# SCIENTIFIC AMERICAN

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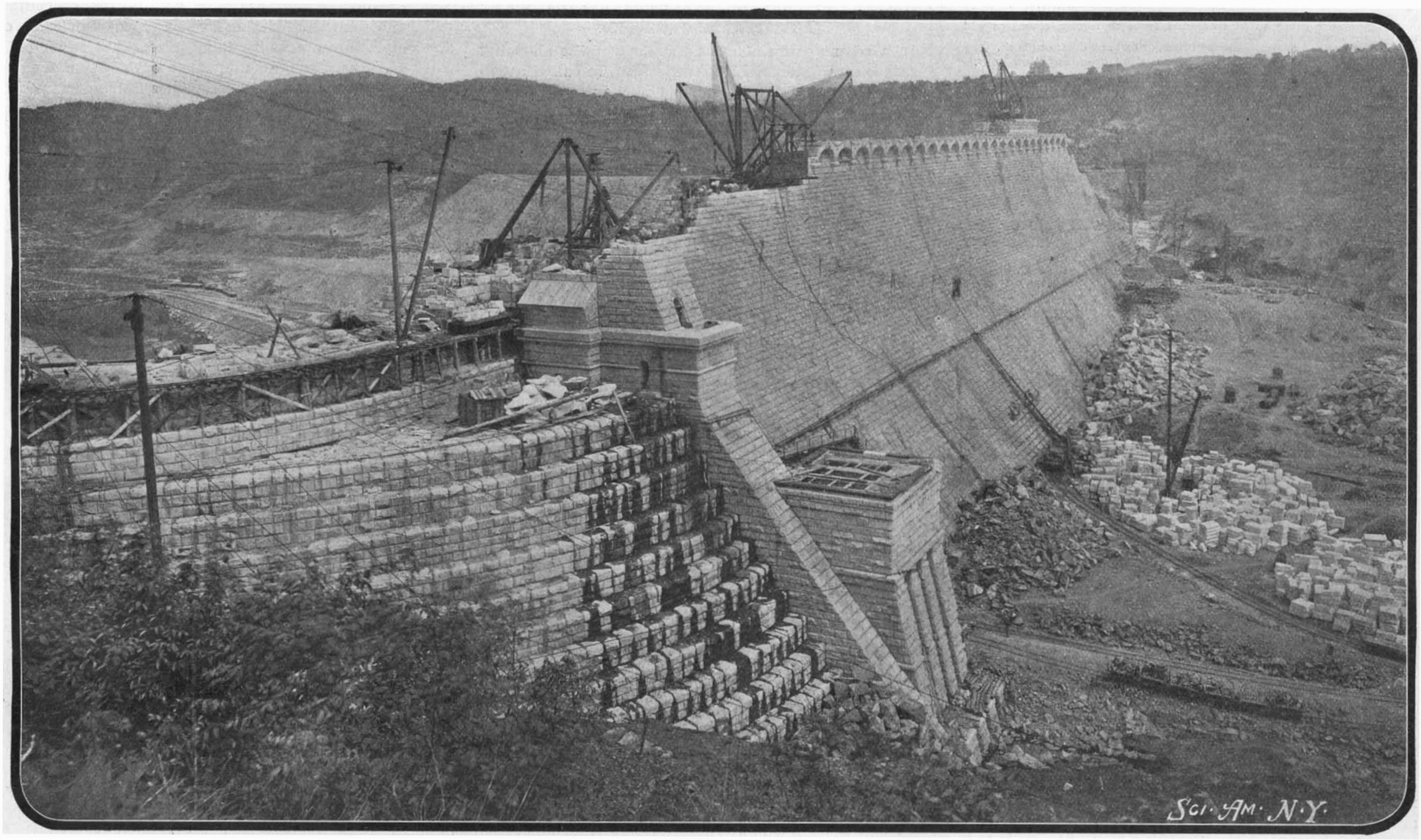
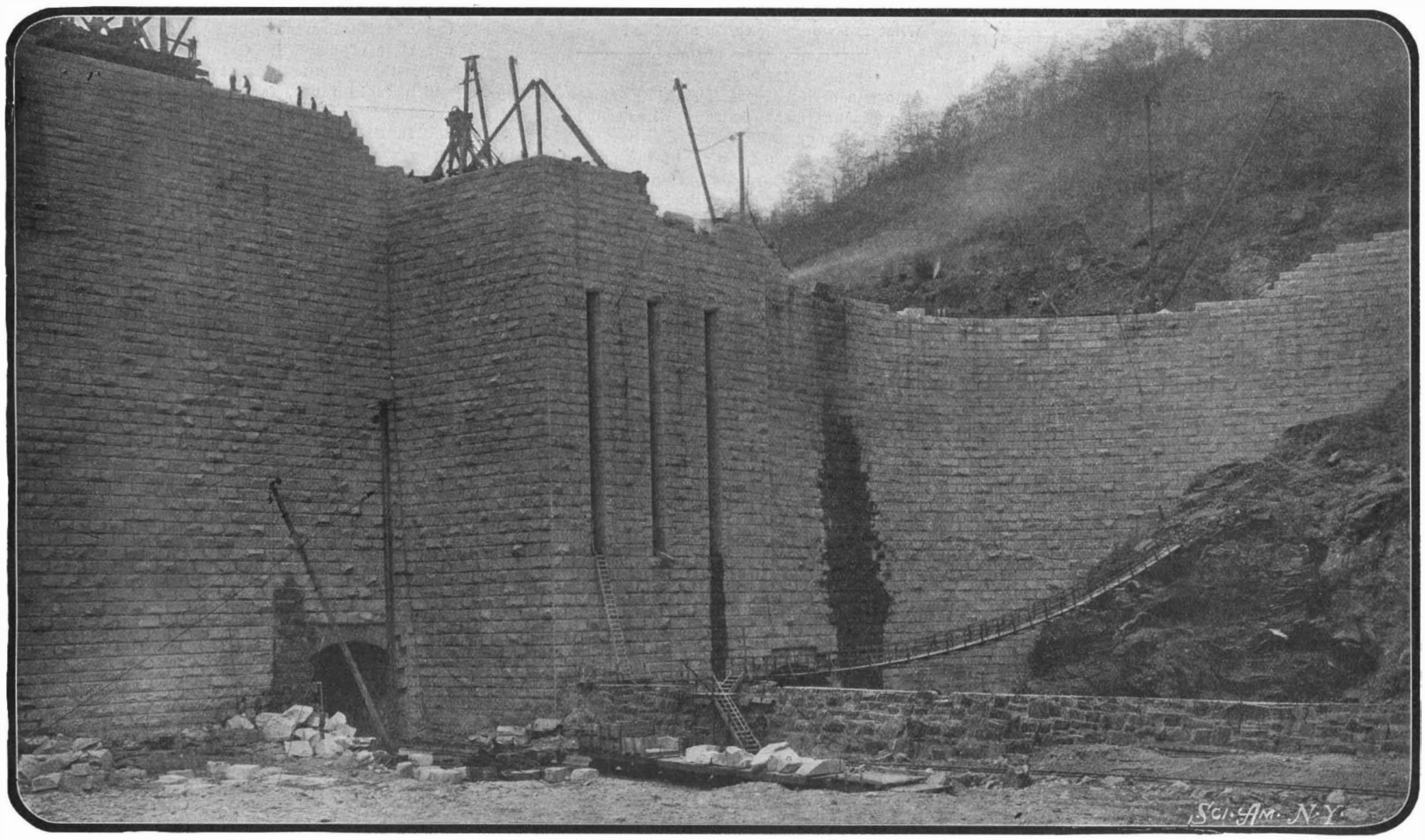



The Masonry Dam, Showing Spillway and Sluice Gates at the Left, and the Incompleted 600 Feet in the Distance.




Upstream Side of Northern End Masonry Dam, Showing Curved Spillway.

**THE GREAT CORNELL DAM—FULL HEIGHT, FOUNDATION TO CREST, 300 FEET.**—[See page 411.]

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**ESTABLISHED 1845**

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NEW YORK, SATURDAY, MAY 30, 1903.

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.


## THE WAR DEPARTMENT AND NEW YORK CITY DOCKS.

It was a far-sighted and, as events have proved, a pre-eminently successful policy to place the supervision and protection of our natural waterways and harbors in the hands of the War Department. Before a bridge can be thrown across any navigable river, estuary, or strait, before any piers can be run out into a harbor beyond certain bulkhead lines that have been laid down, it is necessary to obtain the permission of the War Department. In safeguarding the interests of river traffic, so far as it is affected by the erection of bridges, it has been the object of the War Department to see that no supporting piers are built in midstream that will materially interfere with navigation, and that bridges are either built at an elevation which will allow shipping to pass without hindrance beneath them, or that they are provided with drawbridges of sufficient span to allow shipping to pass through without danger of collision. So also with regard to harbor piers and bulkheads, the War Department has exercised a jealous care that certain lines which they have drawn as marking the limits of the harbors are not encroached upon by docks and landing piers. Had it not been for the professional fidelity with which our military officers have performed their duties, incalculable injury would have been wrought to the shipping interests of this country, both inland, river, and deep sea, by the obstruction of waterways and by destructive encroachments upon the deep-water area of our harbors. At the same time, it has occasionally happened that the War Department has allowed its zeal to get the better of its discretion; for it cannot but happen that the best of principles may, at times, be capable of modification to meet some very special case. We think that such an instance may be found in the present ground of contention between the Mayor of this city and the War Department on the question as to whether an important set of piers which are to be built on the North River, southward from West Twenty-third Street, shall be extended beyond the government bulkhead line.

Time was when a pier with a length of 500 or 600 feet was fully adequate to accommodate the longest transatlantic liners. The last important set of piers completed a few years ago on the North River have a maximum length of 800 feet, this being at that time amply sufficient to accommodate such vessels as the "Oceanic" and "Cedric"; but the fact that the Cunard Company is now contemplating the construction of two vessels which will be not less than 750 feet, and may be 800 feet or more in length, proves that the time has come for 1,000-foot docks. The city has requested the War Department to allow an extension of the pierhead line between West Twenty-third Street and Bloomfield Street, 200 feet further into the North River. The application was made by the Dock Commissioners last summer; but the Board of Army Engineers turned in an adverse report to the Secretary of War. The Mayor of this city and the commissioners have been endeavoring to secure a revision of this report, and we sincerely hope that the War Department may be able to look at the matter from the city's standpoint. The objection to the proposed extension is that it will narrow the width of the North River channel; but even if the extension were granted, the channel would still be 2,600 feet in width, which is amply sufficient for a twin-screw vessel to maneuver in and properly make and leave her dock. As a matter of fact, the War Department, to be consistent with itself in the matter of the New York Harbor improvements, should not hesitate to allow this extension; it is already engaged in dredging 40-foot channels through the lower harbor; and vessels of a size that would call for a 40-foot depth of channel will, of necessity, run to 800 or even 900 feet in length. In a letter on the subject written by Vernon H. Brown, one of the veteran transatlantic steamship men of this city, it is pointed out that "adequate piers are as essential to commerce as adequate channels and waterways;" and that all the expense which the government has entered upon in deepening the channels, in response to a strong and popular demand, may be nullified if the steamships for which such channels are constructed cannot be docked after entering port. In conclusion, we repeat that while the jealous care with which the various boards of engineers of the army have safeguarded our harbors and waterways cannot be too highly commended, we think the present is one of those rare cases in which it would be expedient to observe rather the spirit than the strict letter of the law.

## RAILWAY HORRORS VS. THE "HORRORS OF WAR." AN APPALLING RECORD.

In a recent editorial on the subject of the alarming increase of accidents on our railroads, we called attention to the fact that the railroad companies seemed to place a very cheap estimate upon life, as evidenced by the fact that no special measures were being taken to check the rapid growth of fatalities among railroad passengers and employés. We have before us a government publication whose figures present incontestable evidence that the charge of negligence is well founded. According to Accident Bulletin No. 6, published by the Interstate Commerce Commission, the number of passengers killed in train accidents during the months of October, November, and December, 1902, was 266, and of injured, 2,788. Accidents of other kinds, including those sustained by employés while at work and passengers getting on and off cars, etc., bring the total number of casualties up to 12,811. Of these 938 were killed and 11,873 injured; from which we see that at the close of last year our railroads were killing people at the rate of 3,752 per year, and disabling them at the rate of 47,492, a rate of 51,244 deaths and injuries in a single twelve months. Now, these figures are surely sufficiently shocking in themselves; but we can better appreciate their meaning if we compare them with the casualties in some specified instance of the universally-admitted "horrors of war." During the whole of the Boer war, which lasted about three years, the total number of casualties (killed, wounded, died of disease, and invalided home) in the British army was 27,732, of whom 5,727 were killed in action. The Boer losses, if we exclude the number of prisoners taken, were not so numerous as those of the British; but even if we allow that they were approximately equal, we find that the whole number of casualties of British and Boers, throughout the three years, was only about equal to the total number of railroad casualties in the United States, supposing, that is, that the rate shown in the last three months of last year were to prevail for the whole year. Judging from the daily record of accidents during the first three months of 1903, this rate has not only been sustained, but has greatly increased.

What are we going to do about it?

## BOILER RIVET HEADS.

Among a series of practical hints on the construction and management of steam boilers that has recently appeared in our esteemed contemporary The Locomotive, we note a discussion of the subject of rivet heads, which is illustrated by cuts of some typical defective rivet heads. These illustrations of themselves are sufficient to prove the necessity for a word of instruction and caution on this most important feature of boiler, tank, bridge, and other kindred work. The specimens presented, which we presume were taken from a steam boiler, show very shallow heads with thin feather edges. They are deficient in strength for any kind of duty, and they would be especially dangerous if they should lie on the furnace side of the plate, where they would be liable to burn off, or to be so impaired by exposure to the furnace heat that leakage and corrosion would probably take place. Although boiler rivets are subject chiefly to shearing stress, there is also a tensile stress in the direction of the axis of the rivet, which acts directly on the rivet head with a tendency to shear it off. Hence the importance of giving such a depth to the head that there shall be sufficient sectional area to prevent longitudinal shearing, and hold the plates in steam-tight contact. In much of the current boiler work the depth is not nearly as great as the heavy duty that falls upon the rivet calls for. This is true in a measure of all riveting, whether it be in tank work, bridge work, or the riveted column and girder work that enters so largely into modern skeleton steel buildings. But in boiler work, as our contemporary points out, it is particularly desirable, because of the complexity of the stresses that occur, that the rivet should be properly proportioned in all of its parts. If it were perfectly certain that the total shearing stress occurring along a certain line of rivets were equally divided among them, we could determine exactly what strain would come upon each individual rivet; but faults of workmanship, and other stresses than those due to the direct pressure of the steam in the boiler, may cause certain rivets to be strained far more heavily than others. Although we are accustomed to provide factors of safety by placing the working stress which a rivet is designed to carry greatly below the breaking strength of the rivet itself, still it is necessary that every rivet should be perfectly proportioned if we are to get the full benefit of this factor of safety, as allowed. The ideal rivets are those which have the same strength in the heads at both ends, and it is customary to consider them satisfactory when the two heads contain an equal amount of stock and are so shaped as to give a proper bearing against the plates, and a satisfactory strength of body. Since, in driving a rivet, some of the material is used in filling up the hole, which is usually 1-16 of an inch greater in diameter than the rivet, an extra length of shank must be allowed for this purpose. This will vary, of course, with the diameter of the rivet and the thickness of the plates through which it is driven; but under ordinary circumstances, an allowance of ⅛ of an inch in length of the shank will provide sufficient extra material for filling the hole. The chief allowance that must be made is, of course, that for the stock which is necessary for forming up a rivet head; and to make sure of having sufficient steel, it is necessary to allow a length of shank whose volume is equal to the volume of the cone head that is in the rivet as it comes from the maker. On a one-inch rivet a good average proportion would be a diameter of 1¾ inches at the base of the head, 15-16 at the top of it, and a depth of ⅞ of an inch. For such proportions it will be found that the extra length of shank necessary to form up a good rivet head must be 1.63 times as long as the diameter of the rivet.

## AN AMERICAN OFFICER'S VIEW OF GERMAN INDUSTRIES.

Lieut. Godfrey L. Carden, R. C. S., who was detailed by the government for duty at the World's Fair, St. Louis, has recently returned to the United States after an eight months' period spent among the iron and steel and machinery establishments of Europe. Lieut. Carden went from St. Louis direct to the Krupp works, at Essen, Germany, in July last, and he has been actively employed in the interests of the Machinery Department of the St. Louis Exposition ever since that date.

In a little more than three months' time Lieut. Carden visited more than three hundred of the iron and steel and machinery works of Germany, and his investigations carried him as far north as Stockholm, Sweden, as far south as Legnano, Italy, and included in addition to Sweden, Germany, and Italy, the countries of Switzerland, Belgium, France, and the United Kingdom. In speaking of the conditions in Germany, Lieut. Carden said: "Of all the countries of Europe, Germany has probably made greater advances than any other in the last ten years. The display at the Düsseldorf Exposition was a rude awakening to many of the immense importance of the establishments of the Rhenish Provinces, and plainly indicated that in a matter of sizes the Germans hesitate at nothing. While there was nothing at the Düsseldorf Exposition which could touch, for example, some of the high-speed engine work in the large sizes which one will find in England, still the surprise was that the Germans were so far advanced. This statement applies to the great run of the German establishments, for plants like Krupp, the Bochum houses, Haniel and Lueg, and some others which could be mentioned, have long held a place in the very first rank.

"I doubt if anywhere in the world one will find so many up-to-date plants as exist now in the Rhenish Provinces; and when I say up-to-date I refer to the systems of installation and the general internal facilities. The sanitary arrangements in the various German shops are superb, and in the matter of economics they can teach us on this side of the water very much indeed in fact, I was almost going to say they can teach us everything.

"Ten years ago one might have traveled up the Rhine, and in practically every shop of any importance one would have found English tools; to-day all this is changed. The small shops of ten years ago have given way to pretentious buildings, arranged and equipped in the most modern fashion; but instead of the English tools of a decade past one now finds, for all general work, German tools, with, however, this addition, that for high-grade work requiring great precision and excellence there is also to be found in nearly all the leading shops a group of American tools—a silent tribute to the remarkable position held in the world to-day by the American machine tool's work.

"After I had visited the first one hundred and fifty iron and steel and machinery houses, I reported that I found but two establishments where English was not spoken. As a matter of fact, the German director almost without exception has a very full knowledge of the English language. I have sat at boards of directors' meetings where no less than seven directors were present, and every German director speaking English almost faultlessly.

"Just now the conditions among the iron and steel

and machinery houses of Germany are anything but good, but they are better during the past two and three months than they were last autumn. If the coefficient 5 represent normal conditions, the coefficient 1½ would represent conditions late last year. At the present time the conditions are represented by the figure 2¼. In a number of German establishments practically the whole output just now is in filling American orders—orders which are the result of inability on this side of the water to meet the demand. These orders are largely in the nature of calls for structural steel and allied work, and at one plant which I visited there was an order on hand from America for 20,000 tons of steel rails. The prosperous conditions in the United States have also been felt in the German machine tool trade, and a number of respectable orders for the best grade of German tools to fill demands on this side were in evidence when I was in Berlin.

"On the other hand, I visited a number of German establishments which ordinarily would employ 1,500 to 1,800 men, and not a wheel was turning over in the shop; the cause was—no orders. The depression was so great some five months ago that in many sections of Germany the word 'distressing' best expressed it. But now the outlook is brighter, and with the amalgamation of many interests there is every prospect of the German trade regaining ground. I found considerable apprehension expressed in many quarters regarding the possibly far-reaching influences of American trusts, but I am inclined to think that this feeling of apprehension is disappearing; in fact, some German manufacturers were inclined to ascribe their good fortune in receiving American orders to the very existence of the trusts.

"The electrical business in Germany has been even poorer of late than the iron and steel trade, and the stability of some establishments has been threatened. The amalgamation of many of the important plants has saved a number of these houses.

"Despite the depressing conditions which existed, I failed to hear any talk of strikes or of marked discontent. This is doubtless due to the national spirit, which again is the outcome of military training. On the other hand, there is not apparent among the German workmen the ambition so familiar to us in this country. I am reminded of the American manager whose services had been secured for a German establishment, and who finding a number of orders on hand, endeavored to dispose of these orders by encouraging the workmen to work harder. Inasmuch as the employés were paid on the per cent basis, the manager felt that he was quite in order in urging extra work. He therefore called the foremen together, and endeavored to impress upon them the necessity for greater effort. On the day following, the manager found that the volume of output was exactly the same as the day before. He made a second appeal, but still the volume of output remained the same as before. In his anxiety to dispose of the orders the manager succeeded in having an increased per cent allowance awarded, but despite this concession the volume of output remained as previously. The manager then tried a new tack. He cut the per cent, and immediately the volume of output rose to a point where the workmen could receive the same income as they had formerly derived.

"There is a tremendous latent force in Germany which cannot fail to impress the American who visits the German shops. It is a force which, if thoroughly aroused, will give us a tremendous struggle in the commercial world. But of the two classes, the German workman is doubtless the happier, and in the great Essen district, where the wise administration of the Krupp factory prevails, one finds probably the most ideal and contented community of all Europe. Such a thing as a strike is unknown where the Krupp influence exists."

## THE HEAVENS IN JUNE.

BY HENRY NORRIS RUSSELL, PH.D.

At 10 o'clock on the morning of June 22 the sun enters the sign of Cancer, and in the phrase of the almanacs, "Summer commences." In other words, the sun reaches his greatest north declination, and consequently remains above the horizon for a longer time than on any other day of the year.

In spite of the lateness of sunset, the twilight will be pretty well over by 9 o'clock—at least in the latitude of New York—so that we need not change our hour of observation.

At 9 o'clock on the evening of June 15 Arcturus, the brightest star in sight, is nearly overhead, being about 20 deg. south of the zenith. Half way down from him toward the horizon, and rather to the westward, is Spica. Mars, which still vies with Arcturus in brightness, lies farther west in the same direction, but farther on and lower down, we reach first Regulus and the other stars of Leo, and then Castor and Pollux, the last just ready to set.

Between Leo and the Pole is Ursa Major, which covers an immense amount of sky, the familiar Dipper being less than half of the constellation.

In the south, below Spica, we can see part of the southern constellation Centaurus, while in the southeast appears the more familiar form of Scorpio, with the fiery Antares blazing at its heart, and its long curving tail sweeping down to the horizon.

The bright star in the Milky Way, almost due east, is Altair in Aquila, while the still brighter one higher up on the left is Vega, which belongs to the constellation Lyra. Below Lyra is Cygnus, marked by a cross of bright stars whose upright lies along the middle of the Milky Way. Between Vega and Arcturus lie the large, but dull expanse of Hercules and the pretty semicircle of Corona. The large space between these and Scorpio is filled by Ophiuchus and Serpens. The outlines of the serpent and of the giant who carries him are too much confused to be well traced without the aid of a star-map and celestial globe.

Of the circumpolar constellation, Cassiopeia is below the pole, almost out of sight, Cepheus to the east of it, and Ursa Minor and Draco above.

Now that Lyra is once more conveniently placed for observation, it is a good time to refer to a very interesting piece of work that appeared last autumn; namely, the determination of the parallax and distance of the famous ring nebula in this constellation.

This remarkable object may easily be found by those who have telescopes of moderate size, as it lies almost on the line joining Beta and Gamma Lyræ—the two small stars which lie about one-quarter of the way from Vega toward Altair. In a small telescope it appears simply as a faint oval ring of light, greenish in hue, with an apparent diameter nearly twice as great as that of Jupiter. With great telescopes many finer details are visible, and even more is shown by photography, including a star-like condensation in the center which is only visible with the most powerful instruments.

A number of photographs of this nebula, taken at the observatory of the University of Minnesota, have been measured and reduced by an American student in Germany. They afford conclusive evidence that the central star of the nebula has a sensible parallax, amounting to about 1-10 of a second of arc.

As this central star is exactly in the center of the ring, and shows the same gaseous spectrum as the rest of the nebula, there can be no doubt that it is a part of it.

We are consequently able to calculate the real distance and size of the nebula. The former appears to be about two million times that of the sun, so that the light of the nebula takes over thirty years to reach us. It is, however, a near neighbor of ours as stellar distances go, being only three or four times as far away as Sirius or Procyon, and nearer than Capella or Vega—as far as the best observations show. The apparent diameter of the nebula, measured along the longer axis of the oval, is 80 sec., which corresponds to a real diameter 800 times the earth's distance from the sun. This is 13 times the diameter of the orbit of Neptune, so that the whole solar system is a small affair alongside of this nebula.

Of the mass and density of the nebula we have as yet no knowledge; nor do we know why it shines. The spectroscope shows that it, like many other nebulæ, is gaseous; that is, the luminous part at least is gaseous, and contains hydrogen, helium, and some unknown gas whose lines are the brightest of all. But why this gas shines, whether because it is hot, or under electrical action, or under other conditions quite different from anything that we are able to produce in our laboratories, no one knows. It is one of the many unsolved problems of astrophysics.

### THE PLANETS.

Mercury is evening star until the 3d, when he passes through inferior conjunction, and becomes a morning star. He will not be visible till the last few days of the month, when he is again in elongation. This happens on the 27th, and for some days about that date he rises almost an hour and a half before the sun, so that he should be easily seen.

Venus is evening star, still steadily moving away from the sun and growing brighter. But as she is also moving southward, she becomes somewhat less conspicuous, as the interval between sunset and her own setting decreases from 3¼ hours on the 1st to about 2½ hours on the 31st. At the beginning of the month she is in Gemini, near Castor and Pollux, while at its end she is in Leo, having crossed the whole width of Cancer in the interval.

Throughout the month she can be seen in broad daylight if one knows where to look for her, and there is not the least difficulty in seeing the shadows cast by her light if one admits it through a window into an otherwise dark room.

Mars is in Virgo, and is still a conspicuous feature of the sky, though less than half as bright as he was in April. He is moving eastward among the stars, and decreasing in brightness.

Jupiter is morning star in Aquarius. On the 13th he is in quadrature, and rises a little after midnight, reaching the meridian at 6 A. M.

Saturn is in Capricornus. On the 15th he rises at about 10 P. M. Uranus is in opposition on the 15th, and is just visible to the naked eye on a clear night. He is in Sagittarius in right ascension 17 h. 32 m., and declination 23 deg. 26 min. south. It is difficult to describe his position, as there are no well-known stars near him, but he can be found with the aid of a star-map or identified by his motion, which is in an easterly direction, at the rate of 1 deg. in three weeks.

Neptune is in conjunction with the sun, and is invisible.

### THE MOON.

First quarter occurs at 8 A. M. on the 2d, full moon at 10 P. M. on the 9th, last quarter at 2 A. M. on the 18th, and new moon at 1 A. M. on the 25th. The moon is nearest us on the 13th, and farthest away on the 25th.

She is in conjunction with Mars on the evening of the 3d, Uranus on the 10th, Saturn on the 14th, Jupiter on the 17th, Mercury on the 23d, Neptune on the 25th, and Venus on the 28th.

None of these conjunctions are close, that with Mars being the nearest, about 2½ deg.

Cambridge, England.

## SCIENCE NOTES.

Monsoon stations are to be established in India for the purpose of taking observations by means of kites and kite balloons. The first station will be in the Himalayas at Simla, 7,000 feet above the level of the sea.

Announcement has been made of the election of Dr. Robert Koch as the foreign associate of the Paris Academy of Sciences, which place was formerly held by Prof. Rudolf Virchow. Dr. S. P. Langley was mentioned for the place, and received six votes.

At a recent meeting of the National Association for the Prevention of Tuberculosis in London, it was announced that Messrs. Wernher, Beit & Co. had made a second gift of twenty thousand pounds sterling to further the work of the association. A like amount, given some time ago with the stipulation that it should be used only so as to be of benefit to the poor of London, has been entirely spent in the erection and partial equipment of a sanitarium with sixty-four beds at Pine Wood, near Wakingham, and this second amount was given in order that the undertaking might be completed.

Mr. Follett Osler, the inventor of the anemometer, recently died at the age of ninety-five. Originally he was interested in the glass-manufacturing industry at Birmingham, where his father carried on the business of glass-toy making. When Mr. Follett Osler succeeded to the business, he devoted his special attention to the making of large glass chandeliers and one of his most notable achievements was the manufacture of the huge glass fountain which was such a feature of the Great Exhibition held in London in 1851. Before that time no articles in glass were produced exceeding 3 feet in height, but he made several glass objects exceeding 20 feet in height. He constructed a magnificent, huge glass sideboard for the Paris Exhibition of 1878, and also manufactured table glass, devoting special care to the purity of color, fine cutting, and engraving. When he retired from the glass industry he devoted his energies to meteorological apparatus, natural philosophy, and mechanics. His first anemometer he devised in 1836, and this was the first instrument constructed for measuring the pressure and registering the direction of the wind. In his contrivance there was a large brass plate 12 inches square, supported upon springs, and this by means of a vane was always maintained at a position at right angles to the direction of the wind. Each gust of wind when it blew upon the plate forced it backward, and the pressure thus exerted was recorded by a pencil upon a sheet of paper stretched upon a drum, driven by clockwork so as to make one complete revolution once in every four hours. The motions of the vane indicating the direction in which the wind was blowing were also simultaneously registered upon the same drum with another pencil, while the amount of the rainfall as recorded by the rain-gage was duly indicated by a third pencil. This anemometer was first set up by Osler upon the roof of the Philosophical Society's building in Birmingham in 1836, and is still in use to-day, rendering valuable service at the Midland Institute Observatory in the same city. For the invention of this instrument Osler was elected a Fellow of the Royal Society of Great Britain. His other most important appliance is that utilized in connection with anthropometry, the branch of this science for which it was specially adapted being the measurement, with minute exactness, of the human head. In this device there is a special clip especially for the cross section of the skull, with a sliding pencil which registers the exact contour of the head and gives measurements in small fractions of millimeters.

## THE IVEL AGRICULTURAL MOTOR.

BY HERBERT C. FYFE.

For some few weeks past there has been at work in England a new portable petrol agricultural motor, the invention of Mr. Dan Albone, of the Ivel Motor Works, Biggleswade, Bedfordshire.

This new motor has been designed and made chiefly for the use of farmers. It is constructed to draw motors, reapers, plows, scuffles, wagons, etc., by attaching these machines to the back of the motor. The connection is formed by taking out the long pole of the mower, etc., and substituting a shorter one, the latter being joined to the motor by a spring coupling. Almost any agricultural machine can be attached to the motor in a few minutes, and apart from working in the fields it can be utilized on the farm for cutting chaff, pulping roots, grinding corn and other operations.

THE IVEL MOTOR LAWN-MOWER.

The petrol motor is an 8 horse power double-cylinder with water circulation. It has electric ignition, one speed forward and reverse, and it is claimed that any ordinarily intelligent farm hand could drive it after a few lessons. The engine is free, and when put in motion a friction clutch is employed to transmit the power through an intermediate shaft to the balance gear shaft of road wheels, by means of patent silent running chains. The wheels have extra wide rims with grips on to prevent them from skidding round. The machine complete weighs 17 hundredweight, 7 pounds, and for traveling on the high-road detachable rubber pads are attached to the rims of the wheels by means of thumb screws. These rubber pads lessen the vibration and enable the motor to run more silently than it would do otherwise.

They are easily fitted or taken off in a very short time. The cost of fuel and necessities in running the new agricultural motor is very small and Mr. Dan Albone claims that it works out considerably less than the cost of horse labor.

During the past autumn the Ivel agricultural motor has been employed in harvesting operations in Bedfordshire, Lincolnshire and other English counties. The motor attached to a Hornsby 6-foot reaper and binder cut heavy crops of wheat and it was found that the cost of fuel worked out at about 8d. an acre and that less time was taken than formerly when horse labor had been employed. Besides this, two horses and a man were dispensed with, for the motor requires only one man to manipulate it.

The Ivel motor also cut a field of barley, and after cutting the crop it drew the loaded wagon from the field. In order also to prove its capabilities Mr. Dan Albone attached a two-furrowed Hornsby plow to the motor and a piece of oat stubble land was plowed. The work was declared by farmers, who witnessed the trials, to be exceedingly well done, the furrows being even and of good depth. Martin's cultivators were also tried attached to the motor and the work in this case was equally well done. The motor plow can easily cut two furrows in one operation, about 20 inches wide and 5 inches deep. There is no doubt that in agricultural operations there is a great future before the mechanically-propelled vehicle. Hitherto in Great Britain the stationary engine has been almost exclusively employed, though in some places traction engines are used to haul plows, mowers, reapers, binders, etc., across the fields. The motor in the field itself running up and down the land is a new departure in England and there is no doubt that such a motor as the Ivel will prove of very great value to the farmer. There is much agricultural depression in Britain, yet it was estimated that last autumn there were more than six and a half million acres of wheat, barley, and oats to be reaped, to say nothing of nearly eight million acres of hay to be cut in England alone.

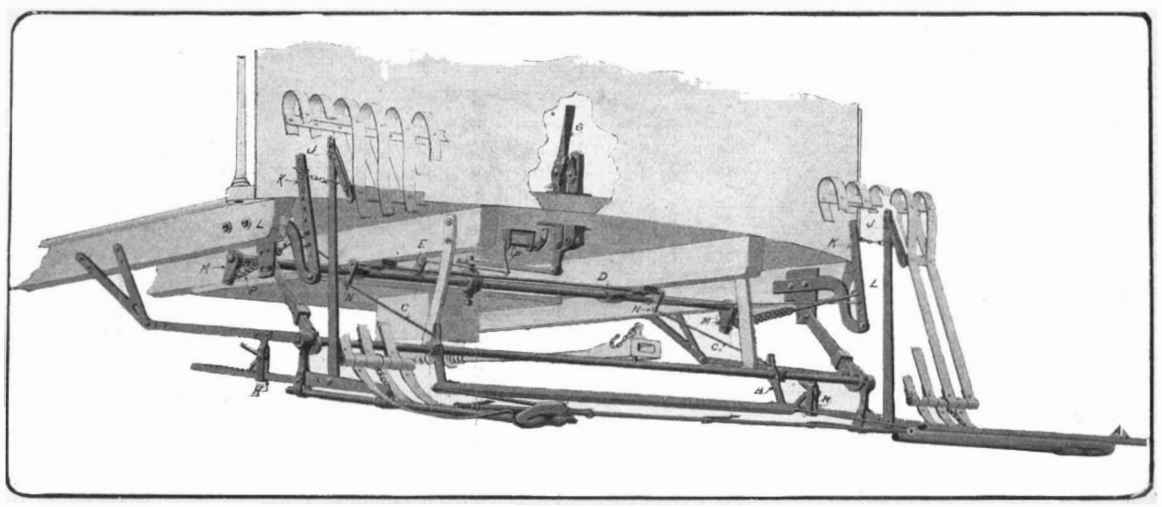
THE IVEL MOTOR-PLOW.

Labor, however, is scarce (due in great part to the South African campaign) and dear and horses are costly, machines which require to be fed and looked after even when the conditions of weather make it impossible to use them either in the fields or about the farm. The motor is a tireless worker, and after a hard day's work in the fields it can be sent up to town at night with loads for the market, returning with household necessaries and all those things necessary for the daily work of the farm.

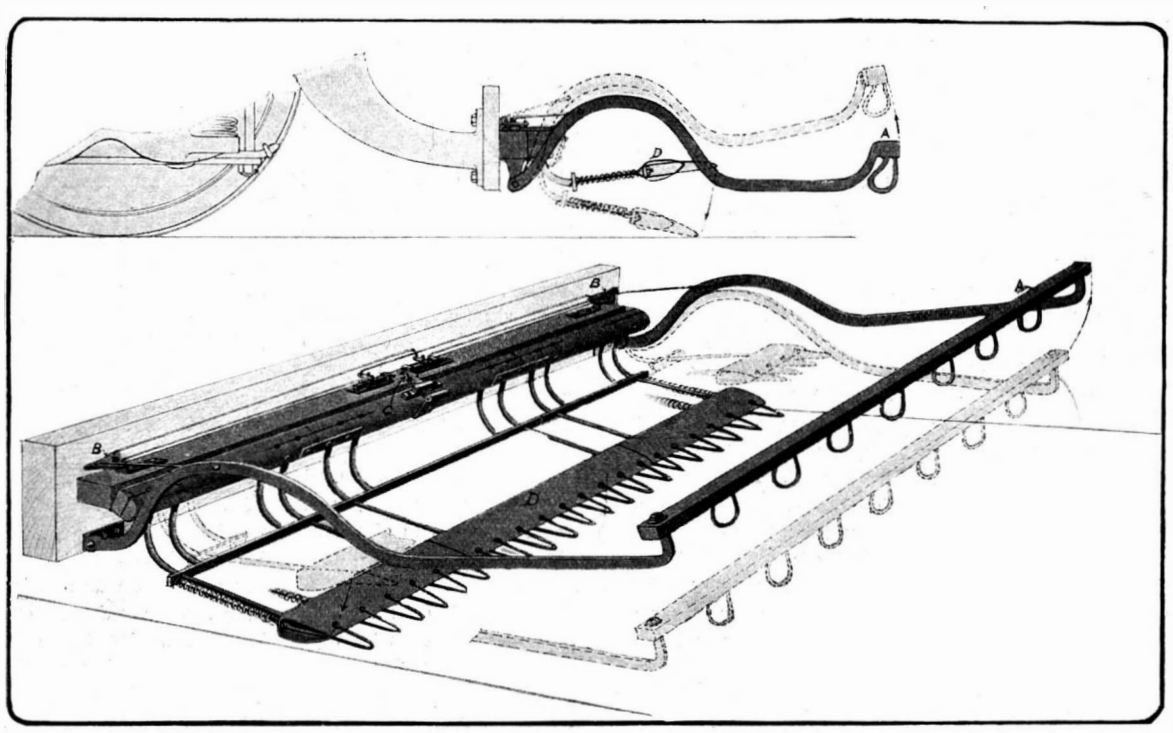
## NEW AUTOMATIC FENDER AND WHEEL GUARD.

The fender most commonly used on street railway cars belongs to what is known as the "foot-drop" type, so called because the motorman must operate a foot-pawl in order to drop the fender to the track. In an emergency, however, for example, when a person suddenly appears from behind a car going in the opposite direction, the motorman is very liable to forget the foot-pawl in his efforts to stop the car, and as a result the victim is rolled under the fender and crushed by the wheels. The daily occurrence of such accidents is gradually forcing street railway managers to adopt fenders which will drop automatically. The motorman can then devote his entire attention to the control of the power, brake, sand, and gong.

A fender of the automatic type which is now meeting with great favor is shown in the accompanying illustration, in which the fender strips have been partly broken away to bring out details of construction. This fender may be operated in three different ways; first by the foot-drop, second by what is called the "front receding trip," and third by an entirely new device called the "automatic release." Where objection is raised to the front trip this may be discarded, and only the foot-drop and automatic release used. To operate the foot-drop the pawl *G* is pressed, releasing the bell crank located immediately thereunder and permitting the rockshaft, on which the arms *M* are secured, to rotate. The rocker-arms are connected by the connections *L* to the levers *K*, which in turn are connected by chains to the levers *J* and the fender cushion attached thereto. Operation of the foot-pawl *G* therefore, releases the fender, permitting the cushion to swing forward and the cradle to drop downward by their own weight.



THE WATSON AUTOMATIC DROP CAR FENDER.



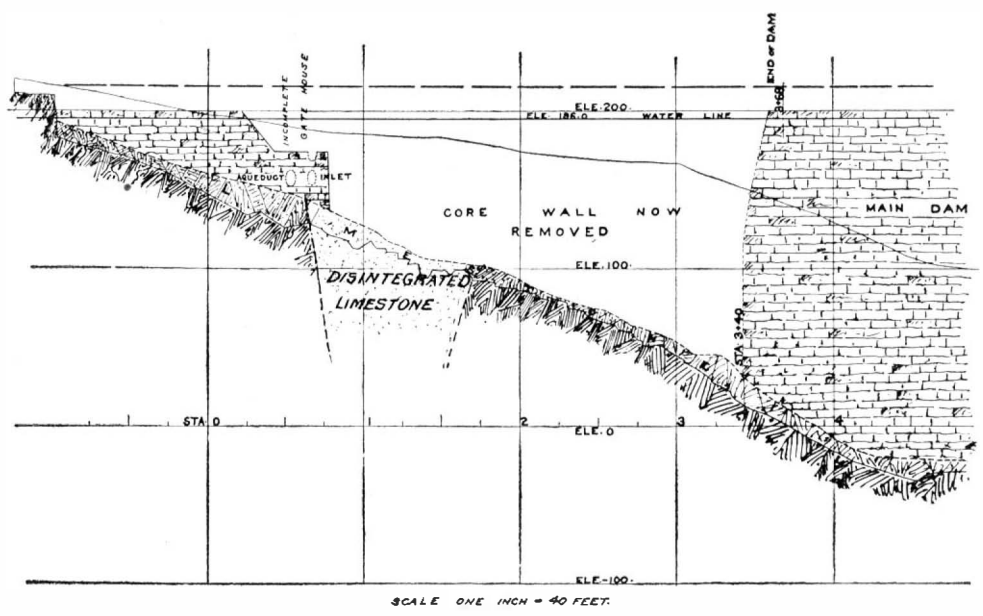
AUTOMATIC DROP WHEEL GUARD SHOWING NORMAL AND OPERATING POSITION.

In the front receding trip, the foot pawl is operated as follows: The front trip-bar *A* on striking an obstruction is forced back, swinging the levers *B* on their fulcrum and throwing forward the rocker-arms *N*. The rod *D* on which these rocker-arms are mounted is also provided with an arm *E* connected to a crank *F* whereby the motion of the trip bar *A* is communicated to the foot-pawl *G*. On release of the foot-trip, the action of the fender takes place as stated above.

In winter time, should the trip-bar *A* come in contact with snow drifts, it may be turned up against the back of the fender. When in that position the automatic release comes particularly into use. The weight of a person falling on the cradle causes the fender to drop to the roadbed. By the use of springs in the connections *L* between the fender and the rocker arms *M* the fender is allowed to fall forward slightly under the additional weight on the cradle, and the rocker-arms *N* are pulled forward because of their connection with the levers *K*. The foot-trip *G* is then operated through the rocker-arm *E* and crank *F*, as described above. In order to prevent the fender from falling of its own weight on being jounced up and down over

an uneven track, the connecting rods from lever *K* are not rigidly secured to the arms *N*, but slide freely therethrough until the springs on the connections *L* have been sufficiently distended to bring the collars on the rods into engagement with the arms *N*. Obviously the collars can be so placed that the crank arms will not be moved until a considerable weight has been imposed upon the fender. When the fender drops, whether automatically or otherwise, it is locked in this position by means of lock bars, which swing backward from the common pivot and are held by pawls *H* engaging ratchet teeth formed on the bars. The fender can be easily attached to a car, two bolts on each outside sill of the car platform being all that are necessary to hold the fender, hangers, and adjustments. It can be compactly folded, and does not interfere with the headlight or offer any obstruction when coupling. The rods each have a direct pull, so that the fender is not liable to get out of order. The cushion front of the fender is made of rubber tubing with a small steel wire cable passing through it, which, together with the telescopic frame, makes a most flexible fender for contact with an obstacle.

The fender is the invention of Mr. W. T. Watson, of Newark, N. J., who has also invented a wheel guard for use on cars not provided with fenders. In our illustration of the wheel guard, the upper view shows the guard in its normal position with the operating position indicated by dotted lines, while the lower view shows the guard dropped and the normal position indicated by dotted lines. The wheel guard is dropped by means of the trip-bar *A* which is raised on coming in contact with a body larger than would pass under the truck pilot board. Through the intermediary of star wheels *B* the motion of the trip-bar is made to release the catch *C*, permitting the guard *D* to drop to the roadbed. The construction of this guard is very ingenious. It comprises a buffer, from which a number of fingers project, the latter being held outward by light coil springs, as shown. In passing over rough pavements, cross tracks, and the like, the fingers play in and out independently. A finger on striking a stone or similar object will be pressed back into the buffer until the latter, owing to its beveled under surface, slides over the obstruction and permits the finger to spring clear of the same. This construction, it will be observed, prevents injury to the parts and at the same time allows the guard to hug the roadbed in order to prevent it from passing over a body. The guard can be readily attached to any pilot board of standard make. It has no connection with any part of the car body and therefore swings around curves with the truck, being held directly over the rails at all times. This feature is particularly important for double-truck cars. The trip-bar *A*, being well in advance of the wheel-bar, when rising over an obstacle gives ample time for the wheel guard to drop. Snow does not interfere with this type of wheel guard because a lifting motion of the trip-bar is necessary to cause the buffer to drop, and in this construction the bar on coming into contact with a drift is forced directly forward, cutting through the snow instead of passing over it.

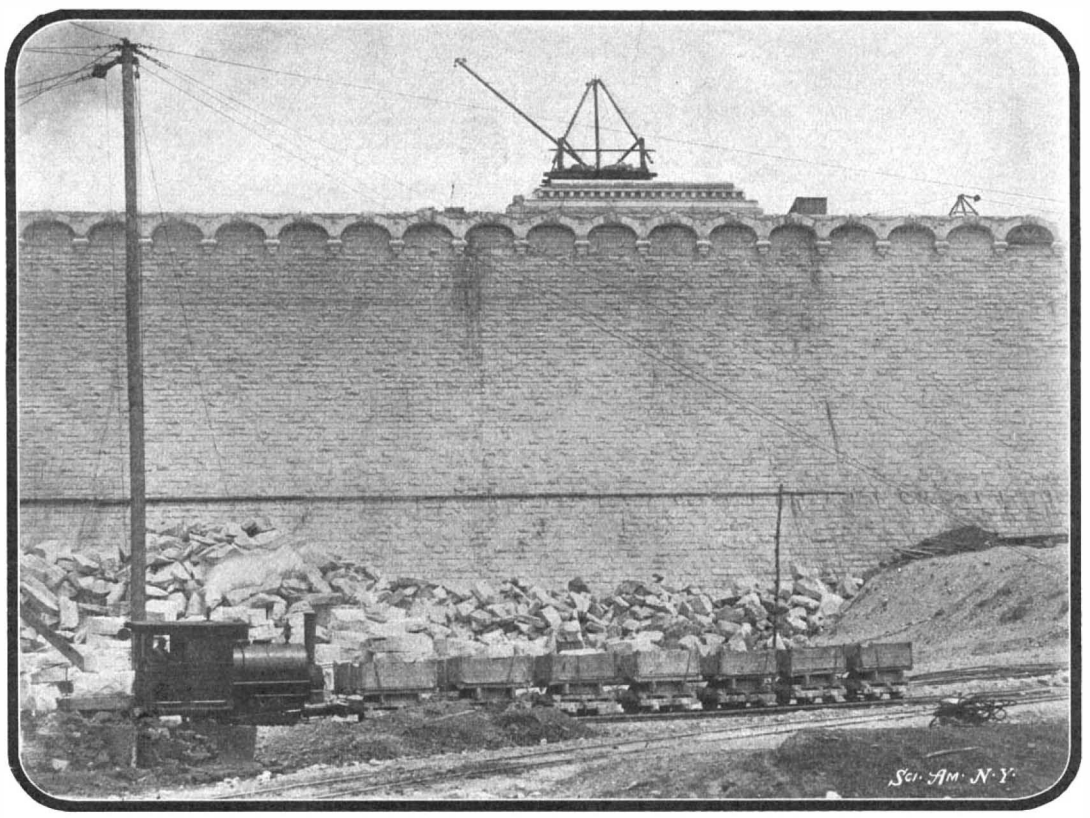



**Longitudinal Section on Axis of Dam, Showing Masonry Dam, Part of Core-Wall, and Defective Limestone Foundation.**

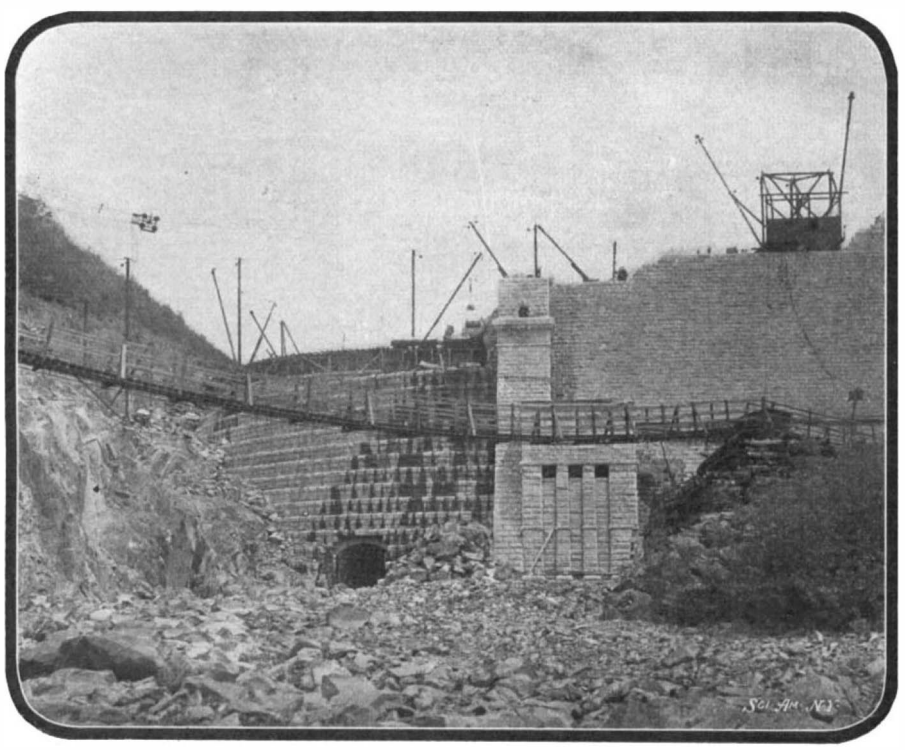
## THE PROBLEM OF THE GREAT CROTON DAM—NEW YORK CITY WATER SUPPLY.

The public alarm over the reported defects of the great Cornell Dam, which, when it is completed, will impound an additional 32,000,000,000 gallons of water for the supply of New York city, is perfectly natural and to a certain extent justified. It is natural, for the reason that if the structure after its completion should give way, not only would the additional supply of water be lost, but probably the present Croton Dam behind it, further up the valley, would be swept away in a terrific downward rush of the water, and New York city would be immediately brought face to face with a water famine that would be tragic in its results. Public concern about the dam is justified, moreover, to the extent that the natural foundations below the existing core-wall-and-earth dam have been proved to be exceedingly treacherous, and unless they are improved by carrying down the excavations until they reach a solid, impervious rock, they will constitute a serious menace to the future safety of the whole structure.

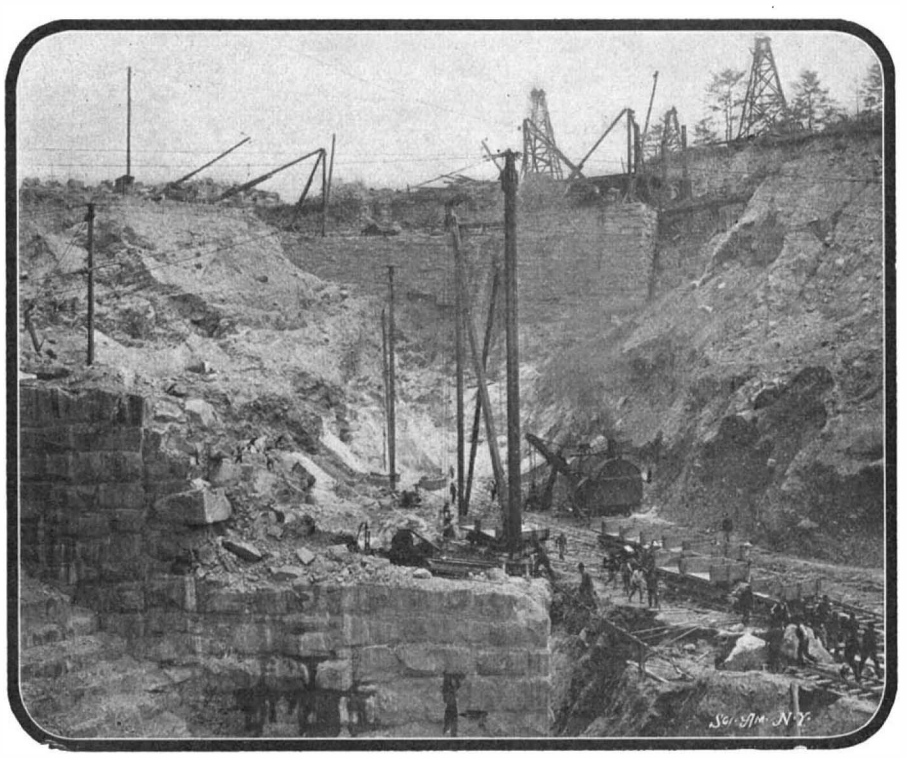
The dam as originally laid out, and now nearly four-fifths completed, consisted of 1,000 feet of masonry spillway, 1,000 feet of masonry dam, and about 600 feet of dam at the southern end of the structure, built on the core-wall-and-earth system. The masonry dam proper consists of an enormous mass of rubble work laid in cement, which is over 200 feet in width at its base and extends for about 300 feet in height from base to crest. In building this portion of the dam a huge trench, extending 160 feet below the bed of the Croton River, was excavated, all the loose, disintegrated rock that was at all pervious




**A Portion of the Dam Completed to Its Full Height.**




**The Northerly End of the Dam, and the Steps of the Spillway.**




**View of Excavation Below Core-Wall, Showing by Lighter Tint the Defective Rock.**

**THE GREAT CORNELL DAM.**

to water was carefully removed, the solid bedrock as thus exposed being thoroughly cleaned and washed with pure cement, and the great rubble wall was then built up with extreme care upon the foundation as thus prepared, the blocks of stone of which it is built averaging three feet or more in thickness and weighing several tons apiece. The masonry portion of the dam as thus built up, now practically completed, is a magnificent piece of work, and among the greatest of its kind ever constructed. From motives of economy, the southerly 600 feet of the dam was originally designed to be built with a central core wall founded like the main dam upon rock, and extending to the full height of the dam, with a mass of earth banked up against it on both the up and downstream sides, the earth and embankments being built up in six-inch layers, watered and rolled as they were put down. In this type of dam the central core wall, which in the present case was 18 feet wide at the base and tapered to a width of 6 feet at the top, is supposed to present an absolutely impervious diaphragm to the passage of water, while the mass of earth on both sides of the wall is supposed to give the necessary inertia to resist displacement by the pressure of the impounded water. Smaller dams of this type have been built and have stood successfully for many years; but there is no record of any being built of the great height and importance of the Croton Dam. For this reason, and also because it was considered that the sudden transition from the massive and unyielding masonry dam to the relatively light and thin masonry core wall presented a feature that was constructively undesirable, and for the further reason that serious cracks had already developed in the core wall before there was any water pressure upon it, the present chief engineer of the work recommended that the core wall be removed, and that the southerly 600 feet of the dam be built of masonry to correspond with the existing masonry portion of the structure as above described. An expert commission was appointed to examine and report upon the suggestion, and they unanimously recommended that the change recommended by the commissioners' engineer be carried through. The blasting away of the core wall and the carrying down of the foundations to secure a solid rock bottom has been going on for several months. On laying bare the foundations, it was discovered that for a distance of some 60 or 70 feet the core wall had been built upon a stratum of disintegrated limestone, which was so soft that upon being struck with a pick it crumbled into dust, and under the action of water would run like so much quicksand.

It was the discovery of this stratum which gave rise to the alarmist rumors concerning the insecurity of the whole dam as constructed. As a matter of fact, it was only a portion of the extreme southerly end of the dam, where it is comparatively shallow, that is affected, and it now becomes merely a question of quarrying down and taking out this decomposed limestone until a perfectly solid rock bottom has been reached. Unfortunately, the limestone stratum is approximately vertical, and runs at right angles to the axis of the dam, and hence it may be necessary to go down to an unprecedented depth before the pocket has been cleaned out and it becomes possible to perfectly seal up the foundations at this point. Borings have been carried down some 40 or 50 feet below the present excavation without revealing any improvement in the material. The disintegrated limestone is creamy white in color, and it can be clearly identified by its lighter tint in one of the accompanying illustrations showing the work of excavating as now being carried on at this point. The wall of masonry shown at the further end of this excavation is the gate house known as No. 1. It was built to control the supply of water from the new dam to the old aqueduct, which intersects the dam at this point. This gate house, together with the location of the limestone stratum, the core wall which is now being removed, and the existing masonry dam, are all shown in the accompanying drawing representing a section along the axis of the dam. Last year, at the request of the chief engineer, the Aqueduct Commission invited Prof. Kemp, of Columbia University, and Prof. Stevenson, of New York University, both geologists, to investigate the matter of the foundations, and their findings spoke of the condition of the foundations of gate house No. 1 and of the adjoining portions of the old aqueduct as "deserving very serious consideration." It is more than likely that the gate house and a small portion of the old aqueduct will have to be taken down and reconstructed during the extension of the masonry dam.

These considerations of the faulty character of the rock below the southerly portion of the dam do not imply that there is anything wrong with the foundations below the main dam. But in order to set at rest any doubts on the subject, a series of deep borings is to be made across the valley at the base of the dam, to ascertain, beyond all question, if there are any pockets of permeable material that need to be dealt with. The Aqueduct Commissioners have appointed Prof. Burr, of Columbia University, to advise the Commissioners and consult with their Chief Engineer on the whole subject of the dam foundations; and while it is, of course, deplorable that this much-delayed and urgently-needed public work should be subjected to still further delay, there is at least the satisfaction of knowing that the work as now being carried through will be beyond any suspicion of weakness and will last as long as the hills themselves.

Our various photographs show clearly the present condition of the work, which is so far advanced that it is proposed to commence filling the dam late in the present year. Including the southerly 600 feet, the total amount of masonry in the whole structure will amount to 820,710 cubic yards. Of this total, 687,180 cubic yards have been built in place, leaving 134,530 cubic yards, or less than one-fifth of the work, to be laid before the structure is completed.

### Results of the Commercial Vehicle Test.

In the test of commercial self-propelled vehicles, held by the Automobile Club of America on May 20 and 21, eleven delivery wagons and trucks started, and seven succeeded in surviving the two days' test. A 40-mile course was traversed each day, in three stages—one of 20 miles north from the club house in 58th Street to 230th Street and back, and the second and third down Broadway to Canal Street, thence west to West Street, to the Battery, and back Broadway and Fifth Avenue to 58th Street. The 40 miles were covered the first day as far as possible without stops; but the second day, each vehicle was obliged to make from ten to one hundred stops, according to whether it was a heavy or light machine. The lighter cars made the best runs and had the least trouble. Among these were two Knox delivery wagons propelled by the Knox air-cooled gasoline motor. One of these cars had a double-cylinder 16 horse power motor. Its weight was 2,300 pounds, and it carried a load of 1,250 pounds. It was the first to finish on both days, its time for the 40 miles being 3 hours, 35 minutes, and 3 hours, 41 minutes, the second inclusive of one hundred stops. The other Knox car, propelled by an 8 horse power motor and weighing 2,070 pounds, carried a load of 3,315 pounds, and finished third (time 4 hours, 37 minutes) the first day and second the second day in 4 hours, 55 minutes. A Mobile 4½ horse power steam delivery wagon, weighing 1,500 pounds and carrying a load of 775 pounds, finished second in 4 hours, 23 minutes the first day, and third in 5 hours, 10 minutes the second day.

The only vehicle in the electric class was a 6 horse power Waverley delivery wagon. This car weighed 2,420 pounds, and carried a load of 1,210 pounds. It covered the course in 6¼ hours elapsed time the first day, and 5 hours, 18 minutes, inclusive of 100 stops, the second. The first day it was halted and charged 20 minutes, and the second, 40 minutes, during the run.

Among the heavier vehicles propelled by a gasoline motor, were two entered by the Union Motor Truck Company, of Philadelphia. One of these was an express wagon like that illustrated in our recent Automobile number. Its weight was 4,525 pounds, and its load 2,710 pounds additional. Its time the first day was 10 hours, 34 minutes. After covering 20 miles the second day, one of the solid rubber tires came off, causing the wagon to skid suddenly into a sandy spot in the road and throw off the operator and observer, the latter of whom sprained his ankle. The 5,810-pound truck entered by the same company, was, like the express wagon, also propelled by a four-cylinder, 20 horse power gasoline motor. It carried its load of 3,240 pounds the required distance of 30 miles in 7 hours, 51 minutes the first day; but it, too, came to grief on the second day after going 22 miles and making 22 of the 50 scheduled stops. The driver, when trying to ascend the 230th Street hill, ran the truck into a bad hole, and, when backing out and down the hill, saw a train at the bottom and reversed, fearing a collision. By so doing, he bent the crank shaft of the engine, which was not strong enough to stand the tremendous strain.

As the test was the first in which heavy steam trucks have figured in this country, the performance of these machines was watched with great interest. The starters in this class were a 14,225-pound 30 horse power truck, carrying a load of 5 tons, and entered by T. Coulthard & Co., of London; an 11,160-pound, 20 horse power truck, carrying a 5,740-pound load, entered by the Morgan Motor Company, of Worcester, Mass.; two Hershmann trucks of 15 and 25 horse power, weighing 10,225 and 14,500 pounds respectively, and carrying loads of 3,805 and 10,000 pounds. A 10 horse power delivery wagon weighing 3,530 pounds and carrying 1,720 pounds load, entered by Blaisdell & Co., of Brooklyn, completed the list of steam machines. This machine only got to 161st Street before it was forced to retire owing to pump troubles. It also caught fire from leaking gasoline. The heavier Hershmann truck also quit at the same place, owing to leaky boiler tubes. The other trucks finished the first day's run of 30 miles in the following times: Coulthard, 4 hours, 53 minutes; Hershmann, 6 hours, 31 minutes; and Morgan, 9 hours, 21 minutes. The second day all three trucks again succeeded in covering the 30-mile course, the Hershmann and Morgan inclusive of 25 stops, and the Coulthard of 10, in the folowing times: Hershmann, 4 hours, 57 minutes; Courthard, 10 hours, 28 minutes; and Morgan, 12 hours, 52 minutes.

Thus it will be seen that the two leading makes of American steam trucks compared favorably with the English one; although the American builders are as yet in the experimental stage. The detailed results of the test, such as fuel and water consumption, we hope to give in a later issue.

### Electrical Notes.

The John Scott legacy medal and premium was recently awarded by the Franklin Institute to William J. Hammer of New York, for a remarkable experiment in the phonographic and telephonic transmission of sounds between New York and Philadelphia. Two Edison phonographs, two Edison carbon transmitting telephones, two Edison motograph receivers or loud-speaking telephones, two sets of induction coils and batteries and 104 miles of long-distance telephone circuit, 6 miles of which was underground and submarine cable, and 98 miles of which were strung on poles, were employed. The sounds, consisting of talking, singing, and cornet playing, were transmitted through the air five times, and were transmitted through no less than fifteen distinct media from the speaker and musician in New York to the audience in the Franklin Institute, Philadelphia. These media included vocal chords, cornet, air, glass, iron, and mica diaphragms, carbon buttons, styli of steel, palladium, fixed pins or springs, hydrogen gas, distilled water, wax and chalk cylinders, copper wire and the mechanism of the ear. The physical characteristics of the sound waves were changed during transmission no less than forty-eight times. It is interesting to note that the same lecturer, by means of transmitters placed upon the stage, was listened to by audiences in fourteen different cities. Music and talking were transmitted by the phonograph and telephone from the stage of the Franklin Institute to Buffalo, Rochester, Boston, Syracuse, New York, Newark, Orange, and elsewhere.

Treatment of diseases of the eye by electricity has been tried as long as electricity was first scientifically employed in therapeutics. Nevertheless, the advantages of this treatment are very little known. Dr. von Reuss deserves credit for referring to Prof. Mendelsohn's monthly Die Krankenpflege, in a detailed article on partly successful experience in electrical treatment of diseases of the eye, made by himself, which he strongly recommends to his colleagues. Without entering into special information chiefly intended for physicians, one point from the experience of the author has to be set forth. According to his statement, there is no doubt as to the sedative effects of electricity upon a diseased eye, particularly in cases of inflammation. At first electricity was used in diseases of the ophthalmic nerves and muscles of the eye, but in these cases Dr. von Reuss could not secure positive results. Most remarkable, however, are the improvements observed in treatment of inflammatory diseases of the eye by electricity. A great advantage is offered by the treatment being simple and not at all disagreeable. As almost every physician with a large practice owns an induction-coil, he need purchase no new instruments. In order not to make the patient afraid of the action of the electrical current, the physician uses the faradaic hand (named after Michael Faraday). For this purpose the physician touches with one of his hands the diseased eye, while the other hand holds one electrode and the patient the other one of the apparatus. Except a prickling feeling in the hand which clasps the electrode, the patient does not feel anything; nevertheless, the action of the electrical current is so annoying for the physician, that he can not continue one sitting for a longer period than three to five minutes. The electrical current can in case of necessity be brought in direct contact with the eye by a compress tied upon the same. The patient can also in this way regulate the current according to his liking to prevent its becoming disagreeable. The whole affair, including the fixing of the electrode (compress) upon the eye, offers no difficulty, so that the patient may treat his eyes at home without the presence of the physician, which is of greatest value in cases of inflammation of the eyes where violent pains set in during the night. In nearly all cases pain disappears almost instantaneously and ceases for a long while. Dr. von Reuss recommends electrical treatment first of all in cases of iritis, corneitis, and choroiditis. The influence of electricity in removal of photophobia, which is due to a certain kind of conjunctivitis, by which the eyes cannot be opened, has been astonishing. Even upon blind eyeballs, which remain sometimes very painful, the electrical current exercises an extremely beneficent effect.

# Correspondence.

### India's Unsanitary Milk Supply.

To the Editor of the SCIENTIFIC AMERICAN:

I think some of your readers will be interested to learn that there is not one refrigerator car in all India, and that we have to take our milk supplies from local cattle stables that are anything but wholesome. Six years of plague have not made very much impression on the survivors as far as active sanitary precautions go, and we may have to look to American enterprise for our first refrigerator cars.

Our current issue of the Indian Municipal Journal sent herewith describes the situation of the milk supply of Bombay and in the other large towns of India.

JOHN WALLACE, C. E.,
Editor of the Indian Textile Journal.

Bombay, India, April 25, 1903.

### On Stropping Razors.

To the Editor of the SCIENTIFIC AMERICAN:

Most people that shave themselves have trouble in keeping their razors sharp. For the benefit of such I will give the simple way I have of keeping my razors in shape.

Everyone knows that metal expands with heat. I put my razor, handle kept out, just before stropping, in boiling water, and leave it until it has absorbed as much heat as I can stand in handling. While the blade is hot I strop it well. The metal cools as I strop. In about twenty-five strokes the edge is sharpened and is keener when cold, for the metal contracts while sharpening. The canvas side of my strop is smeared with putz pomade, which I use if the razor is too dull; since it simply brightens the edge and wears it down just enough. LEON RIGGS.

St. Joseph, Mo., May 14, 1903.

### A Word Against the Metric System.

To the Editor of the SCIENTIFIC AMERICAN:

The editorial, "The Metric System," in your issue for May 16, mentions two of the reasons why the system is opposed, but fails to mention the reason which leads all others in importance, namely:

The substitution of the millimeter for the inch involves the abandonment of all mechanical standards based on the inch.

This proposition was discussed at length in my paper on this subject, which was read at the last meeting of the American Society of Mechanical Engineers. In the discussion, which occupied an entire afternoon and evening, no rebuttal worthy of the name was offered. Such rebuttal is in fact scarcely possible, since the proof is not based on deduction merely, but is a simple matter of experience. To the extent to which American and English manufacturers have used the metric system, to the same extent have they abandoned sizes and standards based on the inch. Germany uses English pitch threads almost exclusively, and she measures them just as we do—in inches. In other words, in order to retain English threads, Germany is obliged to retain the English inch, as we must retain it if we are to save our standards.

Your comparison of American and English money is part of the metric stock in trade. As my paper has it:

"The superiority of the decimal system as applied to currency is largely due to the great amount of adding to be done. With day book, journal, ledger, cash book, trial balance, balance sheet, invoice inward and invoice outward alike, it is add, add, add, and then add some more. One bookkeeper in a good-sized factory office will do more adding than the whole shop and drawing office force combined. When it comes to multiplication or division, vulgar fractions are often the simpler."

If your readers doubt this, let them multiply or divide some number by 1-3 and then by its decimal equivalent .3333+, or even by ¼ and then by its equivalent .25.

The metric advocates should get over the idea, which is unworthy of intelligent men, that the opposition to their system is based on simple purblind conservatism. It is based on the desire to save our system of mechanical standards, which is worth a thousand-fold the value which the metric advocates claim for their system and a million-fold its actual value. This system of standards is the result of half a century of laborious effort, and on it, more than any other one thing, American manufacturing supremacy depends. F. A. HALSEY,

Associate Editor American Machinist.

New York, May 20, 1903.

### Radium Phenomena Considered as "Ether" Effects.

To the Editor of the SCIENTIFIC AMERICAN:

Self-luminosity, power to discharge electrified bodies at a distance, unclassed or abnormal radiation phenomena, generally analogous to X-ray effects, are remarkable attributes of radium compounds, differentiating the element to which they are due from the great body of the other elementary substances.

Now, according to a cablegram published in Melbourne on the 26th of March, the London Times is responsible for the statement that the discoverers (M. and Madame Curie) of the element have demonstrated that without combination, chemical or molecular change, it maintains a temperature 2.7 deg. F. above its surroundings.

If a system of elimination shows—apparently it has shown—that there is no slow process in action, giving rise to the effects by the expenditure of an initial store of potential energy as radiant force, tending ultimately to cessation by exhaustion; and if energy in recognizable form does not pass from adjacent bodies to a "self-luminous" and "self-calorescent" specimen of a radium compound, yet in this particular case the possibility remains that some obscure, or perhaps extra-terrestrial cause, may suffice to produce the effects noted, and in a manner strictly compatible with the established theories of heat and the conservation of energy.

Considering "self-calorescence"—the other radiations may be dealt with on similar lines—heat is one form in which the expenditure of mechanical force becomes manifest to the senses. The connection between the heat developed and the energy expended, is a perfectly definite and well known quantity; hence when a certain amount of heat is constantly given off, it points to the fact that an equivalent amount of energy is constantly being transformed. If a body offer a resistance to movement through any medium, then that resistance is made evident by a rise in temperature exactly equivalent to the kinetic energy, or energy of motion required to overcome the opposition.

The writer would suggest that this offers a clue to the radium phenomena, and would advance—always presuming the verification of the reported thermal effects—as a simple explanation, the following hypothesis:

If in its primordial composition—not necessarily atomic, questions of sub-atomicity may be involved—a mass of radium be dissimilar to a similar mass of another element (not possessing radium characteristics) in relation to a different resistance to motion relative to the "ether," then the observed or reported effects would simply indicate a process of transference and redistribution of energy. The earth's potential energy of motion would here be the source drawn upon to overcome the resistance offered by the "ether" to a mass of radium, the accompanying equivalent effects would naturally appear to be attributable to the radium as an origin.

Given planetary velocities, as in the case of the earth's motion, then, on account of the magnitude of the velocity factor in the velocity-resistance equivalent to the slight heat produced, the resistance factor might be exceedingly small; so small that in ordinary tests it would be altogether masked by other effects, yet not necessarily so small as to escape detection if made the particular object of research by the use of the exceedingly sensitive instruments* now available.

Astronomical data defining the earth's constants are fully tabulated, therefore it may be found that, given sufficiently delicate instrumental means, or efficient thermal insulation, insuring a constant temperature when the force causing radium activity is constant, the periodic variations of the componental planetary motions may be reproduced as corresponding thermal or deflection variations.

The drift of the solar system in reference to the inter-stellar medium is, from the astrophysical standpoint, a subject well worthy of investigation, and radium may supply an analytical method. The drift might, however, introduce an element of complexity, possibly negligible, but conversely it might prove dominant and of such great magnitude that the resistance factor would inversely become infinitesimal and unmeasurable.

The experimental pursuit of these problems would eventually be a series of researches upon disturbed "ether" "streams," and if the results were not altogether negative, would tend to cast some light upon the long sought physical relations of that medium in its fundamental connection with light, heat, electricity and other radiant forces.

That similar resistance effects to those under discussion have not been connected with the other elements is not remarkable; they must necessarily, if existent, be minute, and have not been specially sought. Analogously the "new" elements themselves have only recently been separated, although any one of a myriad of the preceding close analyses might have revealed them.

If speculation be extended into the field of elemental evolution, it might be surmised that the better known elements have been subjected to, or are the outcome of, a common formative process, and have attained a general equilibrium of action in regard to the surrounding ether. The consequent conditions would then form the environment to which, through countless generations, the human senses had become attuned, hence their constitution of a neutral or normal state, not recognized as existent, except by comparison with some unusual, or perhaps, extra-terrestrial standard.

If it be established that radium offers a particular resistance to the "ether," then whether its lines prove present in the solar or stellar spectra, or not, it might, inferentially, be deemed to have had an origin in some region, possibly beyond the star depths, where the physical environment is not that known to man.

The writer fully recognizes the speculative nature of the hypothesis put forward; so far as he is aware, it breaks new ground. The pages of the SCIENTIFIC AMERICAN may bring the matter within the cognizance of those who possess the appliances necessary to put the question to a crucial test. If the hypothesis be verified, important results might be looked for; if disproved, new facts could hardly fail to be brought to light in the process, and thus time devoted to the experiments would still bear fruit.

JAS. ALEX. SMITH.

Melbourne, Australia, April 8, 1903.

* I. e. the quartz film suspension system of Prof. Vernon Boys. Proc. Royal Institution of Great Britain, 1889, Vol. XII, part III, and the Phil. Mag. 1895, Vol. 186.

### The Current Supplement.

With an article by Day Allen Willey on the Cod Fisheries of Newfoundland, the current SUPPLEMENT No. 1430, is opened. Excellent illustrations elucidate the text. "Mechanical Traction on Tramways" is the title of an article which deals with a new system of propulsion employed in Paris. Mr. Cyril Davenport gives a brief history of personal jewelry. Selenium is a substance which, by reason of its remarkable electrical property of varying in conductivity with the amount of light by which it happens to be illuminated, has been made the subject of experiments since the days of Berzelius. In a most instructive article accompanied by many clear illustrations, William J. Hammer describes the results which have so far been obtained with this remarkable substance. His paper may well be considered the most exhaustive which has so far appeared on the subject. Dr. McPherson tells something of Lord Kelvin's new idea about ether atoms. Two novel types of traveling electric hoists are described and illustrated. Emile Guarini presents a lucid account of the Perret electric clock. Sir Oliver Lodge's paper on electrons is continued. The usual trade suggestions from United States Consuls and Selected Formulæ will be found in their usual places.

### A Memorial to Bessemer.

A movement is on foot in England to establish by popular subscription a memorial to Sir Henry Bessemer. That some recognition is due to the man who reduced the cost of steel from $250 to $20 a ton in less than half a century, goes without saying. The scheme has not as yet been fully developed; but the memorial will doubtless take the form of an institution for instruction in the various branches of metallurgy, under the direction of the University of London. A public meeting is to be held on June 29, at which it is to be determined what plan will be adopted.

### The First Municipal Exhibition.

On May 20 the King of Saxony opened the German Municipal Exhibition, the first of its kind ever held. Exhibits of 128 cities were on view. Over 300 manufacturers displayed articles employed in municipal work, street improvement, sewage systems and the like. From the seaport towns models of docks and harbor works were sent. Among the noteworthy exhibits may be mentioned plans of city halls, street car tracks and elevated railway systems, public parks, sewage and drainage systems, municipal slaughter houses and garbage crematories.

### Human Rays.

It is announced by Prof. Arthur W. Goodspeed, of the University of Pennsylvania, that he has been experimenting with rays emanating from the human body. Although photographs were made by the aid of Crookes tubes, it is asserted that the tubes were not the actual means of producing the photograph, but that they acted simply as intensifiers of the rays. Prof. Goodspeed is said to have ascertained that the rays from the human body pass with difficulty through glass and with ease through aluminium.

### "Buddeized" Milk.

A Swedish pamphlet describes a process of "Buddeizing" milk, which process tends to sterilize and conserve the milk so that it can be kept fresh for any length of time. The inventor is a certain Mr. Budde; hence the name. The pamphlet says that he has proven that the enzymes in the milk, together with heat, not exceeding 55 deg. Cent. nor less than 48 deg. Cent., have the power of decomposing hydric dioxide into water and oxygen, and that at the generation of oxygen, microbes and spores are entirely destroyed.

## FIRST RACE OF THE CUP DEFENDER "RELIANCE."

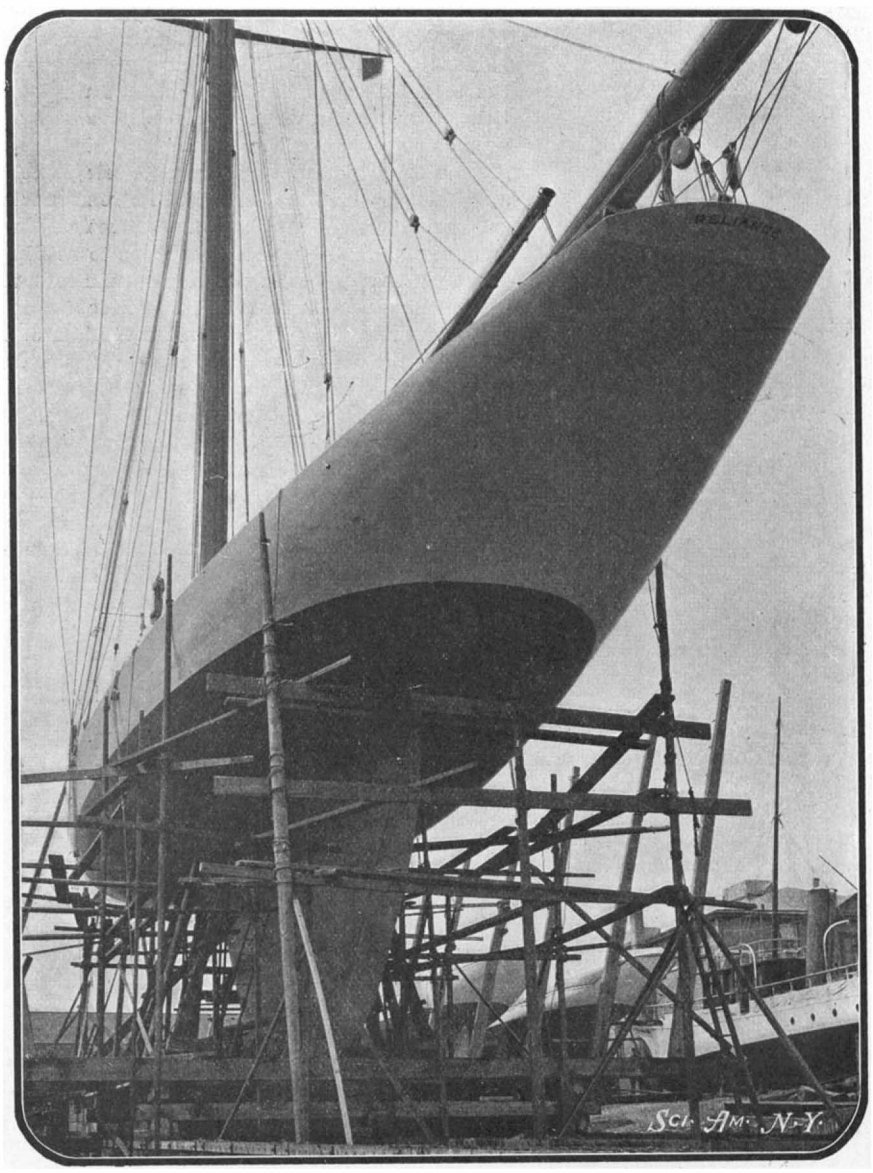
Surely in all the long history of trial races, whether between cup defenders in America, or between cup challengers in their try-outs in British waters, there was never a race sailed that provided such sensational results as were achieved by the new yacht "Reliance" in her first trial race on Long Island Sound. In the first place, none of the American defenders has come to the line with so little actually known as to her sailing capabilities. Because of keen rivalry between the three contestants for cup-defending honors this year, neither "Constitution" nor "Columbia" has been willing to give "Reliance" any opportunities for those preliminary "brushes" and trying-out "spins" on the various points of sailing, which from time immemorial have been granted as a matter of courtesy by former champions to a new aspirant for cup-defending honors. Hence "Reliance" has been doing all her tuning up in very solitary fashion; and, although to those in charge of her she appeared to be thoroughly satisfactory, balancing well, carrying a light helm, and apparently showing great speed under all conditions of sailing, neither her owners nor captain knew exactly what her abilities were, as she drew near the starting line on Thursday last, and commenced to maneuver for position with that well-tested veteran "Columbia." Because of an accident when being hauled out upon the ways, "Constitution" took no part in the race, being at the time in the shipbuilder's hands for the straightening out of some plates that were slightly indented.

The race was sailed in a perfectly smooth sea and a breeze that varied from a knot or two per hour to a maximum strength of about eight or ten; and, therefore, the conditions were the very best possible for a boat with the broad and shoal body and great sail spread of "Reliance." The course consisted of an 11-knot leg down the Long Island shore with the wind over the starboard quarter; a 3-mile reach across the Sound with the wind over the port quarter; and a beat of 11 miles for home. The greatest surprise of the day was furnished on the first leg, when, with a wind that averaged about 3 knots in strength and never exceeded 6 or 7 knots, "Reliance" drew away very rapidly from "Columbia," gaining at an average rate of 40 seconds per mile. It was supposed that in spite of her much larger sail spread ("Columbia" having 13,200 square feet, and "Constitution" nearly 16,000), the greater weight and larger wetted surface of "Reliance" would cause her to show about the same drifting qualities as the smaller boat; but as it was, she beat "Columbia" about as badly as "Constitution" used to beat her two years ago under like weather conditions. After gibing round the first mark, "Reliance" heeled down to a freshening breeze until her lee rail was well under, and proceeded to show something of the well-known reaching ability of the scow type. Her water-line lengthened some 5 or 6 feet forward and drew out for fully 25 feet under the long counter; and considering that the yacht for the first mile of the 3-mile leg must have been going fully 14 to 14½ knots an hour, she made remarkably little disturbance of the water. There was no perceptible drag, and the bow and stern waves were extremely light for a boat of that size moving at such high speed. On this leg she beat "Columbia" 1 minute and 30 seconds, or at the rate of half a minute a mile. It is possible that some time may have been lost by "Columbia" because of the fact that while "Reliance" carried her jib in addition to her balloon-jib topsail and staysail, the older boat did not use her jib over a considerable part of the distance; but even if allowance be made for this fact, the performance of the new boat was most remarkable.

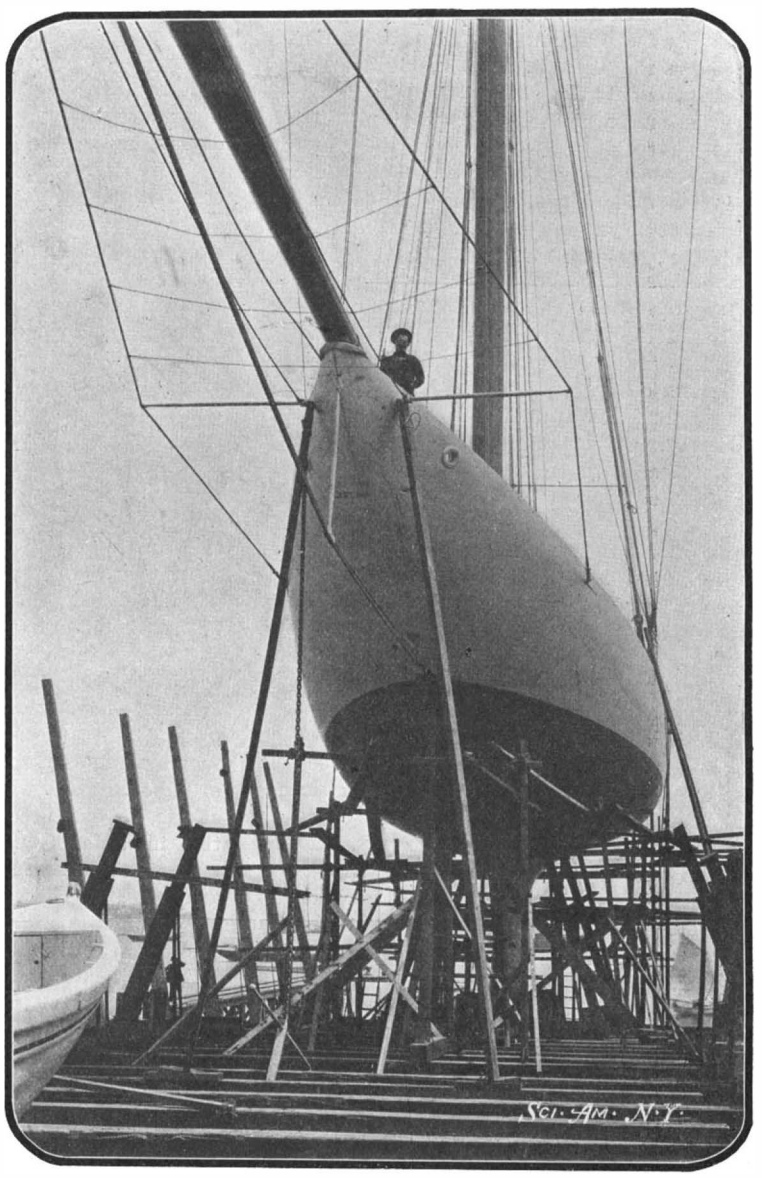
It was expected that when sheets were flattened in for the final thrash to windward, the great ability of "Columbia" on this point of sailing would show itself, and that she would at least hold the big boat, if she did not cut down some of her lead; but, again to the surprise of the yachting "sharps," "Reliance" continued to pull away from her now badly-beaten competitor, and on the 11-mile beat she gained 4 minutes and 23 seconds, which is equal to a gain of about 24 seconds per mile, the speed of "Reliance" being a trifle over 10 knots per hour. In the broad reach over the 3-mile leg of the course "Reliance" averaged 13.2 knots per hour; and it is certain that if the breeze had held at the strength which it had on the first mile of this leg, the new yacht would have shown a considerably higher average speed than that.

We have said that the race was sailed under ideal conditions for a boat of the "Reliance" type, and in all probability she will not be able to pull away from "Columbia" in anything like such an impressive manner when there is a sea running, or when the race has to be sailed under shortened canvas; while the most disadvantageous conditions possible would be the combination of a lumpy sea and a light breeze. As there are yet some dozen or more races to be sailed between the two cup yachts, some of them to take place off Newport and over the cup course off Sandy Hook, this doubt is certain to be satisfactorily settled long before "Reliance" meets "Shamrock III." in an international race.

The accompanying views of the "Reliance" were taken when she was hauled out to clean the underbody for this race. The most surprising feature was the extreme breadth and shoalness of the forebody, the yacht showing up extremely shallow and flat from the forward waterline to the keel. Yet there was no suspicion of unfairness, the lines in every direction appearing to be remarkably sweet, with none of those "humps" or sudden, abrupt changes of curvature that so frequently mar the beauty of extreme boats of this type.




Stern View, Showing the Great Overhang.




Bow View, Showing the Great Breadth and Shoal Body of "Reliance."

THE "RELIANCE" IN DRYDOCK.

### The Cape to Cairo Railroad.

The construction of the Cape to Cairo Railroad has now been completed to a point 167 miles north of Buluwayo, and this section of the extension to the Victoria Falls is open for public traffic. The railroad is now only 40 miles from the extensive Waukie coal fields, but of this stretch of track 15 miles of the necessary earthworks are finished. Already the Waukie coal has been experimentally utilized upon a heavy freight train weighing 376 tons, to ascertain its calorific value for this purpose. The run was made from Francistown to Buluwayo, a distance of 126 miles, and the coal was found to be in every way equal to that hitherto employed. One of the characteristics of this coal is that it is remarkably free from clinker, and not once during this particular trip was it found necessary to clean the fire of the locomotive. Even on the stiff gradients the coal consumption was only 58.4 pounds per mile for 376 tons, as compared with 70 pounds per mile for 300 tons with the ordinary coal. The earthworks for the railroad from Buluwayo to the Matoppos, provided for in Mr. Cecil Rhodes' will, are also well advanced, and the other various railroads in connection with the great trunk track through Africa are being pushed forward with great rapidity.

Sir William Ramsay, who, in conjunction with Lord Rayleigh, discovered the existence of argon, and subsequently krypton and xenon, in the atmosphere, has made a computation of the quantity of the two last elements present in the air. The results of his experiments and calculations shows that the air contains .000014 per cent of krypton and 0000026 of xenon by weight. To be more explicit there is one part by weight of krypton in 7,000,000, and one part of xenon in 40,000,000, of air. Measured by volume as constituent gases of the air, the volume of these two elements is more infinitesimal, since there is only one part of the former in 20,000,000, and one part of the latter to 170,000,000 parts of air.

## BUTTERFLY FARMS IN FRANCE.

BY JACQUES BOYER.

Up to within a year or two, the butterfly farm established at Eastbourn, England, by Mr. William Watkins, an entomologist, was the only one of its kind. To-day, however, there exist several such farms in France, among which we desire to call special attention to those of M. André at Mâcon, Department Saône-et-Loire; M. de Labonnefon, at Cercoux, Department Charente-inferieure; and Doctor Hugues, at Chomérac, Department Ardèche.

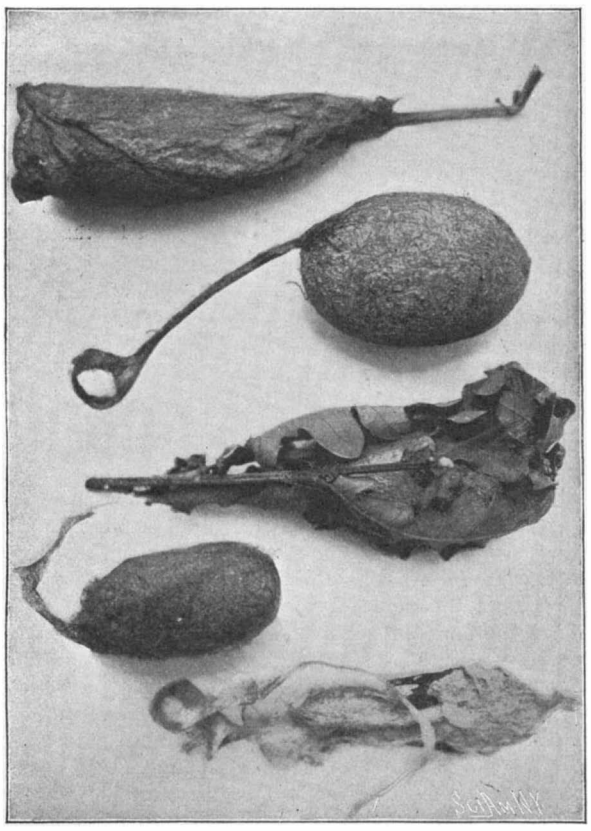


Fig. 1.—COCOONS OF SEVERAL VARIETIES OF SILKWORM.

These gentlemen practically confine their efforts to the rearing of the rarest genera of the family bombycidæ or silkworms; and by fortunate crossings they have obtained some new varieties for which the collectors and the museums of natural history contend with weapons of gold. Moreover, they are endeavoring to acclimate in France the silkworms indigenous to other countries. The silk-producing larvæ will live and reproduce in a wild state in the forests of France, and it is only necessary to collect the cocoons, from which the silk threads are easily obtained.

These attempts at acclimation have in some cases been attended with encouraging results. The ailanthus silkworm, *Attacus Cynthia*, so called because its caterpillar feeds upon the leaves of the ailanthus tree, is a native of Japan; the *Antherœa Yama-Mai*, a native of India, and a most beautiful butterfly whose caterpillar thrives well upon the elm and the chestnut; the *Antherœa Pernyi*, better known under the popular name of the oak silkworms; the *Antherœa Mylitta*, which because of its late hatching or breaking forth is more difficult to raise; and the *Attacus Atlas*, the largest known of the bombycidæ and which produces very large cocoons, have all been successfully domesticated or acclimated. Fig. 1 shows the cocoons of the exotic silkworms which are being introduced in France. 1 is that of the *Attacus Cynthia;* 2, *Antherœa Pernyi*, one having broken out of and one being still concealed in an oak leaf; 3 is the full ovoid cocoon of the *Antherœa Mylitta;* and 4 is the *Attacus Atlas* carefully wrapped up in the leaf. The requisites for the successful culture of the butterfly are a garden of greater or less extent in which are oaks, ailanthus trees, pines, plum trees, ricinus or castor-oil plants, and other bushes the leaves of which serve to nourish the larvæ or caterpillars. Disposed here and there about the garden are various appliances of the most simple kind. Ordinarily the eggs are placed in a brooder such as is shown in Fig. 2. This is altogether a home-made contrivance for preserving the larvæ from destruction and at the same time affording them a means of nourishment after they are hatched.

Branches of the trees with the cocoons still clinging to them are plucked and arranged so that their woody stems may be inserted in a vase of water, the whole upper part being enveloped by gauze or mosquito netting. In the lower part of the netting, where it comes in contact with the stems, is placed a lot of crumpled paper to prevent the wandering insect from taking an involuntary bath. Notwithstanding all these precautions, sometimes the imprudent little beasts fall into the water, and if an attendant with his pincers does not come promptly to their aid, they suffer the same penalty as other mortals who cannot swim. On the other hand, these caterpillars have a most fastidious taste.

They need pure air, offensive odors are detrimental to their health; above all, their food must be sound, succulent and plentiful. They are ravenous feeders, incessant eaters, and consume much more in proportion to their size than an ox. Accordingly, as soon as the leaves in a brooder have been nearly devoured, another one is prepared, placed in a vessel of water, and brought sufficiently close to the first one to allow the insects to change their habitation without great discomfort. They do not require much coaxing—their dominant appetites urge them to possess the new fields. Since a uniform temperature is an important factor in the rearing of these insects, they are very often kept in a room until after the first moulting. They are then placed on bushes in the open air, and to shield them from the birds and another equally deadly enemy, the *Forficula auricularia* (earwig), the branches containing them are inclosed in a sort of sleeve of muslin or tulle. In Fig. 3 can be seen several of these sleeves with the attendants inspecting them. This represents an actual scene on the farm of M. André, at Mâcon.

The breeding of butterfles is not accomplished without work. The attendants must take care that sufficient nourishment is constantly at hand, which, in view of the incessant craving for more on the part of the boarders, is no light task. Besides, it is necessary to frequently remove the excrement from the muslin envelope. After the bodies of the caterpillars have attained a certain thickness, the enveloping hood is removed, there being no more fear of the beaks of the feathered tribe, as they are not eager to make a meal of such oleaginous morsels.

As for the more robust species, such as the *Telew-Polyphemus*, imported from Asia, or the *Attacus Cynthia*, indigenous to Japan, it is only necessary to place the grain or eggs upon the trees in paper cornucopiæ attached to the trees, bell down. Hatching follows without further care, after which the cocoons that are found rolled up in the leaves or hanging from the branches are gathered. Well protected from the rats, who are extremely fond of them, the chrysalides are now brought in and stored in a dry and well ventilated place. If the eggs are desired for the next season's hatching, the cocoons are placed in grilled boxes, where the butterflies emerge from them at birth.

Fig. 3.—PLACING THE SLEEVES AND THEIR CONTENTS ON THE BUSHES.

Should it be the desire of the breeder to mount the butterflies for the museum, he first asphyxiates them in a vial containing potassium cyanide. Once dead, they are mounted on stands with wings carefully and completely distended. To prepare the caterpillars for the entomologist's cabinet is quite another thing. The best process for preserving them is by inflation, a manipulation which requires no little dexterity and patience. Fig. 4 shows M. André in the act of inflating a caterpillar. Before this can be done the insect must first be prepared by pressing it between sheets of paper, and, after all the soft parts of the body are expelled through the posterior opening, by making an incision with a scalpel in the large intestine 2 or 3 centimeters from the end of the body, the latter is threaded, so to speak, upon the fine point of a thin glass tube, which is connected by its other end to an ordinary rubber spraying bulb, or any bulb provided with valves for the admission and ejection of air. The one shown in Fig. 4 is a combination of two bulbs and an idea of M. André, the naturalist.

Moreover, during the inflating process, the subject is placed in a little stove or oven heated by an alcoholic lamp, shown in the figure just in front of the operator. After a few minutes the caterpillar begins to assume the appearance of life, and it is then ready to be placed in an entomologist's collection.

Various other openings of an industrial or artistic nature are available to the French "bombyculturist." The butterflies are worked into brooches or even into highly ornamental cathedral windows by placing, for example, some *Actias Mimosæ* and other insects, together with some desiccated flowers and leaves, between panes of glass.

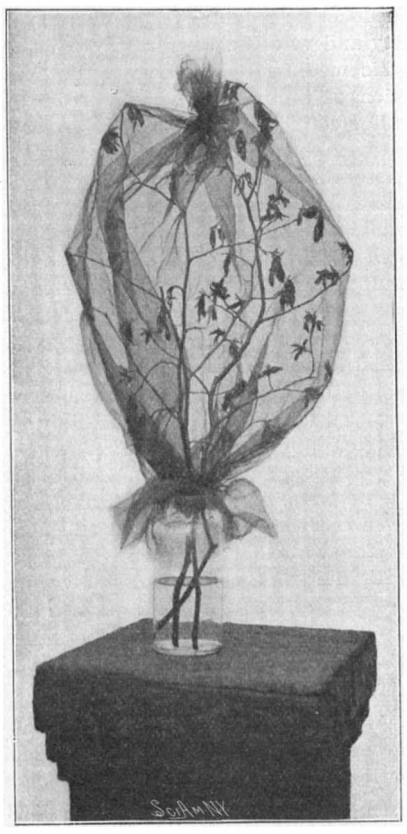


Fig. 2.—A BROODER.

Our elegant dames also affect a gorgeous decoration of their hats with butterflies, for which purpose the insects must undergo a certain extensive preparation. After the wings have been covered with a transparent alcohol varnish, the butterfly is glued upon a piece of satinette which is afterward cut out to conform exactly to their contour. A steel or silver wire is run through the thorax, forming a skeleton at once rigid and light. Mounted in this manner, the butterflies become a very attractive and graceful ornament.

### Automobile Improvements.

Some ingenious improvements have been made by Sir David Salomons, Bart., the pioneer of the motor car movement in England, in connection with the vital parts of a petrol car, to facilitate and expedite inspection of the engine, and replacement of parts. Instead of attaching the ignition wire to terminals of the plug, as is the usual practice, Sir David Salomons has devised an intermediate piece which he can disconnect from the plug by the half-turn motion, similar to that in the withdrawal and insertion of an ordinary incandescent electric lamp into the holder. By this arrangement, the plug can be instantly removed by the hand, for examination or cleaning. Another important time-saving improvement he has also made is concerning quick access to the valves. In many petrol engines it is necessary to detach by unscrewing two unions, and to remove a copper pipe. This pipe he has cut in two, and attached a single union provided with a coarse thread, and has so arranged the screw collar that it may be released by the hand without the aid of a tool. In his car he has also removed the tap controlling the supply of petrol from the tank of the carbureter, from its general position near the reservoir to the point where the pipe enters the carbureter. This is a valuable improvement, since by the existing practice the supply pipe, when the tap is turned off, often contains a quantity of air, which prevents the passage of the petrol from the tank to the carbureter, and thus delays, and militates against, the starting of the motor, since the petrol cannot enter the carbureter.

Fig. 4.—INFLATING A CATERPILLAR.

### The Interior of the Earth.

Prof. John Milne, the well-known seismologist, has published some interesting facts concerning the crust and interior of the earth. At the present time it is only possible to imagine the formation of the earth's crust from the strata present in the matter thrown out by volcanoes. How thick the earth's crust is we do not know, but as it is an established fact that earthquakes and similar earth tremors pass right round the world, through the interior in waves, it is possible to deduce the medium they have traversed by their quality and velocity. According to Prof. Milne, the denser this medium the greater is the speed of the propagation of the waves, varying from 3 kilometers to 9.3 kilometers per second, the velocity increasing the nearer the course of the wave to the earth's center. Assuming the world to weigh more than five and a half times an equal bulk of water, Prof. Milne concludes that a lighter crust of approximately 200 miles and a denser medium fairly uniform and about five and a half times the density of water would satisfy the seismological conditions. To such a core as this, which would be somewhat lighter than iron, he has supplied the special name of "geite," and continues to explain that what seismological observations lead us to suspect is that beneath the lighter crust there is a magnetic medium of greater density, which during penetration slowly passes into a fairly homogeneous "geite," and he anticipates that it will be possible in time to deduce the physical and chemical composition of the white-hot matter in the interior of the earth with the same certainty that we now know the composition of the various bodies of the solar system.

### A Chemical Apparatus for the Removal of Boiler Scale.

Among the impurities of feed-water, the sulphates of calcium and magnesium are more especially deposited as a hard crust or scale on boiler-plate. The active means for avoiding this crust or scale is the treatment of the feed-water with soda or other suitable substances. By the action of sodium carbonate there are formed from the sulphuric-acid salts dissolved in the water insoluble carbonic-acid salts of calcium and magnesium. These salts collect on the bottom of the boiler as a coarse mud, and can be easily removed by occasionally blowing off.

The amount of these salts contained in the feed-water can be determined by chemical analysis, and from this the weight of soda or other chemical which must be added to the feed-water can be calculated. It is not always possible, however, to undertake these chemical investigations, for in most cases the boiler attendants lack the necessary knowledge of chemistry. Consequently an arbitrary quantity of chemical is usually added.

An inventor who lives in Rotterdam, Ferdinand R. K. Erfmann by name, has devised a controlling apparatus, by the aid of which the amount of chemical that must be added for a ton of boiler water can be determined in the simplest manner and in a very short time. The operation of the apparatus is based on the following principle:

A definite quantity of boiler water is caused to react on a definite quantity of basic solution of a definite strength, so that a precipitate is formed. This mixture is filtered. It is then determined how much of the basic solution still remains in the filtered liquid; for this purpose the base is colored yellow, by adding an indicator (methyl orange). If the base be now neutralized by an acid, the indicator will be colored red by the acid at the moment when the neutralization is complete.

These experiments can be carried out with the new apparatus, very simply. The number of pounds of chemical which must be added per ton of boiler water can be read off on a scale.

### New Quick-Firing Gun for the British Army.

Both the artillery and field forces of the British army are being equipped with a new type of quick-firing gun of ingenious design. The gun itself, which is of 20-pounds caliber, is both heavier and longer than those employed in the South African war, and is equipped with several new quick-firing accessories. Yet despite these increases there has been no augmentation of the total weight of the arm, and it will not require any additional horse power for transport.

At the end of the trail of the gun is a simple spade, supplanting that which has hitherto been attached to the axle, the feature of which is that it does not act as a check to the recoil of the gun. This is a grave disadvantage to the axle spade, since every time the gun is fired the force of the discharge drives the spade deeper into the ground, and renders it impossible to move the gun quickly when desired, as the spade has to be first released.

Instead of the spade bearing the brunt of the recoil, there is a special mechanism which allows the gun itself to slide back when fired in a semicircular bed, and neither the position of the carriage, nor the training of the gun, is altered in the slightest. The gunners are also afforded protection against the enemy's fire by steel shields.

Two other improvements have been carried out, which will enhance the firing capacity of the gun to a very appreciable degree. A breech-block has been designed which is not liable to corrosion, and which therefore will not blow back when worn. This constitutes a grave objection to the Ehrhardt gun cone-shaped breech-block, which after continuous firing blows back. In this new army field piece also the breech is closed and opened by one rapid and single action, which is quickly and easily performed, so that the interval necessary between opening, loading, and firing the gun is reduced to the minimum.

### A MAN WHO WAS STRUCK BY LIGHTNING AND LIVES.

P. D. Keim and his son, Clyde, of Rand, Col., went upon a mountain hunting trip last summer. While the party was ascending a steep incline a storm came up. As he walked into a clearing, the elder Keim was struck by lightning. Nearly every article of clothing that he wore was torn off; even his shoes were stripped from his feet. His son Clyde, who was about fifty feet away, was also struck. He regained consciousness, and, despite the fact that one side was paralyzed, he managed to crawl to his father, whom he supposed dead—pulling himself along by means of the long grass, using but one hand and arm. When he reached his father, he found that he had not been killed. Fortunately, the remaining members of the


THE EFFECT OF A STROKE OF LIGHTNING.

party came up, and worked over the unconscious man for two hours, finally succeeding in reviving him.

The body of Mr. Keim was burnt from neck to toes; both ear drums had burst. After he had been revived, Mr. Keim and his son Clyde boarded the train for Rand, Col., where they live. On the way, however, it was necessary to call in medical assistance. Mr. Keim wrote to us last January that he had then sufficiently recovered to don the clothes which he wore at the time of the accident, and to have the picture taken which we reproduce herewith. The picture tells better than words how narrow was his escape.

Borax, which is so largely used in the arts, and for household purposes as well, is found in many parts of the world in a more or less pure state, and the process of separating it from the crude mineral is very simple. A first operation is grinding the material in boiling water containing a small portion of calcined carbonate of soda. The clear solution thus obtained is run into tanks and crystallized. This is only fifty per cent borax, other elements being sulphate of lime and common salt. The crystals obtained by this process are then put through another process by heating them to a certain temperature at a given concentration, when the borax proper crystallizes out, and separates from the impurities held in suspension, the mother liquor being drawn off. Borax has been found in such quantities of late years that it has declined greatly in price; at one time it cost over $200 per ton, but is now but a fraction of that sum.

### Engineering Notes.

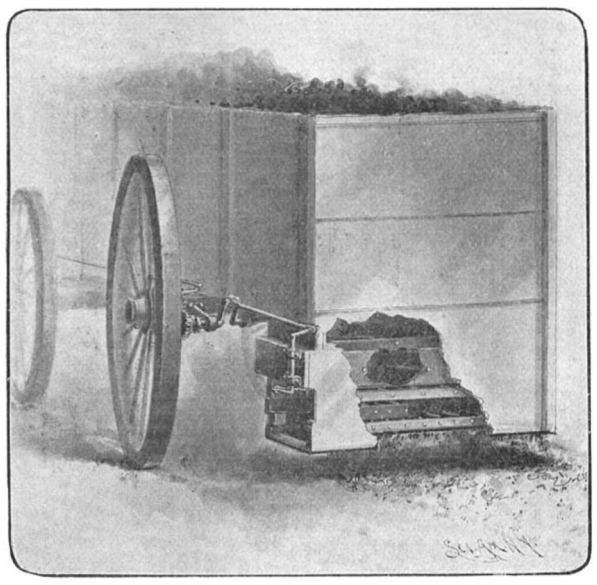
Prof. Thurston believes that the gas engine is a formidable rival of the steam engine and is capable of further development. Each has given a horse power for about one pound of coal, and the efficiency of both, between the coal pile and the point of delivery, is about 20 per cent. The steam engine, he says, has so nearly reached its limit that further progress under commercial conditions would seem to be very slow, but its range may be increased by employing very high pressures and superheating combined with them. In Sibley College work, 1,000 pounds per square inch have been used, and Prof. Thurston expresses the view that twice that pressure may be successfully used eventually, or with sufficient experience in its management. These factors would raise the efficiencies nearly 50 per cent and reduce the coal per horse power hour to about three-fourths of one pound.

One of the principal difficulties of adapting the steam turbine to marine use lies in the necessity of providing some arrangement for reversing the motion of the ship. In the case of light launches a similar difficulty has had to be faced, but for the small powers and speeds here needed it has not proved difficult to construct reversible propellers, a hollow shaft being used in conjunction with pivoted blades. Such a system seems, however, hardly applicable to the transmission of the heavy thrusts involved in the case of high speeds and large vessels. Consequently some attention is now being directed by one or two large firms to the construction of reversing turbines. The difficulties in making these are purely mechanical, since from the point of view of efficiency it matters little whether the turbine wheel rotates in one direction while the casing is held fast, or whether the latter is allowed to revolve in the opposite direction and the turbine proper held fast. The relative motion of the steam through the guide-blades and buckets is identically the same in the two cases, though in the second case the steam should be introduced into the casing with an angular velocity equal to that of the casing, and a corresponding arrangement should be made at the exhaust end. A writer in London Engineering suggests that by coupling up through friction clutches either the casing or the turbine wheels to the propeller shaft, the latter could be driven in either direction at will. The writer states that he is unacquainted with the principles on which the firms above mentioned are at present experimenting, but the governing ideas are probably somewhat on the above lines.

An aerial transportation system which is in use in Italy is described in the Bulletin des Ingenieurs Civils. It has been installed by the factory of G. Pratti at Longara. At the end of 1900 a cardboard factory was established in the valley of the Piave, using wood pulp. In order to use hydraulic power the plant was located at the bottom of the valley. The national route by which the raw material was brought and the products transported lies 2,300 feet away on a horizontal distance and is 64 feet higher than the factory. Hence the problem of transportation had to be studied; the aerial rope system was preferred, as it was necessary to cross the Piave, then two roads and a large field. An aerial cable was stretched upon which travel the cars. It is 2,340 feet long and has a difference of level of 78 feet between the ends. The two parallel cables are fixed by anchorage at the upper part and are stretched by counterweights at the lower. The cables are fixed along the route upon wood pylons from 18 to 50 feet high by cast-iron brackets. The cable is one inch in diameter and made up of 37 steel wires; the two cables are placed 6 feet apart. For the traction a continuous cable is used, of 0.4 inch diameter. It runs over pulleys fixed to the pylons underneath the supporting cables. The lower station has a horizontal pulley of 6 feet diameter upon which runs the traction cable. A small turbine operates it by a set of gearing which allows a forward or reverse movement. It takes about 4 horse power. At the upper station is a horizontal pulley over which the cable passes. This pulley has a shaft whose bearing can be displaced in a slide, and a counterweight attached to the latter gives the proper tension to the cable. The material is conveyed in small cars; it consists of packages containing 200 pounds each which are taken from the factory to the national route and of sawed trunks of trees carried in the opposite direction; these are about 15 feet long and the weight carried reaches 2,200 pounds. Two cars are constantly in circulation on this line; one leaves from above and the other from below, and they cross in the middle. The speed is about 5 feet per second and it takes 8 minutes to make the trip. The loading and unloading takes 4 minutes, giving five trips per hour for each car. This represents a capacity of 10 tons. A special model of car has been designed for receiving the bales and the logs. The latter are hung underneath by two stout hoops. The whole is supported from two rolling chariots. The cost of the plant, which has been put in by Ceretti & Tanfani, of Milan, is $5,000. Its operation has proved very satisfactory.

### MANURE SPREADER.

It is important that manure and other fertilizer of a lumpy nature be crushed before spreading on the ground, and with this in view Mr. O. L. Stadig, of St. Francis, Me., has invented a simple crusher which may be readily attached to any wagon or cart. As

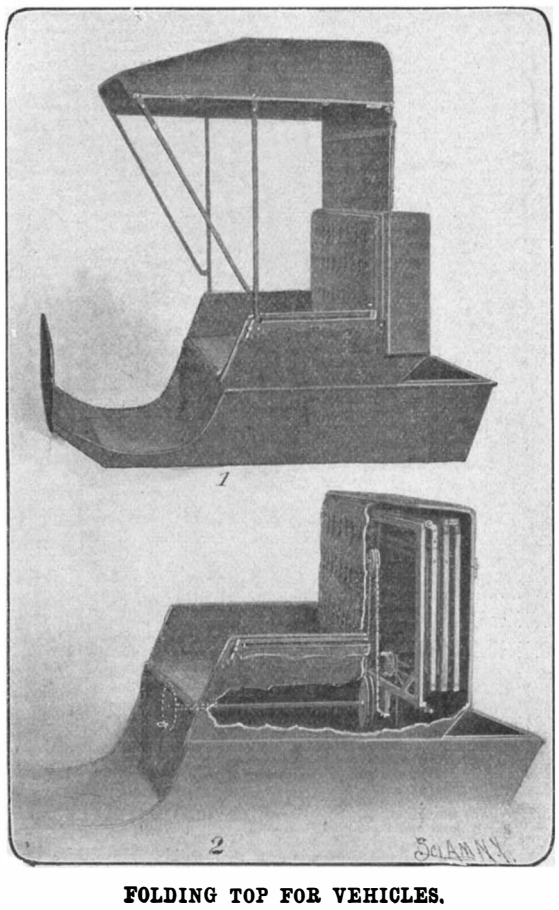


MANURE SPREADER.

illustrated the crusher comprises a number of reciprocating frames mounted in grooves at the rear of the wagon body. The frames are composed of longitudinal and transverse bars and pass between similar stationary frames in the wagon. The reciprocating frames are operated from one of the rear wheels of the wagon as follows: Near the axle of the wheel a crank shaft is journaled, on the outer projecting end of which a pinion is mounted. The pinion is not fixed to the shaft but may be moved thereon into or out of engagement with a gear ring bolted to the spokes of the wheel. This action may be governed by a lever at the driver's seat. With the gears in mesh the crank shaft will be rapidly rotated when the vehicle is in motion and the pitman on the crank portion will be reciprocated. This motion is transmitted by means of levers to the movable frames, causing them to reciprocate and grind or crush the manure in the wagon against the stationary frames. The manure then falls through and is distributed evenly on the ground in the proper broken condition.

### FOLDING TOP FOR VEHICLES.

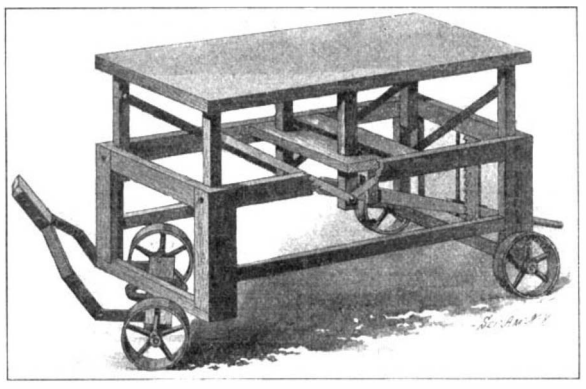
A convenient way of disposing of a buggy top when it is not in use has been provided by the recent invention of Messrs. William T. and Edward Y. Temple, of Trenton, N. J. The top is moved back to folding position, and then by the manipulation of a crank under the buggy seat is lowered into the hollow seat-back. The operating crank is secured to a shaft, which is provided at its opposite ends with a grooved pulley. A chain secured at one end of this pulley passes over a sprocket wheel at the top of the seat-back and is fastened to the lower end of the rear frame of the buggy top. This frame is also provided with a disk, as illustrated, from which two rods extend to the spring bolts located one at each side of the frame. The spring bolts are adapted to enter notches in the seat-back when the frame has been sufficiently elevated. When it is desired to lower the frame, the disk is rotated by means of a handle in the back of the seat, which causes the connecting rods to withdraw the bolts from their notches. The upright members of the middle bow, it will be observed, are each provided at the lower end with a guide piece adapted to slide in a T-shaped groove in its respective seat-arm. At the rear end of the grooves hinged blocks are provided which, on folding up the buggy top, are swung open to allow removal of the guide pieces from the grooves and permit the upright members to be folded back into the hollow seat-back. The location of joints in the buggy frame has been carefully planned to permit of folding the top as compactly and neatly as possible. With the buggy top stowed away within the hollow seat-back, free access is permitted to the rear portion of the vehicle body, which is often used for carrying packages and other articles.



FOLDING TOP FOR VEHICLES.

### ELEVATING TRUCK.

A large proportion of the damage done to baggage in transportation is due to the fact that the floors of the baggage cars are much higher than the platform of the usual hand truck, and consequently the trainmen are apt to carelessly throw out trunks, boxes and packages regardless of their weight or the nature of their contents; but as the train must keep its schedule, and every minute counts, we cannot blame the baggageman for unloading the luggage in the very shortest time possible. An improved type of hand truck, which is calculated to do away with this objectionable feature, is illustrated herewith. It is the invention of H. F. Broyles, of Western Port, Md. This truck is provided with a platform which can be raised up to any desired height by the simple manipulation of a lever, and as easily lowered. With the platform on the level of the car floor, the trunks or other bag-

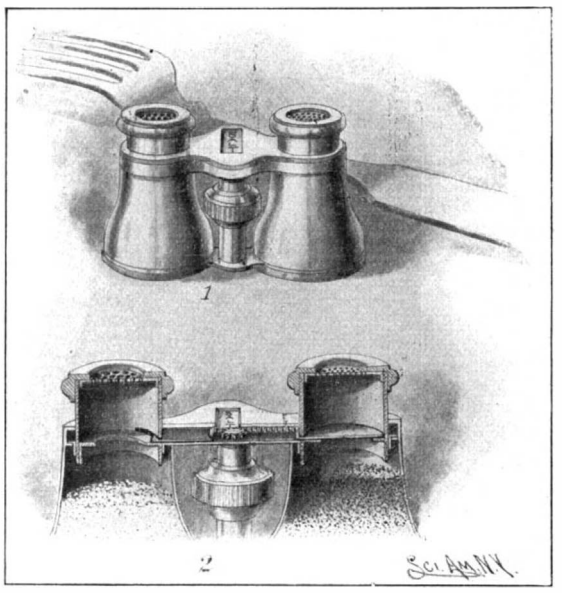


AN ELEVATING TRUCK.

gage can be easily slid along on to the truck, and the platform may then be let down for unloading, or may be adjusted to the level of an express wagon if the baggage is to be delivered immediately. The platform is supported on posts which fit in between the corner posts of the truck frame. The bars which are secured at their outer ends to the platform posts are connected at the center by a rod supported in brackets projecting downward from the platform. This rod passes through the inner end of the operating lever. A forked bracket extending downward from the truck frame affords a bearing for the fulcrum pin of the operating lever. The pin passes through a slot in the lever, which allows necessary play. A plate is fastened to the forward end of the lever, and is adapted to engage the teeth of a ratchet plate to hold the platform at any height desired. A guide rod at one side serves to hold the plate on the lever in engagement with the ratchet teeth. This rod being made of spring metal may be easily sprung outwardly to permit raising or lowering of the lever. Aside from its uses in connection with baggage transfer, this truck will obviously be found very useful for many other purposes.

### AN OPERA-GLASS CONDIMENT HOLDER.

A novel form of salt and pepper holder has recently been invented by Lieut. J. W. Graeme, care of the United States Navy Department, Washington, D. C. The holder has the form of a pair of opera glasses, being about half the size of the actual article. One of the cylinders is filled with salt, and the other with pepper. The parts which correspond with the eyepieces of opera glasses form the perforated tops, through which the salt and pepper may be shaken. To prevent both salt and pepper from being discharged at the same time, the inventor provides a plate which is adapted to close the neck of either one or the other cylinder. A rack is formed on one edge of this plate, and is engaged by a pinion at the upper end of what corresponds to the focusing-wheel shaft. By turning the focusing-wheel this cut-off plate may obviously be moved to close either the salt or pepper box. The words "Salt" and "Pepper" are engraved on the plate in such positions that when the salt box is uncovered the word "Salt" will be exposed through a slot in the casing between the eyepieces, and when the other box is uncovered the word "Pepper" will appear. Imitation of the opera glass is heightened by making the bottoms of the boxes in the form of lenses, which con-

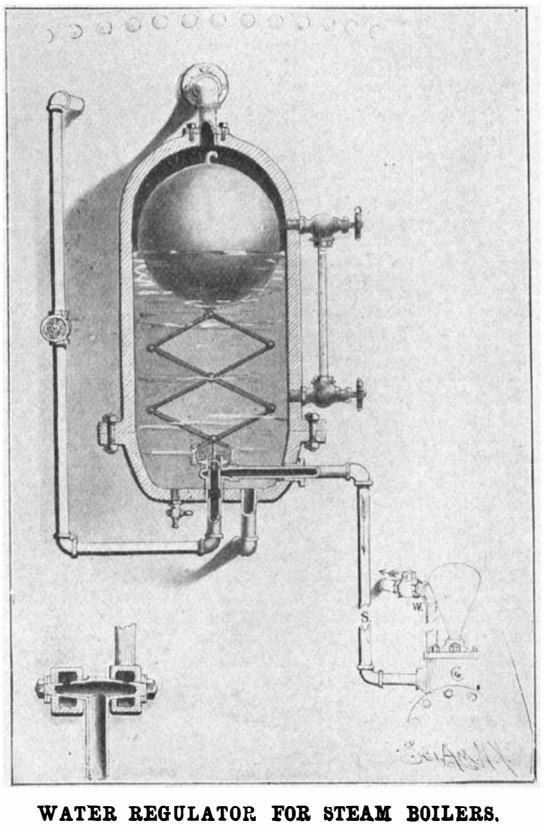


AN OPERA-GLASS CONDIMENT HOLDER.

struction also enables one to see at a glance whether the holder is empty or not.

### WATER REGULATOR FOR STEAM BOILERS.

In the accompanying illustration we show an automatic water regulator for steam boilers, which embodies a number of important new features. The float controlling the valve is so constructed as not to be liable to fill with water by sweating or actual leakage, and means are provided whereby the float will not be liable to collapse by reason of the high pressure at the boiler. The inventor, Mr. Benjamin Walker, Jr., of Austin, Texas, has aimed to make the regulator as neat and light as possible. The cylinder or shell of the regulator is made in two sections connected in a water and steam tight manner. A tubular piece screwed into the bottom of the shell, and provided near its upper end with an annular chamber, serves as a casing for a cup-valve. The annular chamber opens into a pipe connected with the injector or pump, which is supplied with steam when the openings in the cup-valve register with this annular chamber. The valve is connected to the float by means of a lazy-tongs made up of tubular members. These are so constructed as to conduct any water which may have accumulated in the float of the valve. Fig. 2 shows the form of connection used for insuring proper communication at the joints of the lazy-tongs. The curved or gooseneck tube at the top of the float admits air or steam therein, to enable it to withstand the high pressure from the boiler. With the parts in the position illustrated the pump or injector is idle, for its steam supply is cut off by the cup-valve. However, as soon as the water in the boiler has dropped sufficiently, the float will lower the valve, permitting steam to flow out through the annular chamber of the valve casing and into the pump. The latter will then pump water into the boiler until the float has again been raised to its normal position.



WATER REGULATOR FOR STEAM BOILERS.

## RECENTLY PATENTED INVENTIONS.

### Miscellaneous.

RATTLE.—L. J. BAILEY, Claflin, Kan. In carrying out this invention the inventor makes a rattle-box of a series of plates, interlocked to form a box containing one or more balls. One of these plates is prolonged to form a handle. The other plates are made substantially alike, recessed in one face, providing shoulders near the opposite edges of the plate facing inwardly to overlie and secure the plates which are fitted edgewise thereto.

TOOL FOR PYROGRAPHIC WORK.—Z. N. TYSSOWSKA, Chicago, Ill. In this tool the inventor provides means by which the current of hot gases issuing from the tool may be kept at a high temperature and utilized for burning and scorching purposes in artistic delineation. Means are also provided for projecting the hot gases in a stream and indicating the direction of this stream and concentrating it upon the work.

LIQUID-MEASURE.—H. J. BRANTLEY, Valdosta, Ga., and J. C. BRANTLEY, Marksville, Miss. The intention in this invention is to improve measuring apparatus, especially in that class designed for use in dispensing liquids. The measuring vessel is constructed with a central journal portion and with the reservoir portions on opposite sides of the latter The weight of such vessel and of the reservoir portions are so distributed that the measuring vessel can be easily turned and there will be no twisting strain in the bearing portion of the casing.

FOUNTAIN DRAWING OR RULING PEN.—W. C. PETTEE, New York, N. Y. The instrument invented by Mr. Pettee, has for its object the provision of a new and improved drawing or ruling pen which is simple in construction and arranged to supply ink to the ink-points without the ink unduly drying up. The arrangement permits convenient setting, filling, and cleaning whenever desired.

BROODER.—C. STAAFF, Peapack, N. J. In the operation of this brooder or hover, the heat from a lamp passes into the heating-box along the box at the opposite side and out through a tube. This provides a continuous current of heated air. The air passes into a hood and thence through an opening into a casing, where it is heated by radiation from the heating-box and kept at an even temperature.

MUSIC-HOLDER.—U. C. TERWILLIGER, Islip, N. Y. This invention consists of a simple, light, and practical construction of a holder which is an improvement on that form of music-holder for the use of bandsmen and others which is made in the shape of a pocket with transparent sides, inclosing the music so as to protect it from the weather and yet permit the music to be read through the transparent sides.

CALCULATING DEVICE.—W. T. WILLIAMS, Brooklyn, N. Y. The device contrived by Mr. Williams belongs to that class employed in the solving of problems and known as "calculating devices;" and its aim is to provide one which shall be capable of ready adjustment in a manner to clearly and in a sense instantly present to the mind of the user the result of various arithmetic problems required by the user, and one which shall possess advantages over prior analogous devices.

OIL-CAN.—W. J. DONNELLEY, Victor, Col. This hand oil-can is adapted to the use of machinists and others, and the object of the improvement is to provide such a can as may be readily carried in the pocket and one that is automatically sealed when not in use. It is particularly adapted for using heavy oils.

CYLINDER AND PISTON PACKING.—J. E. DOUGLAS, Birmingham, and G. W. HAYS, Avondale, Ala. The invention provides improvements in the packing of cylinders and pistons. The object is the provision of a simple, economical, durable, and effective packing which can be conveniently applied to pistons in course of construction and to those already in use. It may be used on solid or skeleton pistons or with followers.

COMB.—T. DOUGLAS, New York, N. Y. The object of this invention which relates to improvements in toilet or hair combs, is to provide a comb of simple and inexpensive construction having a liquid holder and distributer, so that while in use water, hair-dye, hair-tonic, or other liquid may be applied to the hair.

WASHING-MACHINE.—G. H. RHODES, Healdsburg, Cal. A peculiar form of drum is employed in this improvement. It is suspended to rock or turn on a transverse axis and the configuration of the drum is designed for throwing the fabrics from one side to the other of the drum and for causing portions of the fabrics which do not come in contact with the drum surfaces to frictionally rub against each other during oscillation of the drum, whereby all portions are cleaned without injury.

TRICK TOY.—J. R. ARMSTRONG, Pittsburg, Pa. The purpose claimed in this trick apparatus is to provide a toy adapted to illustrate the coining of money from blanks and to so construct the device that repeated operations may be successfully performed whereby to seemingly strike up a number of coins from a number of blanks.

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For logging engines. J. S. Mundy, Newark, N. J.

**Inquiry No. 4205.**—For castings and materials for building a one-half horse power dynamo.

Morgan Emery wheels. Box 517, Stroudsburg, Pa.

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

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Blowers and exhausters. Exeter Machine Works, Exeter, N. H.

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

**Inquiry No. 4209.**—For makers of cordage and fabrics of sisal and other coarse vegetable fiber.

Mechanics' Tools and materials. Net price catalogue. Geo. S. Comstock, Mechanicsburg, Pa.

**Inquiry No. 4210.**—For manufacturers of house-boats.

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

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Let me sell your patent. I have buyers waiting. Charles A. Scott, Granite Building, Rochester, N. Y.

**Inquiry No. 4212.**—For makers of spring steel ⅛ inch in width.

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Manufacturers of patent articles, dies, stamping tools, light machinery. Quadriga Manufacturing Company, 18 South Canal Street, Chicago.

**Inquiry No. 4214.**—For manufacturers of voltmeters and ammeters for battery circuits having a scale of 1 to 10 volts or more.

Crude oil burners for heating and cooking. Simple, efficient and cheap. Fully guaranteed. C. F. Jenkins Co., 1103 Harvard Street, Washington, D. C.

**Inquiry No. 4215.**—For manufacturers of Home Savings Boxes.

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**Inquiry No. 4216.**—For manufacturers and inventors of vending machines.

The largest manufacturer in the world of merry-go-rounds, shooting galleries and hand organs. For prices and terms write to C. W. Parker, Abilene, Kan.

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**Inquiry No. 4219.**—For makers of toy savings banks with musical attachment.

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**Inquiry No. 4221.**—For a machine for planing and sanding hardwood floors.

PATENT FOR SALE—Entire right to U. S. and Canada. Automatic screw-holding attachment for screw-drivers. Simple, compact, inexpensive. John A. Yates, Rockport, Ind.

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Manufacturers desired for the manufacture under royalty of valuable U. S. air compressor patents. Invention great success and growing rapidly into large use abroad. Principals only dealt with. Full particulars on application to Box 722, c. o. Judd's, 5 Queen Victoria Street, London, England.

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| Wagon, lumber, O. C. Nickerson | 728,406 |

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|---|---|
| Wagon rack, convertible, I. W. Snow | 728,316 |
| Wall, provisional or permanent, J. Kulhanek | 728,472 |
| Wardrobe, J. O. Clay | 728,673 |
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| Washing machine, O. H. Larson | 728,587 |
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| Waterway, pleasure, H. Roltair | 728,303 |
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| Weather strip, A. J. Kitson | 728,244 |
| Weather strip, Donden & Robb | 728,686 |
| Web roll shaft, F. Meisel | 728,486 |
| Weed exterminator, B. Smith | 728,312 |
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| Weighing machine, coin operated, J. Morgenthan | 728,275 |
| Welt cutting machine, W. B. Arnold | 728,532 |
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| Windmill, W. F. Kerr | 728,468 |
| Windmill, G. S. Lowell | 728,481 |
| Windmill regulator, G. E. Steenrod | 728,513 |
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| Window ventilator, T. T. Doll | 728,447 |
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| Wire strainer, J. Brown | 728,198 |
| Wire stringing apparatus, E. E. Salisbury | 728,768 |
| Wire tightener, G. Robinson | 728,764 |
| Woven fabrics, apparatus for preventing production of reed stripes in, N. & J. Chaize | 728,366 |
| Wrench, J. J. Quinlan | 728,410 |
| Wrench, C. F. Doebler | 728,554 |

## DESIGNS.

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| Cup, R. L. Johnson | 36,330 |
| Dish, covered, R. L. Johnson | 36,331 |
| Hat holder standard, N. Simmer | 36,333 |
| Lamp, gas, A. H. Humphrey | 36,332 |

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| Battery cells, American Hard Rubber Co. | 40,406 |
| Beverages, certain named carbonated, Gruel & Otto | 40,394 |
| Butter, E. J. McBride | 40,386 |
| Candy, P. J. Alexander | 40,382 |
| Canned fruits and vegetables, H. C. Baxter & Bro | 40,390 |
| Canned fruits and vegetables, J. C. Ainsley Packing Co. | 40,391, 40,392 |
| Canned goods, certain named, Acker, Merrall & Condit Co | 40,388 |
| Cement, portland, Sandusky Portland Cement Co | 40,412 |
| Cleansing enamel surfaces, compound for, W. W. Sykes | 40,407 |
| Coats, vests, pants, and overcoats, L. Greif & Bro | 40,376 |
| Corsets, Royal Worcester Corset Co | 40,379 |
| Foods, cereal breakfast, Genesee Pure Food Co | 40,384 |
| Fruits, preserved, Acker, Merrall & Condit Co. | 40,389 |
| Garment supporters, Wheeler & Baldwin | 40,378 |
| Gas generators, acetylene, Monarch Acetylene Gas Co | 40,419 |
| Hair lotions, A. Cornioley | 40,397 |
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| Jelly, Genesee Pure Food Co | 40,383 |
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| Listing and adding machines, combined, Felt & Tarrant Manufacturing Co | 40,417 |
| Lubricants, R. N. Nason & Co | 40,411 |
| Margarin, China Export, Import and Bank Compagnie | 40,385 |
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| Medicine for treatment of certain named diseases of horses, Bradbury Equalizer Co. | 40,402 |
| Packing, machinery, C. A. Daniel | 40,416 |
| Paint and varnish remover, H. K. Sidle | 40,410 |
| Paints, prepared and mixed liquid, Jewell & Vinson | 40,409 |
| Practice apparatus, certain named, Sub Target Gun Co | 40,415 |
| Publication, serial, Francis Brothers | 40,375 |
| Remedies for certain named diseases, Rio Chemical Co | 40,400 |
| Remedies for indigestion, W. B. Nichols | 40,399 |
| Remedy for piles, D. Weeks & Co | 40,401 |
| Ribbons, satin back velvet, Abegg & Rusch | 40,380 |
| Roofing materials, C. B. Jameson | 40,413 |
| Salt, table, Ohio Salt Co | 40,387 |
| Savings boxes, metal, Edmonds-Metzel Manufacturing Co | 40,414 |
| Shirts, J. M. Robinson, Norton & Co | 40,377 |
| Spool cotton, A. King & Co | 40,381 |
| Syrup and carbonated beverage made therefrom, certain named, G. S. Preston | 40,395 |
| Tea, Compressed (Whole Leaf) Tea Syndicate | 40,393 |
| Tobacco, smoking, British-American Tobacco Co. | 40,396 |
| Washing machines, Capt. M. C. Randleman & Sons | 40,418 |
| Washing solution, clothes, J. E. Craig | 40,408 |

## LABELS.

| | |
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| "Flashing Beauty," for canned fish, Acker Merrall & Condit Co | 10,020 |
| "For Your Liver's Sake Podophylets Take," for medicine, M. C. Stephens | 10,012 |
| "Gibson Musical String Co.'s Columbia Brand Steel Strings," for musical strings, Gibson Musical String Co | 10,005 |
| "Gilberts Self Packing Gauge Glass Preserver," for gage glass preservers, R. F. Morse | 10,006 |
| "Harrington's Strictly Pure Extracts, Essences and Preparations," for extracts, essences and preparations, Schlotterbeck & Foss Co | 10,017 |
| "Labor's Choice Whiskey," for whisky, Hamburger Company | 10,016 |
| "Lightning Tapioca," for tapioca, W. S. Hurd | 10,019 |
| "Lilley's Pick Me Up, P. M. U," for medicine, R. M. Lilley, Sr., and R. M. Lilley, Jr. | 10,014 |
| "McNamee's Sanitary Mesh-Knit Underwear," for underwear, J. McNamee | 10,007 |
| "'Nojar' Rubber Heels," for rubber heels, F. W. Whitcher | 10,009 |
| "Ryena," for food product, Battle Creek Ryena Food Co | 10,018 |
| "Star," for snuff, C. J. Bachmann | 10,015 |
| "Sunshine Metal Polish," for metal polish, Sunshine Polish Co | 10,021 |
| "Velvet Rubber Heels," for rubber heels, F. W. Whitcher | 10,010 |
| "Velvet skin cream," for cosmetic, A. F. Wood | 10,011 |
| "Velvet Whole Heels," for rubber heels, F. W. Whitcher | 10,008 |

## PRINTS.

| | |
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| "See The Bottle," for ginger ale, Gosman Ginger Ale Co | 704 |
| "The High Grade Mirror Candies," for candy, Gray Lithograph Co | 703 |

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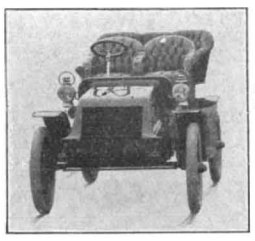

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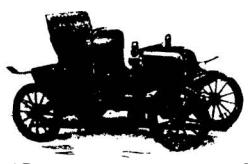

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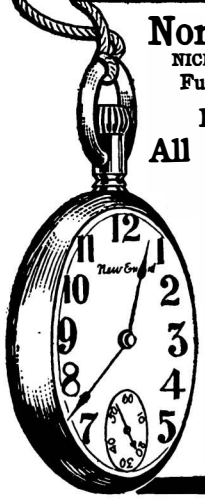

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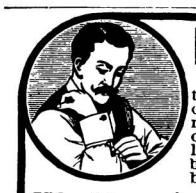

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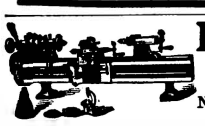

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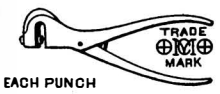


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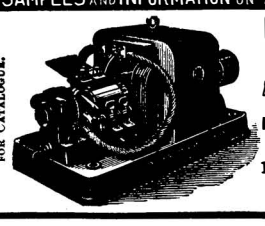

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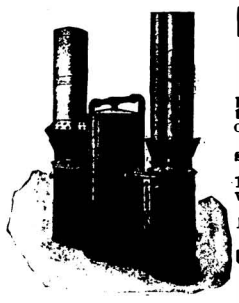

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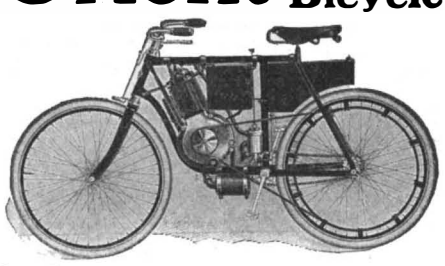

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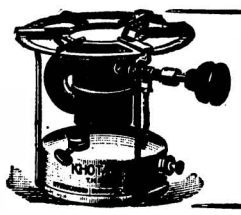

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