished, would be fireproof, durable, and serviceable, and whether it would have sufficient capacity and strength. These questions were answered with "yes," and if I had been a member of the committee I would, with strict adherence to the same questions, have given the same verdict!

The action of the board of engineers is, therefore, no criterion for the correctness or incorrectness of my statements.

Your editorial mentions also the Buda-Pesth bridge, where the question of eye-bar chain or wire cable, considered "purely on its merits," was decided in favor of the former. I beg to say that you were wrongly informed. The fact is that, among many competitive designs, one of a wire cable bridge stiffened by trusses, submitted by the Nuernberg Bridge Works, was selected by a board of eminent bridge experts as the best and was awarded the first prize. The local authorities, however, fully acknowledging that a wire cable would be cheaper, decided in favor of the eye-bar chain for patriotic reasons, because eye-bars could be manufactured at home, while wire had to be imported from other countries. Moreover, wire would have been subject to a heavy import duty, while eye-bars were free from it, which helped considerably to reduce the greater cost of an eye-bar bridge. In spite of this circumstance, favorable to eye-bars, it is conceded that the chain bridge was 12 per cent dearer than the wire bridge would have been, notwithstanding the fact that the unit stress in the eye-bars is relatively about twice as high as it would have been in the wire cables. (These data are taken from the Zeitschrift des Vereins deutscher Ingenieure.)

The Buda-Pesth bridge is, therefore, no criterion for the relative merits of wire or eye-bar cables. Now I will show, by the figures quoted in your editorial, that the proportions of weight between wire and eye-bar cable is not 1:2, as stated therein, but that it was correctly given in my letter of September 13.

One of the wire cables of the Manhattan Bridge is quoted to contain 275 square inches, hence the average section of the cable, if it could be varied like a chain, would be 265 square inches. This, compared with the average section of 555 square inches for the eye-bar chain, gives the following relative strengths: Breaking strength of one chain: 555×40 tons $= 22{,}200$ tons; breaking strength of one wire cable: $265 \times 112 = 29{,}680$ tons. Forty tons is the ultimate strength per square inch of nickel-steel eye-bars, as accepted by the bridge department for the Blackwell's Island Bridge, and 112 tons is the tested actual strength per square inch of the wire in the Williamsburg Bridge.

The wire cables of the Manhattan Bridge are therefore at least 33 7-10 per cent stronger than the eye-bars in the chain bridge design. As my comparison of weight and cost is for cables of equal strength, the true useful section of one chain is therefore 555 + 33 7-10 per cent = 742 square inches, to which 20 per cent must be added for eyes and pins, making the actual section of one chain 890 square inches, which, compared with 275 square inches, is not twice, but 3.23 times as much as the section of the wire cable.

The total weight of steel in the bridge is, as correctly quoted, 41,700 tons. Subtracting from this weight the weight of anchor chains, towers, saddle castings and hand-rail ropes amounting to 15,800 tons, we obtain 25,900 tons for the weight of the steel superstructure, of which 12,400 tons are in the main span. Adding to the latter figure 1,760 tons (= 2,400 pounds per lineal foot) for floor measurements and 5,880 tons (= 4 tons per lineal foot) for live load we find the total dead and live load of the main spans to be 20,040 tons, of which the wire cables weigh 3,180 tons and the other parts, including live load, 16,860 tons. To support the same weight of 16,860 tons with eye-bar chains, the total weight of the main span would be $16{,}860 + (3.23 \times 3{,}180) = 27{,}130$ tons, which is 35 per cent greater than the present weight. For supporting this increased weight, the former chain section of 890 square inches must be increased in the proportion of 27,130 : 20,040, making it 1,205 square inches, which is 4.38 times as much as the wire cable section.

The discrepancy between this figure and 4.84, as given in my letter of September 13, is due to a difference in the assumption of the relative strength of nickel steel and wire. In the present calculation I compared the strength of nickel steel with the wires in the Williamsburg Bridge, which is as 1 : 2.8, while in my former calculation I assumed the more correct proportion of 1 : 3, because there is no trouble in manufacturing wire having an ultimate strength of 120 tons per square inch. Giving the benefit of the different assumptions to the eye-bar chain, its cost will still be $3,268,500 more than that of wire cables.

The above given figures are mathematically correct and not based on guesswork, as intimated in your editorial, and it is, therefore, not fair to doubt the figures or make light of them, unless someone clearly shows where they are wrong, if wrong at all.

I took the same standpoint before the board of engineers but, so far, nobody has ever tried to contradict or disprove my calculations. The only attempt to do so, in your editorial, has, as I have demonstrated, failed because in the given weight of the eye-bar chain, the weight of eyes and pins was omitted, and a comparison was made between two kinds of cables, of which one was 33 per cent stronger than the other.

That the anchorages for the wire cable plan are more costly than for the chain cable design, as stated in your editorial, is decidedly an error. The anchorages must resist the pull of the cables, which is in direct proportion to the weight of the bridge. It is therefore impossible that a heavier bridge should require less anchor masonry than a lighter bridge. We have seen that the dead weight of the eye-bar plan is 50 per cent greater than that of the wire bridge, and, including an emergency live load of 8 tons per linear foot, the former is still 27 per cent heavier and will, therefore, require 27 per cent more anchor masonry than the latter. In the same proportion the anchor chains, the section of the towers, and the area of the foundations must be increased in order to support the greater weight of the eye-bar bridge.

In my first paper on this subject (published in Engineering News of March 12, 1903), I have shown that the additional cost for such an increase in anchor chains, anchor masonry, towers, and foundations amounts at least to one million dollars, which, added to the excess of cost of eye-bar chains, demonstrates that a bridge on this design will cost at least $4,268,000 more than a wire cable bridge of equal size and strength.

It is possible that the chain cable design contains some economic features (for instance, hinged towers) which are not contained in the wire cable design; but all these features are independent from the nature of the cables, and could be adapted to either design. It was not my object to compare two designs in all their details, but to show what influence on the cost of the structure the application of eye-bar chains has, in place of wire cables. We have seen that the difference in cost is so enormous that, in comparing the two designs as they are, and with a liberal allowance for all economic advantages claimed for the eye-bar design, it is evident that the latter will cost fully or nearly $4,000,000 more than the present wire cable design, and not $2,000,000 less, as claimed in your editorial.

Wilhelm Hildenbrand.

New York, October 21, 1905.

[A discussion of this letter will be found in the editorial columns.—Ed.]

The Queen Bee and Poison.

To the Editor of the Scientific American:

The article entitled "Precautions Against Poisoning the Queen Bee" which I wrote for the Scientific American has called forth a reply from the editor of an agricultural paper, in which reply the accuracy of my statements is questioned. The article in question summarizes the results of many experiments conducted by myself.

I do not profess to be superior to mistake, but I certainly took much care and sacrificed eleven queens in making my observations, to ascertain how long they live on plain honey. In common with others, I long considered the evidence that queens were frequently seen lapping honey, as conclusive. I determined, however, to test the matter and conducted a series of experiments the deduction from which must "hold the field" until something superior is provided. Not one of the queens experimented with survived 12 hours on unsealed honeycomb kept at a temperature of 65 to 70 deg. F. The unmated queens made the record of nearly 12 hours; none of the laying queens survived two-thirds of that time, some expiring in less than 12 hours.

Now if a queen bee has been kept out of the reach of any attendant bee for twenty-four hours, alive on honey, my observations would be upset, but until some specific statement on these lines be made, I hold to the accuracy of my investigations on this point, and shall await with interest information as to the exact character of other experiments.

Inasmuch as everything stated in my note is impliedly challenged, I may add that the description of what goes on in the wasp's nest is another piece of independent observation. For years I have made a practice of securing several tree-wasp's nests, removing the outer covering and placing the comb in a glass case where the wasps could fly freely out-doors, and their movements could conveniently be watched.

J. M. Gillies,

Lecturer in Beekeeping, Albert Agricultural College (Government).

Drumcondra, Ireland, October 18, 1905.

Another Spontaneously Moving Stone Ball.

To the Editor of the Scientific American:

In a recent number of the Scientific American there was an illustrated description of a monument surmounted by a stone ball, which was apparently spontaneously turning on its support. It may interest your readers to know that an almost exactly similar phenomenon has been observed in the case of a granite cemetery monument in the Bradford district of this city. The monument, which has been erected about ten years, bears on the top of the shaft an immense granite ball nearly eighteen inches in diameter, resting in a cup-shaped depression. Since it was placed in position the ball has moved nearly a quarter of its circumference in a northeast and southwest vertical plane, and the unpolished portion of the ball which originally rested in the depression now faces the northeast horizon.

There seemed to be a great variety of opinions as to the cause of the movement of the ball described in your previous issue, but in the case of the Bradford monument I think the explanation is obvious. It will be noted that the movement of the top of the ball is toward the winter sun. The remains of a lead washer placed between the ball and the shaft, now very much corroded and broken, allow free access of water to the cup-shaped space between. Now let us assume, as would almost certainly be the case, that the depression becomes filled with rain or melted snow, and afterward freezes. As is well known, water in freezing expands with an enormous force quite sufficient to lift even the massive stone ball a small fraction of an inch. Imagine this to occur on a cold night. The next day as the sun moves round to the southwest, it warms the stone and melts the ice *on the southwest side first.* Naturally the ball will topple over slightly in that direction, and as the remainder of the ice melts will settle down in its new position. A repetition of the process of freezing and thawing will cause it to turn a little farther, and so in the course of years the movement becomes very evident. There are no trees or other obstructions to the sunlight in the vicinity, and it seems as if the all-powerful radiant energy of the sun must be the sole cause of this remarkable movement of a mass of stone weighing at least several hundred pounds.

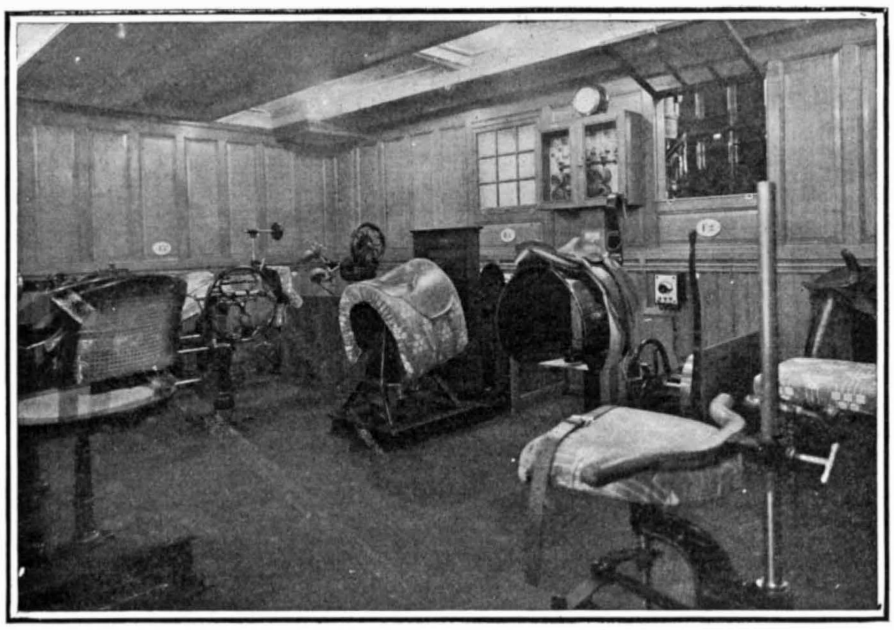
Austin P. Nichols.

Haverhill, Mass., October 25, 1905.

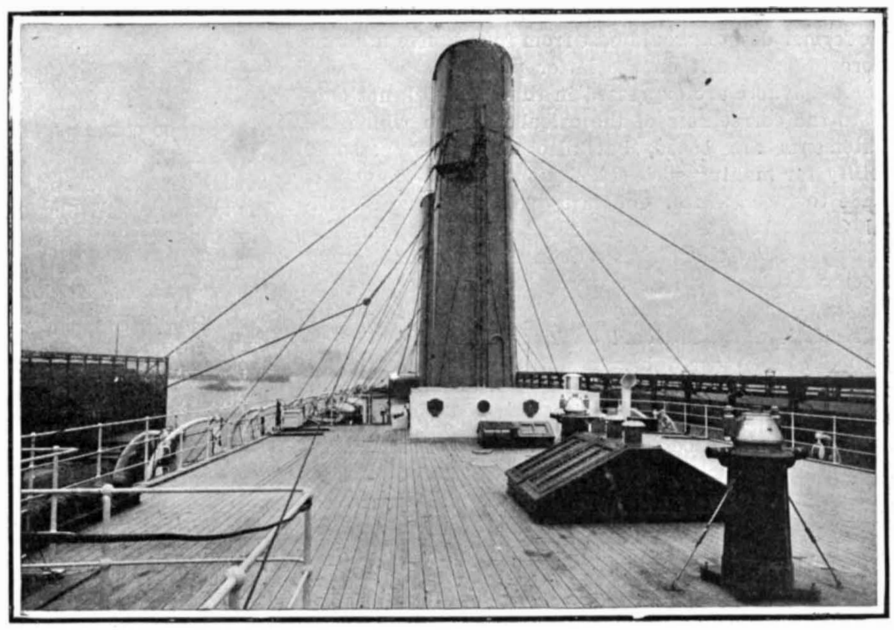
THE TWIN-SCREW LINER "AMERIKA."

The recent maiden trip of the new Hamburg-American twin-screw steamship "Amerika" to the port of New York marked the advent of another of those vast freight and passenger steamships, whose great proportions present emphatic evidence of the enormous growth of the transatlantic freight and passenger business, and of the increasing number of travelers who can afford to pay the cost of luxurious accommodations.

Modern development of the transatlantic steamship has been along two lines, the first of which marks the growth of a type of ship devoted exclusively to mails and passengers, and driven at the highest speed compatible with requirements of accommodation, strength and safety. These ships are extremely costly to build and operate, and they depend entirely upon the revenue from mails and passengers to enable them to add to the owners' dividends. The steamship companies affirm that so great are the first cost and the current expenses that these ships are not a paying proposition. The other line of development is in the direction of large freight steamers of great carrying capacity, provided with roomy accommodation for passengers, and driven at moderate speeds of from 14 to 17 knots an



The Gymnasium.



Unobstructed Promenade on the Sun Deck, 65 Feet Above the Water.

Main Stairway, Showing Florist's Store in the Far Corner.

The Ladies' Writing Room.

The à la Carte Restaurant.

THE "AMERIKA": THE LATEST TRANSATLANTIC PASSENGER STEAMSHIP.

hour. The vessels of this class, as a rule, charge lower rates than those of the express passenger steamers, and they, of course, take longer to make the passage. In the earlier vessels of this class, like the "Pretoria," the accommodations were not so elaborate as those on the faster boats. But so popular have they become with the public, that the steamship companies of late years have devoted special attention to the passenger accommodations, until in the latest boats they have been brought fully up to the high standard of the fastest mail boats.

To the first type belong such steamships as the "Lucania," "St. Paul," "Oceanic," "La Lorraine," "Kaiser Wilhelm II.," and the "Deutschland." To the latter class belong the "Pretoria," "Celtic," "Baltic," "Ivernia," and now the "Amerika." In this last-named vessel the passenger accommodations and the provision of conveniences tending to reduce the monotony and enhance the comfort of the transatlantic passage have been brought up to the high level of the very latest of the express steamships. In some features, indeed, the "Amerika" excels them.

The "Amerika," which was built at the shipyards of Harland & Wolff, at Belfast, is a twin-screw ship, with a length of just under 700 feet, a beam of 74 feet 6 inches, and a depth of 53 feet. Her gross tonnage is 23,000 tons, and when she is fully loaded she carries 16,000 tons of cargo. Provision is made for four classes of passengers, including 550 first-class, 300 second-ones measuring 12 x 14 feet and 14 x 8 feet in size.

It is impossible within the limits of the present article to cover all the features of interest in a ship of this size; but among others we may mention the installation of a passenger elevator which extends through four decks; the provision of an *a la carte* restaurant, accommodating 120 persons; the provision of a thoroughly equipped gymnasium, to say nothing of all such accessories as a stateroom telephone service, a nursery with several trained nurses, a complete florist shop, and many other features that serve to bring the accommodations one step nearer to that which can be obtained in the most expensive hotels on shore. The *a la carte* restaurant is located amidship on the upper promenade deck. The idea is an elaboration of the grill-room feature which is so popular on the "Deutschland." The convenience of being able to drop in at any hour of the day or night and order from a bill of fare as elaborate as that of Delmonico's or Sherry's will be appreciated by all seasoned transatlantic travelers. This restaurant, which is easily the most splendid feature of the accommodations, is decorated in the Renaissance style. Its walls are paneled in mahogany and chestnut mounted in bronze, after the style of the latter half of the eighteenth century. The chairs are copies of the old Versailles design, of the same pattern of tapestry as used by Marie Antoinette in the Petit Trianon. The main dining room, which is on the saloon deck, is 100 feet in length by 72 feet in width.

engines are of about 15,000 horse-power, and they stand in a single room surrounded by the condensers, auxiliary engines, and electric lighting plant. This is one of the most convenient engine rooms that we have ever inspected, the whole of the machinery being placed so as to be readily accessible for attention and repairs.

Among the provisions for insuring the safety of the ship is the installation of the system of the Submarine Signal Company, of Boston, which provides a means for communicating through the water between the ship and the shore. By bell signals, the navigator can locate lightships and lighthouses regardless of weather conditions. Dangers from fog and thick weather are safeguarded against by the use of the Stone-Lloyd system for closing the water-tight bulkheads. By pushing a button on the bridge, the water-tight doors of every compartment into which the hull of the ship is divided are closed in a few seconds. As a protection against fire the latest system of extinguishing fire, that of forcing sulphuric acid gas into it, is installed, and may be put in operation immediately upon the sounding of the fire alarm.

The Gallery of the Smoking Room, Showing Stairway. This Handsome Room on Two Decks is Finished in Dark Oak.

THE "AMERIKA": THE LATEST TRANSATLANTIC PASSENGER STEAMSHIP.

class, 250 third or intermediate class, and 2,300 steerage passengers. As the ship carries a crew of 600, it will be seen that with a full passenger list she is literally a floating town, there being altogether no less than 4,000 souls on board. This number is larger than the population of many an inland town that boasts of its opera house, court-house, churches, and all the other accessories that are thought to justify the inhabitants in dignifying it with the name of city. The "Amerika," as seen from near the water level, say from the deck of a ferryboat, presents a most imposing appearance. In the first place, she has a molded depth of 53 feet, the plating being carried up without a break to a height of three decks above the water line. Forward, the plating extends to the forecastle deck. It is carried up to the same level for nearly two-thirds of the length of the vessel amidships, and it is here that the first and second class accommodation is provided, the great beam of the vessel rendering it possible to build the various halls, restaurants, etc., and even individual staterooms, on a scale of spaciousness that marks a distinct advance in the comfort of transatlantic travel. The staterooms are more commodious than in preceding ships, and there is not a single upper berth in the first-class accommodation. A striking feature is the special suites, of which the imperial suites are the most splendid, including bedrooms, private sitting rooms, dining rooms, and bathrooms. The rooms in these suites are of unusual size, some of the larger

and it can accommodate about 400 persons at one sitting. The walls are pearl gray, hung with copies of Bouché's best work, the furnishings are of the Louis XVI. period, and the carvings are reproductions of those at Versailles. The safety devices are of the newest and best of their kind.

Two delightful rooms are the ladies' writing room and the drawing room. The prevailing color in the first is a delicate heliotrope, and in the second a soft rose pink. The drawing room is decorated in the Adams style and an exquisite effect is obtained in the Wedgwood plaques which form part of the electric light fittings. It would be difficult to excel the dainty simplicity of this room, or that of the adjoining writing room, which is treated throughout in the Empire style.

Perhaps the most interesting and novel apartment is the Elizabethan smoking room, which is carried out in solid oak in the roughly finished style of the sixteenth century. It consists of two floors connected by a splendid staircase, at the head of which is a decorative painting representing a scene in the Arctic regions, which is noticeable in the accompanying engraving. Around the upper floor is a lovely carved frieze in light wood, illustrative of incidents of the life of St. Hubert, patron saint of huntsmen.

As the "Amerika" is not a high-speed vessel the engine room does not possess the spectacular features that mark some of the high-powered boats. Her twin

Plant Poisons.

The question of the action of poisons in different plants has been examined by G. J. Stracke, a German scientist. We observe that a great number of plants show toxic secretions or excretions, but still continue to live, in spite of the poisonous matter which they contain. It is possible that the plant is protected by localizing the poison in some of the tissues or in determined cells, which are thus sacrificed, and that thick walls serve to isolate the dangerous regions from the other parts, but on the other hand it is certain that proto-vegetable matter can exist in contact with the poisons of some bodies without being destroyed. M. Stracke makes some researches which are interesting, even though incomplete. He determines the resistance of a vegetable tissue to solutions of different poisons, according to the degree of plasmolysis and sometimes by a change of color which follows the death of the green tissue. In this way he observes the action of the oxalic acid on a leaf or rather on the outer scales of the leaf, using the *Begonia manicata* which contains a large quantity of oxalic acid, combined or free. The leaf of this plant has a great resistance to solutions of this and other acids in different degrees of concentration. This resistance is greater than other plants show. But while the red scales of the leaf seem to be immunized, some other parts have no more resistance to the poison than other plants. Thus we find a difference in this respect between different tissues. Some cellular juices are even toxic for the neighboring tissues of a plant. We may affirm that there is a relative immunization in the case of the higher vegetables, but the extent to which this occurs does not seem to be definite.

SOME CITIES OF ANCIENT EGYPT.

Thebes, one of the most celebrated of the great cities of ancient Egypt, was situated on both banks of the Nile some four or five hundred miles above the river's mouths. Its Egyptian name was *Weset*, later *Nu (t) Amen*, or "the city of Ammon," while in the Old Testament it appears as *No Amon*. Thebes was the capital of the fourth nome of Upper Egypt, and while of great antiquity, it did not rise to importance until the time of the Eleventh Dynasty, which was of Theban origin. Some of its oldest and most remarkable temples and edifices date from this and the following dynasty, during which periods it was the capital of Egypt.

Thebes began the period of its real greatness, however, under the Theban princes, who expelled the Hyksos invaders and united the whole land under their sway. This was the Eighteenth Dynasty, which saw the city adorned with temples and palaces of unprecedented splendor. During the Nineteenth and Twentieth Dynasties, whose rulers followed the example of their predecessors and added to the beauty and magnificence of their chief city, Thebes by far surpassed the other cities of Egypt in wealth and splendor. Despite the persecution of its worship of the god Ammon and the desecration of its temples by the heretic King Amenophis IV., Thebes continued to flourish, for Seti I. and Ramses II. lavishly restored its despoiled temples and fanes, the latter especially devoting enormous wealth to this purpose. During the following or Twenty-first Dynasty, when it ceased to be the capital, the city began to decline and with the exception of the temporary revival under the Twenty-fifth Dynasty during the seventh century B. C., Thebes gradually but surely sank into insignificance, overshadowed by the rise of new cities, even though its temples were repaired and some new buildings were erected during the reign of some of the latter monarchs, especially the Ptolemies. War, earthquakes, and time completed the destruction, and even in the day of the geographer Strabo (B.C. 24) Thebes was a ruined city as at present.

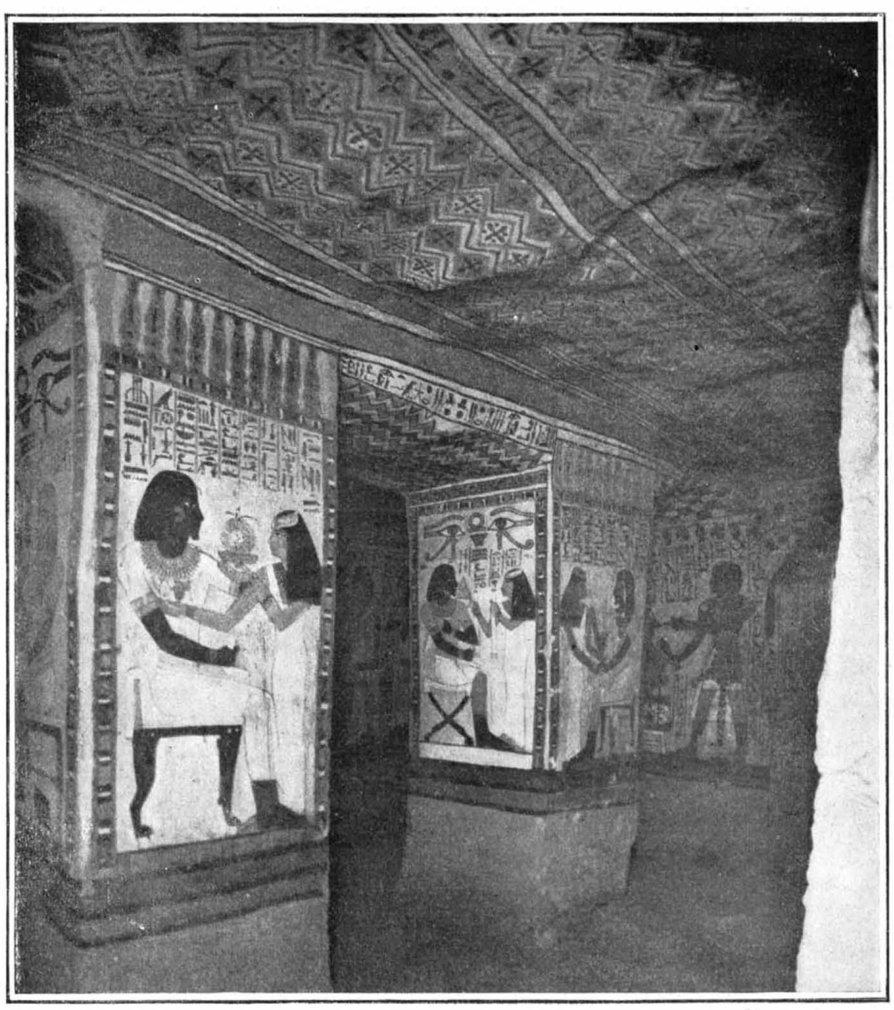
The city proper lay upon the east bank of the river, between the great temples whose ruins remain to-day at Luxor and Karnak. On the west side of the stream were extensive suburbs and many palaces and memorial temples, among them those of Ramses III., but in general this side of the river was devoted to the great necropolis, which extended to the Libyan range. The necropolis formed a great city, with its temples and their attached dwellings, schools, stables, storehouses, and other buildings and the dwellings of the numerous artisans employed in the great "city of the dead." The rocky hills bordering the plain were honeycombed with tombs, among them in a narrow valley the tombs of the monarchs of the Eighteenth to Twentieth Dynasties. The mortuary temples in the plain were dedicated to the manes of the dead, and commemorated the lives of their royal builders, while the tombs proper, which contained the embalmed bodies, were the above-mentioned rock-hewn chambers.

The first of the illustrations is a photograph of this Valley of the Kings' Tombs. These usually consist of a series of passages and chambers hollowed out of the living rock, and, like the corridors within the pyramids, they were intended only for the reception of the sarcophagus. Their structure was practically the same in all. Three corridors, placed one beyond the other, led into the innermost chambers. Small side-chambers sometimes opened off the first corridor; oblong recesses were made at the top of the sides of the second; and small recesses for the reception of the furniture of the dead were provided at the end of the third. The anteroom opened off the third corridor. Beyond this lay the main hall, which contained the massive granite sarcophagus deposited in a hollow in the floor. The roof of this main hall, which was frequently adjoined or even preceded by other chambers, was often supported by pillars.

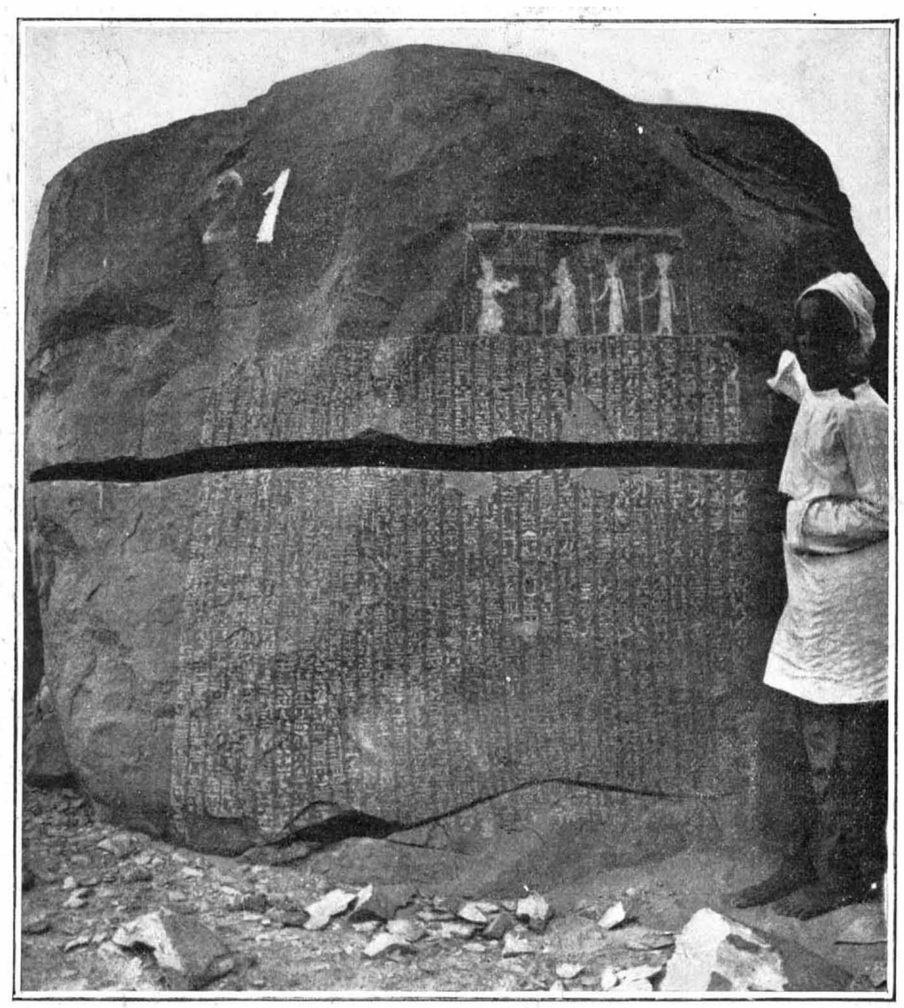
The walls of the tombs from the entrance to the inner chamber were invariably covered with sacred pictures and texts, executed in bright colors or engraved upon the rock. It was considered essential by the ancient Egyptians that the dead have a knowledge of the information conveyed in these mural decorations, for their future lives. As our next illustration shows, a splendid example of tomb painting of this character is to be seen in the mortuary chamber of Prince Sen-Nofer of Thebes, a dignitary of the Eighteenth Dynasty and overseer of the Gardens of Ammon. It is one of the tombs of Shêkh Abd el-Kurna to the southeast of the Valley of the Kings' Tombs. This splendidly preserved tomb has been explored within recent years. It is distinguished by the beauty and freshness of its paintings, which are all of religious import. The photograph was taken in the innermost or main chamber, and shows two of the four massive columns supporting the room.

In the Valley of the Kings' Tombs shown in the first engraving, the large rectangular opening cut in the hillock sloping up to the cliff which directly faced the camera, is the door of the tomb of Ramses IV. Before it, to the left, are the remarkable tomb of Sethos I., and that of Ramses XI. To the left are also the tombs of Ramses III. and of Amen-meses, a pretender to the throne during the Nineteenth Dynasty. To the right, but hidden by a hill in the foreground, are the tombs of Ramses IX. and of Ramses II. Many other tombs to the number of over forty—of which twenty-five or

Brick Store-Chambers of Pithom, the City Built by Hebrew Bondsmen, Looking North—Egypt.



Painted Tomb Chamber of Prince Sen-Nofer in the Great Theban Necropolis, West Shore of the Nile, Egypt.



Remarkable Description of a Seven Years' Famine Found on the Island of Sehel, First Cataract, Egypt.

SOME CITIES OF ANCIENT EGYPT.

more are accessible to-day—are to be found in this portion of the great necropolis, which to-day is known under the native name of Bîbân el-Mulûk.

The excavations conducted by Henri Eduard Naville at the site of the ancient city of Pithom in the Nile Delta are among the most interesting of the delvings into the hidden story of Egyptian history. Pithom, the store city of the Pharaohs, a fortress outpost at the edge of the desert for the armies of Ramses II., its founder, and his successors, was built by the Israelite bondsmen. It lies between Ismailia and Tell el-Kebîr in the Wâdi Tûmîlât, on the south side of the sweet-water canal from Cairo to Suez.

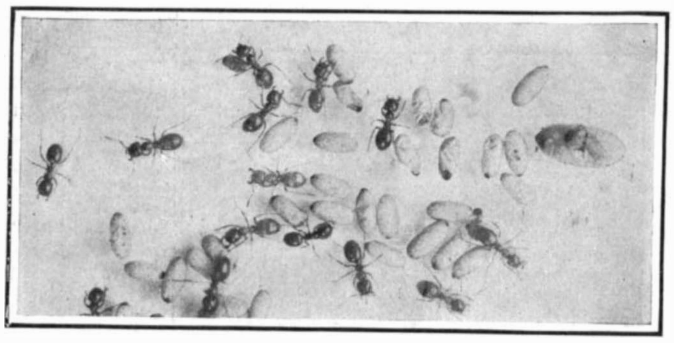
A few blocks of stone and a monolithic statue were described at this locality by the French engineers who surveyed Egypt at the end of the eighteenth century, but during the next fifty or sixty years all these traces of the historic city had vanished, the blocks being either removed or buried in the shifting sands, and a barely discernible mound or undulation in the desert and the traces of ancient canals were all that marked the site of ancient Pithom. In 1860 a thriving European and native town sprang up because of certain French canal-engineering work. The natives called the place Tell el-Maskhûta, while the French engineer designated it Ramses, through an error of the Egyptologist Lepsius, who believed it to be the site of the ancient city of that name. At the completion of the French undertaking, the town was abandoned, and again soon fell into ruins. During its construction and existence, however, sufficiently strong indications of the presence of archæological remains had been discovered to induce Naville to conduct excavations, primarily for the purpose, if possible, of determining the route followed by the children of Israel in the Exodus.

From the objects discovered, it was soon proved conclusively that the Egyptian city had been not Ramses, but Pithom. Moreover, as was soon learned from numerous inscriptions, later, during the Greek Dynasty, it was changed to the Roman city of Heroöpolis, a name which was abridged to Ero.

Pithom, the city proper, consisted of a large square area inclosed by enormous brick walls. The temple, strangely enough, occupied only a small space in the southwest angle. It, too, was inclosed by heavy brick walls. While considerable limestone had been used in the building and ornamentation, the principal material consists of the usual unburned, sun-dried Egyptian brick. Before the excavation had been under way very long, numbers of thick walls of the crude brick mentioned were uncovered, the bricks of which, joined by layers of thin mortar, had been made *without straw*. The walls, as shown in the accompanying illustration, rested on the sand and were well made, from two to three yards in thickness and evidently originally of considerable height. They formed rectangular chambers, which had no communication with each other. In the walls, about two yards from the bottom, were holes, probably for timber cross-pieces or floor beams. There were no door or window openings, the contents evidently placed within or withdrawn through the tops, which may have been closed by wooden roofs or merely by awnings.

There is little doubt that these vastly interesting structures were used as the storehouses and granaries of the Pharaohs, for the armies and caravans traveling across the desert, and that they were built by the Hebrew bondsmen. Much corroborative evidence, too, has been produced that Ramses II., the founder of Pithom, was the Pharaoh of the Oppression. Indications, also, of the route of the Exodus were uncovered in the ruins of this fascinating old city.

The fourth engraving is of a famous rock inscription found on the island of Sehêl, below the first cataract of the Nile. Sehêl was dedicated to the god Anukis, and contains the ruins of two temples. Besides, over two hundred inscriptions have been found engraved upon its rocks and cliffs. It also contains the remains of an ancient quarry, for it was from this region that a great part of the granite rock was procured by the Egyptians for their tremendous architectural and engineering undertakings. One of the temples dates from the time of the Eighteenth Dynasty, the other, which is near the village of Sehêl, on the west side of the island, from the Ptolemaic period. The inscription of the illustration, of the same date as the second temple, is found high up on the southeastern rocks. The hieroglyphics, which are in a fairly good state of preservation, record that in the reign of the primeval king, Zoser, the Nile failed to rise during seven successive years, and that in consequence, a terrible famine arose in the land. This was relieved by a great inundation following the prayer of the king to the cataract god Khnum.



Workers, Queen-Cocoon and Worker-Cocoons of *Lasine lalipes.*

TENACITY OF LIFE IN ANTS.

BY ADELE M. FIELDE.

Among the insects, ants are remarkable for their longevity. A queen in an artificial nest of M. Charles Janet's lived there to her tenth year, while two queens under the observation of Sir John Lubbock lived, the one into her fourteenth, the other into her fifteenth year. Worker ants in my nests have lived four years after capture, and then been returned to their native soil without having given sign of senility.

MAIMED ANTS.—Ants deprived of a portion of the body show great tenacity of life, but do not regenerate the missing part. After loss of the abdomen they sometimes run with great speed, continue to take care of their young, and to fight with enemies, and appear to be unaware of their own defect. A small brown ant-queen in my formicary lived fourteen days without her abdomen, and was seen to eat. Though the whole domestic economy of the ant is dictated and dominated by the sense of smell, the antennæ, which are the organs of that sense, may be cut off, and the protected ant may exist without them for fourteen months, as did a queen in one of my nests.

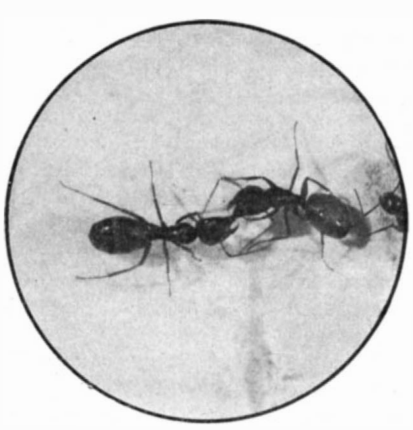
In experiments made by me last year, in which the surgery was carefully aseptic, and the patients were kept at low temperature in a clean ant-hospital, headless ants continued to walk about for a month or more, the last survivor among the decapitated ants having lived forty-one days.

In my nests, no ant has ever been maltreated by its fellows because of its being maimed. Those deprived of some part of the body have been returned, after their recovery from the surgical operation, to their former habitation, and in no case has the cripple received extra attention, either hostile or benevolent.

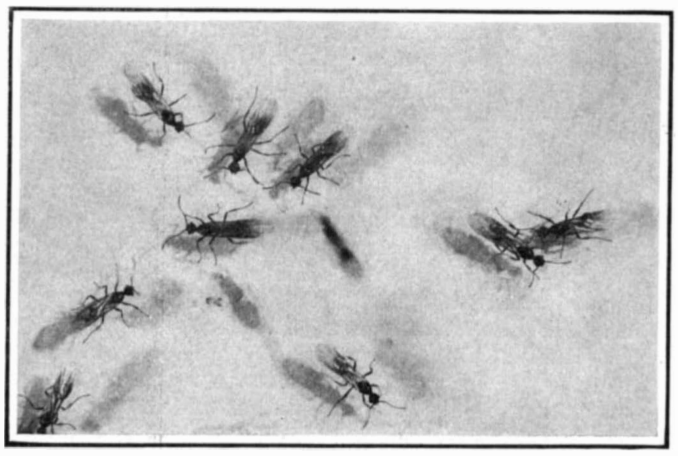
SUBMERGED ANTS.—When ants are submerged, they cease to struggle after a few minutes, sink to the bottom, and appear to have died. But they may remain in water several days and afterward recover all their activities when dried. Some carpenter ants that I merged for eight days in distilled water at a low temperature revived on being removed from the water, and after a few days resumed their usual occupations in the ant-nest.

This ability of the ants to recover from drowning explains the existence of ants in areas subject to freshets that destroy all other land insects.

FASTING ANTS.—Although ants manifestly suffer and soon die if deprived of moisture, they can exist for considerable periods without food. Experimenting with seven species of ants, small and large, I found that my ants could continue their common activities for several months with no nutriment whatever. The ants were kept in glass cells that were frequently cleansed with alcohol, and were empty of everything except the ants and a bit of sponge saturated with distilled water. Several of the ants lived for seven months in enforced fast, the longest fast being that of one of the common gray ants, a *Formica subsericea*, who lived nearly nine months without food. The fasting ants walked about, and appeared to be in normal health up to the day of death. Such capability to live without nutriment explains the curious fact observed by travelers in deserts, that ants inhabit places where they are subject to a complete annihilation of their food supply during long periods of drought.



One Worker Regurgitating Food to Another.



Male Ants. (*Stemma fulvum.*)

***Camponotus americanus.* Two Queens, One Winged, One with Wings Removed.**

Among my fasting ants no cannibalism was practised, and the bodies of those that died were always found to be intact.

Food is, however, necessary to the ant-larvæ, the quantity and quality of the nutriment taken while in the larval stage determining the size of the ant within the limits of the species. The larvæ, when the food supply is deficient, may live a year or more in the larval state, with scarcely any visible growth, apparently waiting for better days. In prosperous times the larval stage may occupy but twenty days.

DWARFS.—I have reared many dwarf ants by suddenly cutting off the food supply from well-nourished and half-grown larvæ. The feeding of the larvæ may be stopped by a removal of nearly all the ant nurses that ordinarily furnish food to the undeveloped young, or by depriving the nest of foraging facilities. Under propitious conditions, the larva, fed by the ants, grows to the length of an adult, expels the contents of the alimentary canal, and eats nothing for the five or ten days preceding its pupation. But if suddenly deprived of food, it may enter the resting stage when but half grown, and ultimately become a perfectly formed dwarf ant. To exist as dwarfs is better than no existence at all, and the ants take the better possibility in the great struggle for life.

REGURGITATION OF FOOD.—An advantage accruing to the ants through their commercial life is that of individually receiving food containing a great number of chemical elements that would not be obtained by individual effort. The ant-workers go out to forage in all directions, one imbibing nectar, another fruit, another oil, another insect or animal juices; and all the foragers return to the nest, bearing in their crops an over-supply which is regurgitated to those who have stayed at home. Regurgitation of food is common among the ants, and I have seen an ant that had fasted so long as sixty-two days regurgitate food to a hungry sister. The regurgitating ant holds the globule of pabulum at the end of her tongue, while the recipient laps it therefrom, assuming a posture that facilitates such action. This interchange of food-stuffs must

Larvæ and Pupæ of *Formica subsericea.*

TENACITY OF LIFE IN ANTS.

greatly conduce to the well-being of the ants, and enable the colony to persist long under adverse circumstances.

Rejection of Non-nutrient Substances and Avoidance of Poisons.—The ants not only exercise a judicious choice among edibles, but they carefully eliminate all innutrient particles from what they take into the mouth. Into each of four similar nests I put a queen and fifty workers, and during three months fed one group with pure molasses; one with molasses triturated with cochineal; one with molasses triturated with indigo; and one with molasses triturated with turmeric. In every nest the finely pulverized dye-stuff was separated in the mouths of the ants from the nutrient fluid, and was cast out in minute pellets forming a characteristically colored heap in a corner of the nest. In the first nest a pile of brown pellets indicated that non-nutritious particles had been rejected from the unmixed molasses. It is evident that the ants do not burden the digestive organs with innutrient matter, and that the preclusion of all such matter must greatly conserve the energy of the ants in the processes of digestion.

Ants that had fasted ten days did not partake of sweets in which poisons had been incorporated, although their mates ate the unpoisoned sweets with avidity.

When the ants were compelled to walk over viscid sweets with which virulent poisons had been commingled, the ants appeared to die soon after cleaning their feet with use of the tongue, but many of them revived some minutes or some hours later and resumed their normal activities. Even the fumes of cyanide of potassium, which caused the ants to swoon after a brief exposure to it, did not prevent their revival after they were returned to pure air.

Effects of Heat on Ants.—While the activities of ants in their ordinary occupations, the laying of eggs, the feeding of the larvæ, and the hatching of pupæ, are all accelerated by rise of temperature to about 82 deg. F. or 27 deg. C., any degree of heat above 90 deg. F. or 32 deg. C. proves injurious to them. In torrid countries it is commonly said that the ants, like the people, take a rest at midday; and the withdrawal of the ants from noontide heat is probably an act of self-preservation.

In experiments recently made by me, a continued application of heat, wet or dry, of a degree so high as 122 deg. F. or 50 deg. C. killed all the ants of the four species used. The larger the ants the longer the exposure required for their extinction, but two minutes compassed the destruction of the largest ants known in the United States. No ant recovered after two minutes in water or in air heated a little more than half way to the boiling point of water, and ant-infested earth raised by any means to this temperature will present no danger of further development of the ants therein nested.

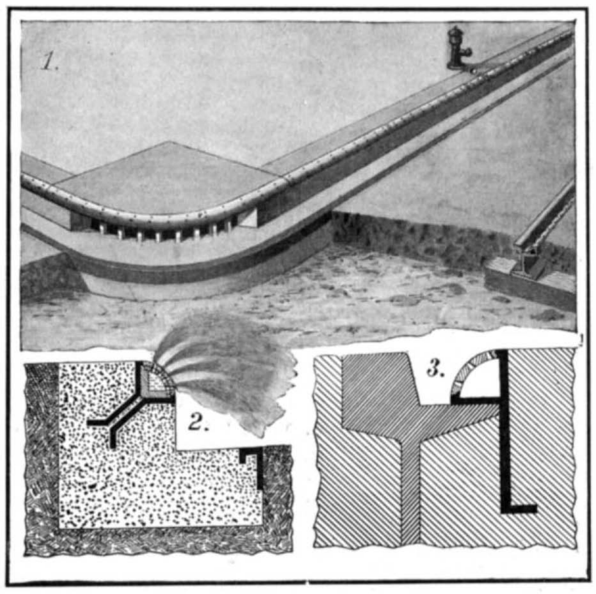
Male ants are much less tenacious of life than are the workers; and workers, usually much smaller, are less hardy than are the queens.

A Dental Invention Which Permits of Painless Work upon Teeth.

By an invention of Dr. Crittenden Van Wyck, of San Francisco, Cal., all dental work, such as drilling into a tooth to remove decay and prepare it for a filling, or to grind down a tooth for a gold cap, or to remove nerves, may now be done painlessly. This is a wonderful advance in dental science, and will take away all dread of approaching the dental chair, when such work becomes necessary. The method has been proven successful during four years' trial. The device of which this note is a brief description is called the Van Wyck obtunder. By its use a tiny spray of ether is thrown upon the tooth to be operated upon. The rapid evaporation of the ether produces coldness, and within a few moments the tooth becomes perfectly numb and all sensation is lost. The dentist can now use his drilling machine, and bore out all decay and properly prepare the cavity for a filling, the spray continuing to run during the cutting operation. The method is therefore very simple and effective. By placing a few drops of a strong perfume in the ether glass receptacle, the odor from the spray is made welcome, the ether odor being almost entirely disguised. No bad effects are noted in any manner from the use of this method. The first shock of coldness is prevented by placing a piece of cotton upon the tooth to be sprayed upon, and thus the temperature is reduced gradually and without any pain. The normal temperature returns to the tooth as soon as the spraying is discontinued, and no after effects of any kind are to be feared. The spray is formed by using twenty pounds of compressed air, and is regulated by a valve. It is directed upon the tooth by a flexible metallic tubing, bent in such a manner as to throw the spray upon any tooth desired.

A STREET-SPRINKLING CURB.

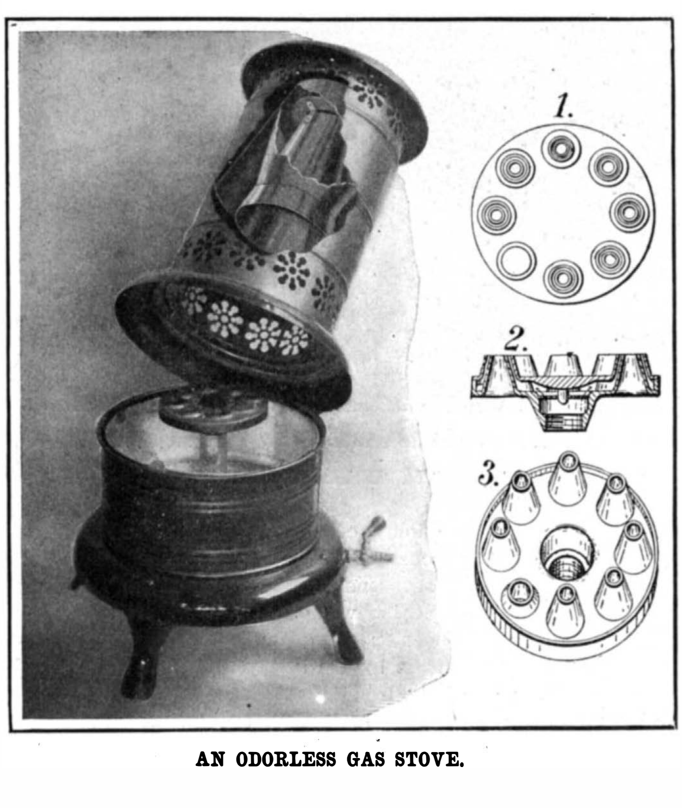
A decided novelty in curbs for sidewalks and streets is provided by the recent invention of Mr. John F. McCoy, 1433 Melpomene Street, New Orleans, La. Imbedded in the concrete curbing is a metal tube provided with perforations in its outer side. The tube is connected with a street hydrant, and when it is desired to sprinkle the street, it is merely necessary to turn the valve of the hydrant, permitting the water to pour into the tube, and out through the perforations. The street can thus be flushed and cleansed of refuse, which will be washed into the gutters and drained off in the usual catch basins at the corners of the street. Obviously this is an improvement upon the costly and primitive methods now commonly followed in our cities of using sprinkling carts; for by merely operating a single hydrant a whole street or a whole section of the city may be sprinkled at once. But aside from its use for sprinkling the streets, this tube serves as a bond to protect the edge of the curb. The edge of the gutter is also protected by imbedding an angle rail in the concrete, as shown in our engraving. Mr. McCoy's patent covers a number of constructions for the sprinkling tube, one of which we show in cross section in Fig. 2. It will be observed that the tube, which is of approximately triangular shape, is made up of two heavy metal sections, one of which forms the bottom and rear walls, and the other the curved outer wall. In the latter are the perforations for sprinkling. The tube is secured in the concrete curb by means of metal straps which fit over the tube and have their lower ends imbedded in the plastic material. Perforations are provided in the straps which register with those in the tubes. These straps are used for coupling together the different lengths of tubing. The perforated wall sections are reduced or offset at the ends so that a recess is formed between the two lengths of tubing which are to be coupled. In this recess the strap snugly fits with its outer face flush with the curved wall of the tube. The sprinkler tube may be fed either from the regular fire hydrant or from the supply pipes of adjacent yards and houses. In the latter case valves are placed at intervals along the tube so that the owners may sprinkle the street in front of their own premises. Fig. 3 shows the sprinkling tube applied to a street railway rail, where it serves both as a bond for the edge of the pavement and as an additional means for sprinkling the street. This curb construction may also be used as a border for yards, garden walks, and the like.



A STREET-SPRINKLING CURB.

AN ODORLESS GAS STOVE.

The principal objections advanced against gas stoves of the usual type are that they give a very dry heat, and that they almost invariably yield a disagreeable odor. In addition to this the amount of gas consumed is quite large, so that they do not afford very economical heat. In the accompanying illustration we show a new type of gas stove, in which these objectionable features are overcome. It is claimed for this stove that the cost of running it does not exceed that of the ordinary oil stove, that it keeps the air of the room moist, and that it is absolutely odorless. An important feature of the stove is a novel burner which insures a perfect distribution of the mixed gas and air to the burner tips, and which is arranged to be easily taken apart for cleaning purposes. The burner consists of two plates, the lower one of which is coupled to a gas supply pipe projecting through a galvanized-iron pan in the base of the stove. This pan is filled with water which, as will be shown presently, serves to keep the air in the room moist. At the bottom of the supply pipe is the valve which controls the amount of air mixed with the gas. The lower plate of the burner, as shown in Fig. 3, is formed with an annular flanged rim which serves to space the two plates apart and with a series of conical tubes which are adapted to project through openings in the upper plate. These openings are larger than the tubes, and thus form annular passages through which the gas mixture flows to the blue flame jets. A plan view of the burner is shown in Fig. 1, from which it will be observed that since the conical tubes open through the bottom plate, a center supply of air is fed to each jet on the principle of an Argand lamp burner. It will be noted in Fig. 2, which is a section through the burner, that the flanged rim of the lower plate is very low and, consequently, the chamber formed between the two plates is very shallow, much shallower than the usual gas chamber, and in reality serves merely as a passage for the gas mixture. To insure a more perfect distribution of the mixture to the jets, a boss is formed on the under side of the upper plate in which there are a number of spiral grooves leading to the different burner tips. One of the conical tubes is shorter than the others, and over it in the upper plate is a closed thimble. The gas flows through a passage between the top of this pipe and the thimble and is then directed downward in a jet which plays upon the water in the pan. This insures a rapid evaporation of the water, which intensifies and moistens the heat and removes all odors from the gas stoves. If desired, antiseptics and disinfectants may be added to the water to purify the air of the room. In our engraving the upper portion of the stove casing is broken away to show an interior cone-shaped drum so arranged as to produce a strong draft. A plate at the top of this drum deflects the heated air, causing it to flow against an outer cone, thence it passes through an opening in the top of the latter cone and out through the perforations in the stove casing. The outer and inner cones are connected by a third cone, forming a reservoir for heated air which keeps the outer cone hot, thus heating, as well, the air which pours up between the outer cone and the stove casing. In use the deflector at the top of the interior cone becomes red-hot and insures perfect combustion of any partly burned matter which may be carried up by the strong draft. The patents on this novel stove are owned by the Odorless Gas Heater Company, 86 and 88 Worth Street, New York, N. Y.



AN ODORLESS GAS STOVE.

A Long-Distance Heating Plant.

A long-distance steam heating plant, where the source of heat and the place of consumption are 2½ kilometers distant, has been completed in the Eglfing Sanatorium, in Upper Bavaria. The steam conduits are arranged in a concrete tunnel, the walls of which are lined with an asphalt coating, which in connection with a cork slab vault minimizes the loss of heat by radiation. The pit is sufficiently wide to allow a man to stand and walk within it. It is lighted at intervals from above by daylight, and by small electric lights during the night. A novel substance, consisting of charred silk threads, has been used to surround the conduits and protect them against heat losses. The steam entering the conduit at 159 deg. C. was found to have a temperature of 152 deg. after covering the 2½ kilometers distance. The buildings themselves are heated by hot water, the steam serving only to heat the water boilers by means of coils. The plant is provided largely with electrical long-distance signaling apparatus, so as to allow of its being controlled and adjusted from the boiler house. Thirty pavilions and six administration buildings have been connected to this extensive plant, the cost of installation of which, including the tunnel, was about 250,000 marks.

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 you the name and address of 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. 7426.—For manufacturer of roller skate for carriage wheels.

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

Inquiry No. 7427.—For manufacturers of a device for loading fresh fruit.

Inquiry No. 7428.—For manufacturers of machine for making graphite.

Drying Machinery and Presses. Biles, Louisville, Ky.

Inquiry No. 7429.—For manufacturers of moulds for making small monuments in plaster of Paris.

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

Inquiry No. 7430.—Wanted, names of American fiber washer manufacturers; also of "Guayule" which is a vegetable substitute for rubber.

Sawmill machinery and outfits manufactured by the Lane Mfg. Co. Box 13, Montpelier, Vt.

Inquiry No. 7431.—For manufacturers of endless canvas aprons.

I sell patents. To buy, or having one to sell, write Chas. A. Scott, 719 Mutual Life Building, Buffalo, N. Y.

Inquiry No. 7432.—For manufacturers of very small rubber-insulated wire.

WANTED.—Patented specialties of merit, to manufacture and market. Power Specialty Co., Detroit, Mich.

Inquiry No. 7433.—For manufacturers of small metal rings, one inch in diameter and upward.

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

Inquiry No. 7434.—For manufacturers of small bells, such as are used upon toys, both the sleigh bells and the ordinary form,

WANTED.—Ideas regarding patentable device for water well paste or mucilage bottle. Address Adhesive, P. O. Box 773, New York.

Inquiry No. 7435.—For manufacturers of devices for adjusting the length of tape or webbing, as used for suspenders and garters.

FOR SALE.—Paying up-to-date metal working plant. Best location; good building. $75,000, or will sell large interest to right man. Chance, Box 773, New York.

Inquiry No. 7436.—For manufacturers of round cord ¼ or ⅜ inch in diameter, similar to the ordinary sash cord, but made from better material.

WANTED.—Patented specialties of merit, to manufacture and market, or to take agency and market. Heissenbuttel & Ludlam, 48 Dey St., New York, N. Y.

Inquiry No. 7437.—For manufacturers of devices for fastening the ends of webbing or belts with a hook or snap, for width of material of about one inch.

FOR SALE.—A small manufacturing plant in operation, well equipped for manufacturing wrought specialties. Reason for selling, other interests. Address Box 1163, Hartford, Conn.

Inquiry No. 7438.—For manufacturers of brick machines; also elevators for dry goods stores.

Manufacturers of patent articles, dies, metal stamping, screw machine work, hardware specialties, wood fiber machinery and tools. Quadriga Manufacturing Company, 18 South Canal Street, Chicago.

Inquiry No. 7439.—For manufacturers of hot air engines large enough to operate rotary washing machine for family use.

Absolute privacy for inventors and experimenting. A well-equipped private laboratory can be rented on moderate terms from the Electrical Testing Laboratories, 548 East 80th St., New York. Write to-day.

Inquiry No. 7440.—For manufacturers of castor oil mills.

WANTED.—An A1 foreman to take charge of machine shop. Manufacturer of gas and gasoline engines and accessories. Address with references,
Foreman, Box 773, N. Y.

Inquiry No. 7441.—For manufacturers of hollow shafting 1¼ inches in diameter.

Manufacturers of all kinds sheet metal goods. Vending, gum and chocolate, matches, cigars and cigarettes, amusement machines, made of pressed steel. Send samples. N.Y. Die and Model Works, 508 Pearl St., N.Y

Inquiry No. 7442.—For manufacturers of dish-washing machines suitable for boarding schools.

PATTERN-MAKING BUSINESS FOR SALE.—Reputable, well-known, old-established and fully equipped plant in fine condition, thoroughly organized, large and prominent clientage. Located in New York City, and earning handsome profit; stand strict investigation; exceptional opportunity; references exchanged. Address Profitable, Box 773, New York.

Inquiry No. 7443.—Wanted, a small cold storage and ice plant.

Inquiry No. 7444.—For manufacturers of paraffin paper containing 40 per cent of paraffin.

Inquiry No. 7445.—For manufacturers of snap fasteners, such as are used on gloves, pocketbooks and leather goods; also the tools for putting on such fasteners.

Inquiry No. 7446.—Wanted, address of pattern makers; also foundries.

Inquiry No. 7447.—For manufacturers of small engines from ¼ to 2 horse-power; also manufacturers of material for making balloons.

Inquiry No. 7448.—Wanted, address of manufacturers of paper conduit suitable for the underground carrying of from 25 to 50 No. 14 R. C. wires.

Inquiry No. 7449.—For manufacturers of brass and iron nails for shoes.

Inquiry No. 7450.—For manufacturers of lace; also car-making machines.

Inquiry No. 7451.—For manufacturers of machines for consuming dirt in smoke.

Inquiry No. 7452.—For manufacturers of novelties and labor-saving devices.

Inquiry No. 7453.—Wanted, catalogue, prices and general information regarding cold storage plants.

Inquiry No. 7454.—For manufacturers of pipe organs.

Inquiry No. 7455.—For manufacturers of lawn mowers, having a reciprocating sickle similar to a mowing machine.

Inquiry No. 7456.—For manufacturers of soft iron or soft steel punchings of special make for laminated magnets.

Inquiry No. 7457.—For manufacturers of gasoline iron for tailors and launderers.

Inquiry No. 7458.—For manufacturers of steel tempered for mill picks, same as are used on burr stones.

BABBITT METALS.—SIX IMPORTANT formulas. SCIENTIFIC AMERICAN SUPPLEMENT **1123.** Price 10 cents. For sale by Munn & Co. and all newsdealers. Send for catalogue.

ELECTRO MOTOR, SIMPLE, HOW TO make.—By G. M. Hopkins. Description of a small electric motor devised and constructed with a view to assisting amateurs to make a motor which might be driven with advantage by a current derived from a battery, and which would have sufficient power to operate a foot lathe or any machine requiring not over one man power. With 11 figures. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **641.** Price 10 cents. To be had at this office and from all newsdealers.

RECENTLY PATENTED INVENTIONS.

Electrical Devices.

AUTOMATIC BLOCK-SIGNAL SYSTEM.—J. McIlwain, Okawville, Ill. By this system it is almost impossible for engineers to be unaware of the presence of other trains, and there is no excuse for a wreck. Lights upon the north side of the track are of different color from those upon the south, and lights in the signaling-station are colored accordingly. Should the engineer be color-blind he can at least see by looking ahead along the track that there are lights upon both sides of the track, which indicates something wrong. Should he recklessly disregard signals altogether, he is warned by the station agent, who watches the signals and keeps track of the trains.

Of Interest to Farmers.

WEEDING-HARROW.—L. M. Morrow, Wasco, Ore. The harrow frame is mounted on wheels and provided with a draw-bar and appliances for hitching draft-animals thereto. Duplicate supplementary frames are employed, together with cutters and brackets therefor, mounted in duplicate series, one series being reversely disposed to the other and each having independent co-operative relation with one of the supplementary frames. The cutters of one or both series may be operated at will to penetrate the soil to effect cutting and upturning of weeds, and by same means both series may be elevated from the surface of the soil to facilitate turning the harrow or transferring it from field to field.

COMBINED RAKE AND STACKER.—I. D. Schenck and F. V. Thomson, Basin, Wyo. This invention relates to apparatus adapted to rake hay of various kinds from the swath, bunch, or windrow, to carry a charge of hay upon the rake-fingers to the stack, and to raise the charge and deposit it upon the stack. The object is to provide a simple apparatus which will work effectively as a rake and a stacker and which will so enable one man driving the rake and stacker to do the work ordinarily performed by two, one driving the rake and the other operating the stacker located at the stack.

Of General Interest.

RECEPTACLE-CLOSURE.—J. C. Chadwick, Englewood, N. J. This invention refers to improvements in closures for receptacles for tooth-powder or the like and of that class having a discharge-opening at one side. The object is to provide a closure of simple construction by the use of which the exact amount of powder will be discharged, thus resulting in an economical use of the powder.

VETERINARY MOUTH-SPECULUM.—I. C. Carstensen, Oakesdale, Wash. In this instance the invention is an improvement in mouth-speculums which are particularly adapted for use in veterinary surgery or dentistry for holding an animal's mouth and preventing the jaws closing while the operation proceeds.

KILN.—A. F. Dietz, Perth Amboy, N. J. This improvement relates, primarily, to a kiln for burning brick, tile, terra-cotta, and other earthen or ceramic material in which the heat is developed by burning pulverized fuel, such as a bituminous coal fed in the combustion-chamber in suspension in a blast of air. In this way complete utilization of the fuel fed into the kiln and high temperature are attained.

GARMENT-SUPPORTING DEVICE.—J. W. Stockwell and R. Coates, Jackson, Mich. The object of the invention is to produce a device which may be easily attached and detached, but which will not become detached accidentally, and which will be simple in construction and cheap to manufacture. The device has two reverse hooks for supporting garments and one or more hooks for securing it to one of the garments, all made out of a single piece of wire.

CHAIR LIFE-PRESERVER.—M. Kuhnen and A. Spader, Rondout, N. Y. One of the purposes of the invention is to provide a chair which will serve all the functions of such an article, but which at a moment's notice can be quickly and conveniently converted into a life-preserver for use upon water, the parts of the device when used as a life-preserver being in the form of a raft.

Machines and Mechanical Devices.

TENSION DEVICE FOR WARP-BEAMS.—G. Keller, New York, N. Y. The object of the present invention is to provide a device for warp-beams or warp-carrying spools having a long range of movement and designed with a view to take up comparatively little room and to allow direct application of the device on the warp-beam or warp-carrying spool without the use of interposed gear-wheels. The invention relates to tension devices for warp-beams, such as shown and described in the Letters Patent of the United States formerly granted to Mr. Keller.

BAND-SAW.—C. Seymour, Defiance, Ohio. Certain new and useful improvements in band-saws are provided by this inventor, whereby any sudden quiver or jar in the saw band or blade incident to the latter's striking a knot or the like is quickly compensated for to prevent injury to or breaking of the saw band or blade and whereby the endless saw-band can be readily removed and replaced and all slack in the saw-band can be taken up at any time and while the band-saw is in use. This application is a division of the application for Letters Patent of the United States for a band-saw formerly filed by Mr. Seymour.

OIL-CLOTH-PRINTING MACHINE.—W. H. Waldron, New Brunswick, N. J. The intention of the present improvement is to provide a machine for printing oil-cloth arranged to insure a positive locking of the intermittent driving mechanism for the color-trough, to cause an easy driving and locking of said mechanism without shock or jar, to allow convenient adjustment or detachment of the printing-blocks, and to reduce the weight of the trough to a minimum. This is a division of the application for Letters Patent of the United States formerly filed by Mr. Waldron.

PNEUMATIC CONTROLLING DEVICE FOR ORGANS.—H. L. Davis, New York, N. Y. The object of the improvement is to provide a device arranged to render the pipe-valves exceedingly sensitive, to insure proper opening and closing of the pipes, to render the pipe-valves noiseless in their action by stopping off the exhaust for the key-action by a diaphragm-valve controlled by high pressure from the draw-stop action.

AUTOMATIC PIANO-PLAYER.—J. B. Walker, New York, N. Y. The invention relates to musical instruments and to appliances for actuating the same and admits of general use, but is of peculiar value in instances where the playing is partially automatic and partially under manual control of the operator. By Mr. Walker's improvement any variation of the relative intensity of theme and accompaniment may be produced that is possible in playing the piano by hand. He provides means by which improved control of expression may be secured with fewer levers than commonly used. For this control he employs a movement that admits of a "touch" corresponding in direction, sensitiveness, and rapidity to the stroke of the fingers in hand-playing. He brings the apparatus into conformity with the natural instinct of the operator to strike vertically downward with his hand and to strike with vigor proportional to the intensity desired in the expression of music.

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.

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How To Increase Your Business

READ carefully, every week, the **Business and Personal Wants** column in the

Scientific American

This week it will be found on page 365.

Some week you will be likely to find an inquiry for something that you manufacture or deal in. A prompt reply may bring an order.

Watch it Carefully

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Flour, Geo. T. Evans & Son 47,066
Flour, wheat, New Century Milling Co.... 47,061
Flour, wheat, J. Hoffer 47,107
Food preparation made from wheat, health, E. R. Durkee & Co. 47,037
Furniture polish, M. Watt 47,092
Gelatin, C. B. Knox 47,042
Gelatin capsules, both filled and empty, J. R. Planten ....47,049 to 47,051
Gin, W. H. Jones & Co. 47,073
Gin, National Distilling Co. 47,079
Gin, Union Distilling Co. 47,090
Gloves, Jacob Adler & Co. 47,030, 47,031
Gloves, kid and suede, Jordan Marsh Co.. 47,040
Hair dye, W. W. Scheffler 47,053
Handkerchiefs, Cochrane Manufacturing Co. 47,035
Inks, printing and lithographing, Kast & Ehinger, Gesellschaft mit Beschrankter Haftung 47,110
Knit hosiery and underwear, M. & C. Mayer 47,043
Lager beer, Christian Moerlein Brewing Co. 47,128
Macaroni, spaghetti, vermicelli, and noodles, Anger Baking Co. 47,033
Medical compound for certain named diseases, Finlay Dicks & Co., Ltd. 47,038
Milk, condensed, Pacific Coast Condensed Milk Co. 47,080
Naphtha, Republic Oil Co. 47,123
Oil, olive, Parodi, Ermino & Co. 47,048
Paints, liquid or ready mixed, James F. Kurfees Paint Co. 47,075
Paper and envelops, writing, Southworth Co. 47,084, 47,085
Paper, wrapping, F. C. Traver 47,086
Papers, case lining, sheathing, insulating, and roofing, Standard Paint Co. 47,089
Peanuts, National Essence for Coffee Co.... 47,046
Peanuts, salted, Bosman & Lohman Co..... 47,034
Penholders, Eagle Pencil Co. 47,102
Phonographs, National Phonograph Co.. 47,114 to 47,118
Photographic prints, composite, J. G. Kitchell 47,111
Pianos, Hamilton Organ Co. 47,072
Pocket knives, razors, table knives, butcher knives and carving knives, Gray & Dudley Hardware Co. 47,069

Powders, toilet and bath, Pacific Coast Borax Co. 47,047
Scales, McDonald Brothers Pitless Scale Co. 47,044
Seeders and grain drills, Dowagiac Manufacturing Co. 47,101
Shafting, shaft pulleys, shaft hangers, shaft couplings, and shaft clutches, Patterson, Gottfried & Hunter, Ltd. 47,081
Shoes, heavy leather, Manier, Dunbar & Co. 47,112
Shot shells and cartridges, Winchester Repeating Arms Co. 47,094
Shot shells, cartridges, and primers, Winchester Repeating Arms Co. 47,093
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Varnishes, American Varnish Co. 47,126, 47,127
Varnishes and japans, Mayer & Loewenstein. 47,077
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Whisky, James Olwell & Co. 47,109
Whisky, Missouri Wine & Liquor Co. 47,113
Whisky, A. A. Wolf & Co. 47,132
Whisky, N. M. Uri 47,133
Wine, L. Rosenzweig 47,082
Wine, Wm. Hoelscher & Co., Inc. 47,131
Woolen piece goods, F. Almy 47,032

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"Summer Beauties Tomatoes," for canned tomatoes, United States Printing Co. 12,400
"Tamora," for cigars, Schmidt & Co. 12,411
"The Octo Clip," for clips, Clipper Mfg. Co. 12,393
"The Uji Tea," for tea, G. E. & F. Renfro 12,406
"Wheat Fibre," for cereal crackers, W. E. Williams 12,403
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"Malt Nutrine," for malt extract, Anheuser-Busch Brewing Assn 1,454
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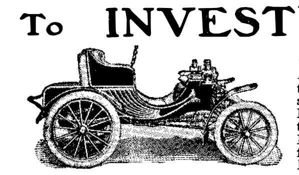

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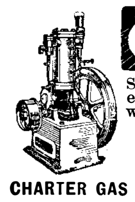

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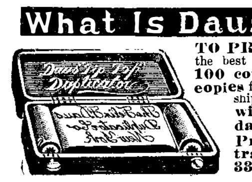

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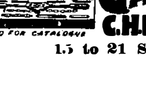

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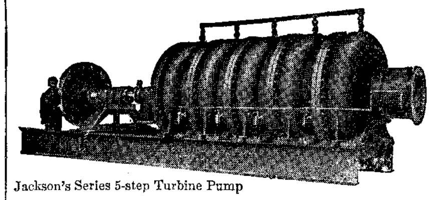

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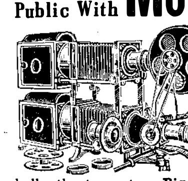

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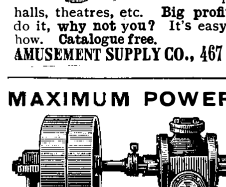

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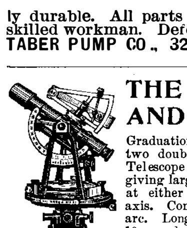

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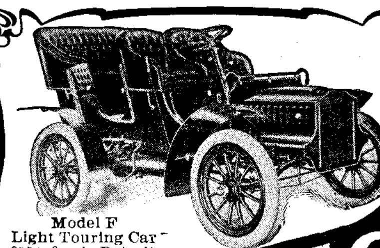

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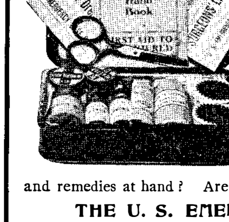

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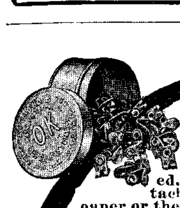

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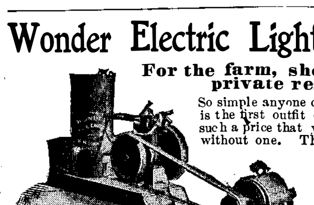

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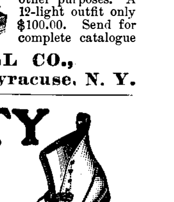

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