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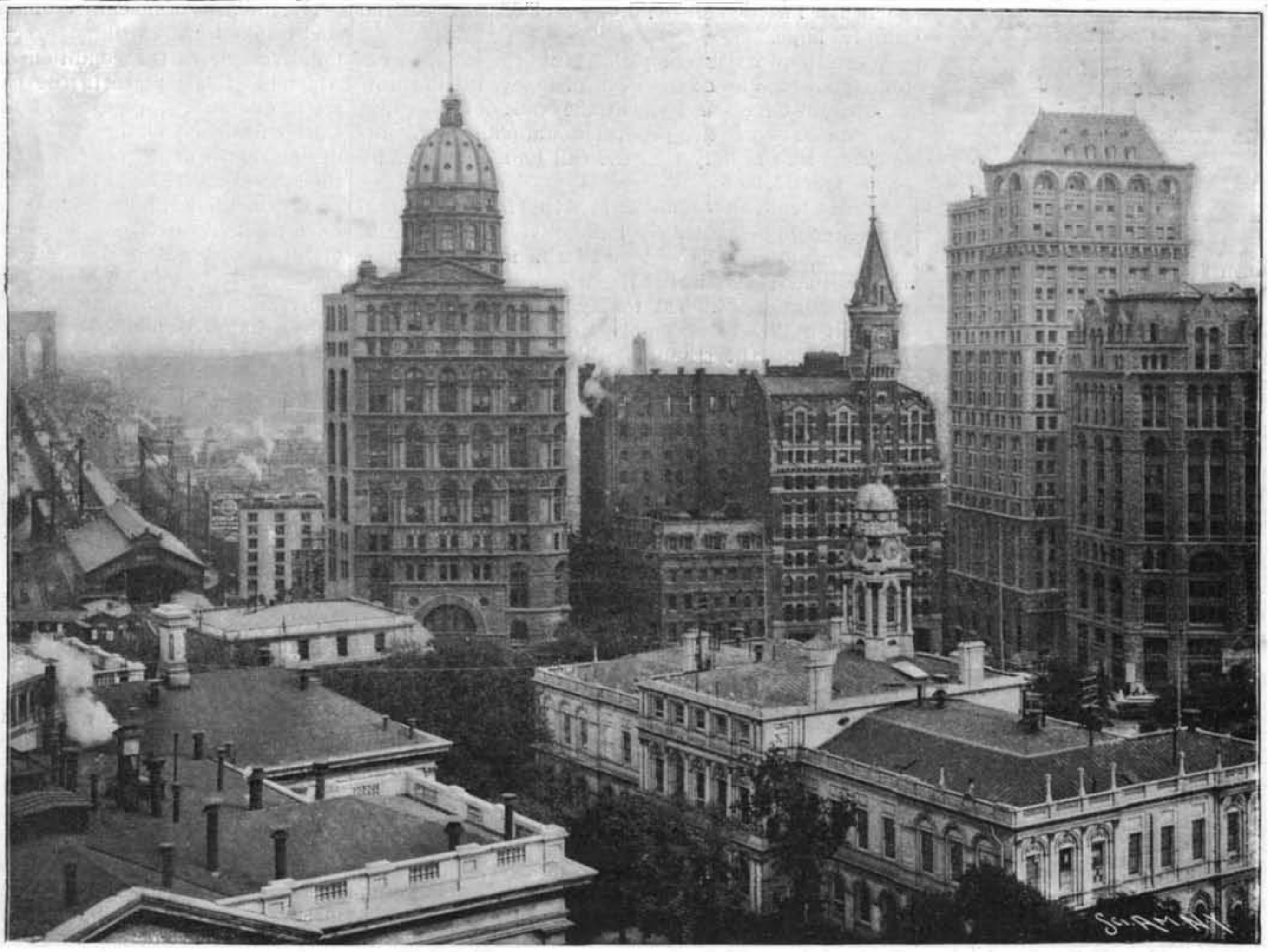
THE LOFTY BUILDINGS OF NEW YORK CITY.

Were it possible for its first settlers to revisit Manhattan Island in these closing years of the nineteenth century, they would find that a transformation had been wrought which, to their wondering eyes, would appear truly magical. The fisherman who was wont to make his landing from the Hudson River at what is now Greenwich Street, or from the East River at Pearl Street, would find that the land had encroached upon the water to such an extent that the area of the triangular lower end of the island had grown to well nigh double its former proportions, a continuous belt of land, from 400 to 700 feet wide, having been reclaimed from the water and covered, like the original soil, with the towering buildings of a great metropolis.

We have already, in a recent issue, shown how great has been the increase in the area of this section of Manhattan Island as the result of the extension of its bulkhead lines far beyond the natural boundaries of the river. In the present article we shall show how the capacity of the same district to provide for the vast business interests which center within it is being further increased by carrying its buildings up to unprecedented heights above the street level.

It is safe to say that there is no (Continued on page 285.)



Brooklyn Bridge. Court House. World Building. Sun Building. Tribune Building. American Tract Building. Times Building.

VIEW OF THE CITY HALL AND THE NEWSPAPER BUILDINGS ON PRINTING HOUSE SQUARE.

World, 294 ft. Surety, 312 ft. Trinity Church, 286 ft. Park Row, 386 ft. Tract Society, 290 ft. St. Paul, 307 ft. Sun, 70 ft. Capitol, 287¼ ft.

THE TALL BUILDING PROBLEM IN NEW YORK.

THE LOFTY BUILDINGS OF NEW YORK CITY.

(Continued from first page.)

center of business in any of the great cities of the world which is so shut in by the natural conditions of the site upon which it is built as the southern end of New York City, lying between the City Hall Park and the Battery. This was the original city; and the location within it of the Custom House and the City Hall, and the Treasury, with its inevitable concentration of banks, brokers' offices and insurance houses, has enabled this locality to maintain its standing to this day as the most important commercial center of the whole city. In comparison with the magnitude of the interests which are represented within its borders, its area is exceedingly small, even if we include the belt of artificial ground above mentioned; and as a consequence there has been an appreciation in the value of land for which no parallel can be found in any city of the world. The greatest increase, as was to have been expected, has taken place upon property which fronts upon Broadway or that lies within the banking district in the neighborhood of Wall, Pine, and Nassau Streets and Park Row. As instances of this it may be mentioned that the lot upon which the Manhattan Life Insurance building stands was purchased for $157.02 per square foot; that No. 141 Broadway cost $181.12 per square foot; and that before they could even dig the foundations for the Surety building the syndicate had to pay for the site at the rate of from $176 to $282 per square foot. Now it is a matter of very simple arithmetic to prove that at the ordinary rate of office rentals it would require in the case of the Surety building the erection of a structure many stories in height to pay merely the interest on this enormous land value; that above this building must be raised another lofty stretch of stories to pay the interest on another vast sum representing the cost of the building itself; and that above this again must be other stories, whose rental shall go to pay for the operating expenses, such as lighting, heating, water supply, sanitation and repairs, not to mention insurance and taxes. Whatever further additions it may be possible to pile up above this level may be looked to for the future profits of the undertaking.

From these considerations it is evident that the raison d'être of the lofty office building—at least in New York—is to be found in the enormous appreciation in land values; while this, in turn, is mainly due to the concentration of vast commercial interests within a restricted area. At the same time it is certain that, in regard to the relation of land values to the height of buildings, the effect has, in some measure, become the cause. The system of steel construction, which has quadrupled the size of building which it was formerly possible to erect upon a given area, has assisted to raise the value of land to its present high figure, and give it a value which it would not otherwise possess.

The accompanying diagram has been prepared with the object of showing the extent of what might be called the vertical growth of the lower city during the past few years. It covers all that part of New York bounded by Duane Street and the Battery and the East and Hudson Rivers, and it includes all the structures built or building which are above seven stories in height. The areas at the various levels are estimated upon the basis of the lot dimensions; and it is to be understood that no deductions have been made for court areas. Where the upper stories do not cover the whole building, as in the case of those buildings possessing towers, the area is calculated accordingly. The height of a building in stories is estimated by the number of bona fide office floors, even if they are included in a tower above the main body of the building. Thus the new building in course of erection on Park Row is put down as twenty-nine stories in height; since the twenty-eighth and twenty-ninth stories in the two towers are contained within masonry walls, and are commodious rooms, measuring some 22 feet each way.

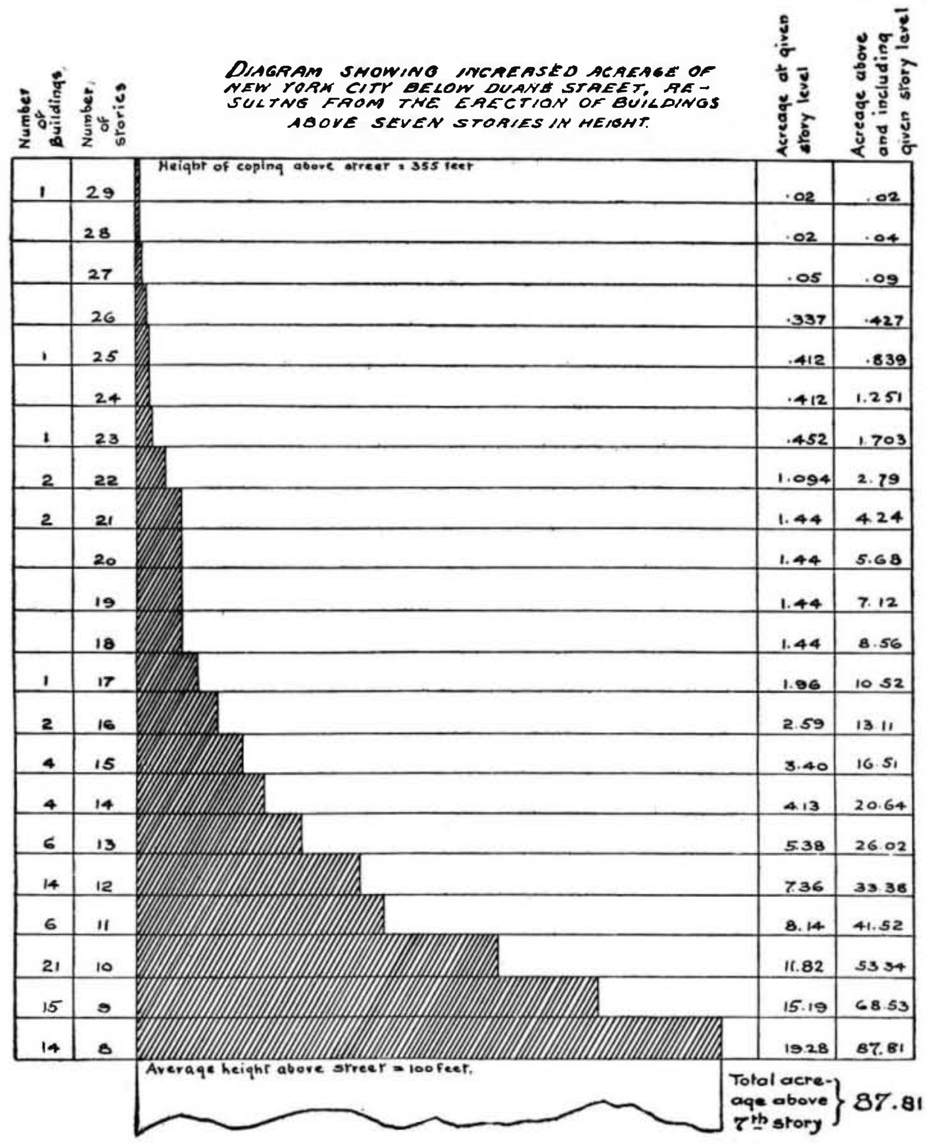
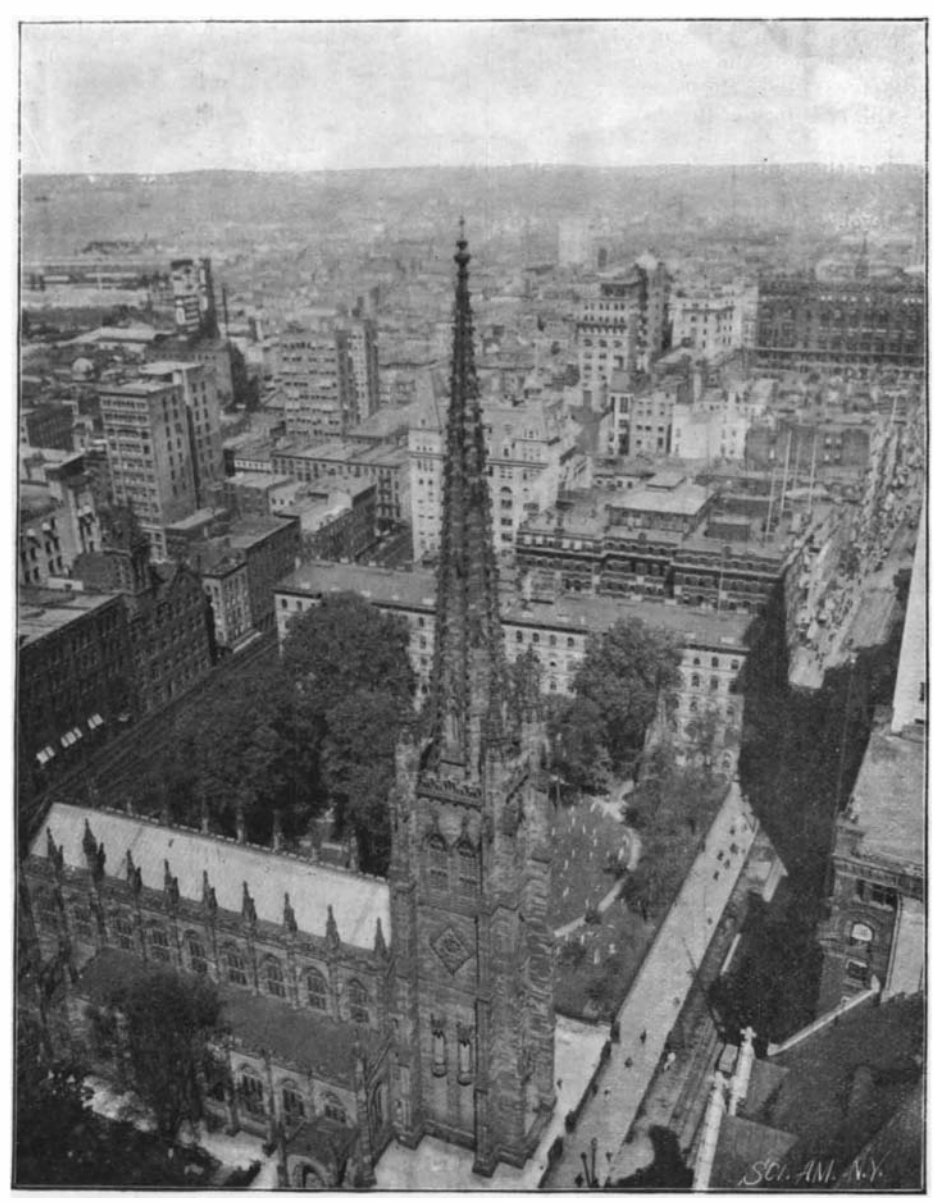


DIAGRAM SHOWING THE AREA, NUMBER, AND HEIGHT OF TALL BUILDINGS IN LOWER NEW YORK.

The first two columns of the diagram show the number of buildings of any given number of stories in height. The shaded portion and the third column show the areas for all the buildings at any given story level, and the last column gives the total area above and including any given story level. Thus there are in the district in question fourteen twelve story buildings, the aggregate area of whose twelfth

The St. Paul Building on the site of the old Herald Building. Height, 25 stories, 307 feet.



Bird's eye view of Trinity Church and vicinity from Manhattan Life Building

THE TALL BUILDING PROBLEM IN NEW YORK.

floors is 7·36 acres. This added to the total area of all floors above the twelfth, in buildings over twelve stories high, gives 33·38 acres as the total area above and including the twelfth story level. We thus arrive at a final estimate based on lot areas of 87·81 acres, as representing the total floor space added to the city in this district by carrying up these ninety-four buildings beyond the seventh story level. Their average height is 10·7 stories, and if we take 5 stories, which is the basis commonly used by real estate agents in New York City, as being the average height of the buildings which were put up fifteen to twenty years ago, we find that the ninety-four buildings in question represent a clear gain of 5·7 stories to the city, the capacity of the 19·28 acres upon which they stand being thus more than doubled. To put it in another way, it may be said that there has been already an addition of nearly 20 acres of ground area to the city as the result of the modern system of construction.

It may be remarked in passing that while the remarkable building activity of the past three years has been due to the concentration of business, to the facilities offered by the modern system of construction, and to the fear of legislation restricting the height of buildings, it is largely owing to the fact that capital has sought this form of investment, because of the uncertainty affecting investments in such of the Western States as have enacted laws hostile to capital, or which have been dominated by the theories of the Populists.

MAP SHOWING LOCATION OF TALL BUILDINGS IN LOWER NEW YORK.

Of the scenes chosen for illustration, perhaps the most familiar will be that which includes the City Hall and the adjacent buildings, in which some of the leading daily journals make their homes. Respectively to the right and left of the picture are the Times and the World buildings, which are good examples of the earlier lofty buildings of composite construction. The small building on the corner opposite the World is the home of the New York Sun, and adjoining it is the Tribune building. At the time of its erection, twenty years ago, this was the architectural wonder of the day.

The thickness of the lower walls shows us that the limits of economical height for a structure of solid masonry had been reached in this building. To the rear of and dominating the Times building is the handsome new structure known as the American Tract building.

The main structure is twenty stories high, the top cornice being 244 feet above the sidewalk. Above this is a block of three stories, which covers the western end of the building, the ceiling of the twenty-third story being 272 feet above the street level. The approximate weight of steel columns and girders in this structure is 2,800 tons.

Another of our views is taken from the west side of Broadway, opposite the Post Office, looking south. The unfinished structure at the corner of Broadway and Ann Street is the St. Paul building, 25 stories in height. The foundations extend 31 feet below the street, and the coping will be 307 feet above the same level. The total combined dead and live load of the whole building will be 19,859 tons, and this will be carried upon a lot whose area is only 5,778 square feet. The foundation consists of an unbroken layer of 12 inches of concrete, with footings of steel grillage.

About a quarter of a mile further down Broadway is seen the towering mass of the Surety building, which from a base about 83 feet square towers up 312 feet above the street level. It is 21 stories high. The caisson foundations extend to the rock, 72 feet below street level, the whole structure from base to summit measuring 384 feet. There are 3,500 tons of steel in the superstructure alone.

The most notable building now in course of construction is being erected on Park Row. It will cover an area of nearly 15,000 square feet, and in no part will it be less than 25 stories in height. The front facing the Post Office building will be 27 stories in height, the top cornice being 336 feet above the street level. The two flanking towers will each contain two stories to be used as offices, the cornice of the towers being 355 feet above the street and the top of the lantern 386 feet above the same level. The foundations will extend 34 feet below street level, making the total height of the structure from top of piles to top of lantern 420 feet. The foundation will consist of piling capped with 10 inches of granite bedded in cement. Upon this will be 4 feet 9 inches of brickwork, stepped up to a granite capping. Upon this will be placed a grillage of steel I beams and a series of huge box girders, some of them 8 feet deep, for distributing the pressure of the columns evenly to the brickwork. The largest of these girders weighs 55 tons. The approximate weight of steel in the building will be 9,000 tons; the total dead and live load will be about 50,000 tons, distributed upon some 4,000 piles.

To those of our readers who may not have visited this city since the era of tall buildings has set in, the most impressive view of all will be that in which the spire of Trinity Church figures in the foreground. The photograph was taken from the top of the Manhattan Life Insurance building, at an elevation of over 300 feet above the Broadway curb. Trinity Church spire, 288 feet high, was for many a decade the tallest landmark in or around New York; but now the visitor to the city can look down upon its cross from a point many feet above it.

Although the tall building is serving to multiply the number of business interests which can be accommodated within the area of the lower city, it is bringing with it many serious drawbacks which render its all around utility very doubtful. A startling evidence of this is seen in the dark shadow cast across Broadway and over the whole face of the five story building on the western side of the street by the twenty-one story Surety building, whose white wall can just be seen on the right side of the illustration. The smaller shadow is cast by the eight story building adjoining it. Broadway, actually a fine thoroughfare, if it be flanked by many more of these giant walls of steel and stone, will ultimately become a narrow canyon from which sunlight and air will be all but "quite shut out."

Electrical Hardening of Steel.

A French technical journal announces a new invention in the field of electrical metallurgy, says the Electrical Review. It is a process which will give an extraordinary hardness to steel. It is reported that the inventor, a Mr. Taux, has executed the following experiments before a committee of engineers at Strasburg. A drill hardened by electricity pierced a shell twice as quick as a drill of the best steel hardened in the ordinary way. The drill was closely examined afterward by means of a strong microscope and not the least injury could be discovered. An electrically hardened circular saw cut iron bars with surprising ease. With a cold chisel similarly treated a steel bar, one by one-half inch, was cut through and the operation was repeated five times on the same bar. Then a cast steel plate, one-quarter inch thick, was cut with the chisel, the edge of which showed neither a fissure nor any other alteration afterward. An electrically hardened table knife cut iron wire of one-eighth inch diameter just as easy as cotton string. The process is said to consist in the hardening of the red hot steel objects in a conductive bath traversed by an electric current. If these tests should confirmed by further practical experiences, the consequences would be of the greatest importance for the manufacture of tools.

Improved Method of Electro-Plating.

According to the London Standard, an invention which promises to be of great importance to the electro-plating trade has been brought out by Messrs. A. S. Smith & Sons, Walsall. Hitherto articles on which a deposit of metal is desired have had to be suspended in the electrolyte by means of wires, and after remaining in the solution for a stated time they have been taken out in a dull or unpolished condition, and subjected to another process for polishing or burnishing them. By this invention, it is claimed, wiring is done away with, and no "moppers" (polishers) are required. What this means as a saving in the cost of plating any practical plater will understand. In addition to this, it is stated, three to four times the amount of work can be turned out in the same time as heretofore.

The system, we understand, has been in operation in Messrs. Smith & Sons' workshop for the last seven or eight months. One important advantage is that no interference with the existing arrangements of vats, solutions, or dynamos is involved. All that is required extra is shafting to be placed over the vats, for the purpose of supplying motive power. The process is not suitable for the plating of such articles as teapots, trays, art work, and the like; but as regards seventy-five per cent of all platable articles, we are informed, whether the deposition required is of nickel, copper, brass, tin, or zinc, a perfectly bright and lustrous surface is given, with a thicker, more malleable, and more lasting deposit than heretofore by means of the apparatus in question.

The articles are placed in large quantities in a revolving hollow container—theoretically there is no limit to the quantity, but practically it may be found advisable not to have more than 90 or 100 pounds at a time—and this container is suspended or supported within the electrolytic bath, and during the time the deposition is taking place is subjected to a rotary movement varying from fifteen to fifty revolutions per minute. The container, which is mounted centrally upon a long insulated metal sleeve, is made of non-conducting material, and its walls are perforated in such a way as to allow the fluid to circulate freely through it, and to act upon the work contained therein. The sleeve, with the container carried by it, is fixed to a central metal rod or box, supported by metallic bearing brackets clothed in wood or other suitable insulating material and fitted at equidistant points in its length with copper contact arms. These latter are mounted in such a manner as to always be in intimate contact with the articles placed in the container, acting as channels for the passage of the electric current to the negative pole of the generator.

The anodes (or positive terminals) are slung upon their supporting rods around the inside walls of the vat in the ordinary manner, or in rows to get more anode surface, as the case may require, so that there is nothing in the interior of the container to interfere with the continued rolling movement of the articles placed therein. The electric current is sent through the solution and back to the generator by means of the articles being plated (the cathodes) through the contact arms or their equivalents, and thence through the sleeve and the insulated rod or bar to the negative pole of the generator. Messrs. Smith do not claim for the invention that it does away with the processes preparatory to ordinary plating. To get good results, the work has to be prepared at least as carefully as it used to be under the old system, and the more careful this preparation, the better are the results.

PERSONS who have catarrh or who easily catch "catarrh cold" find immediate and permanent relief by snuffing a little lukewarm water into the nostrils every morning after rising, first cleansing them thoroughly by blowing the nose. The water may be held in the palm of the hand and thus applied to the nostrils. During an attack of cold in the head this method of treatment will be found very effective. A little salt added to the water is very good, and a drop of carbolic acid is also recommended, but must be used cautiously.

DR. CARL PETERS, the explorer, is said to have left Germany for good and to have left directions to have all his affairs there wound up, since the sentence of Herr Schroder, the East African administrator, to fifteen years' imprisonment at hard labor for brutality to the natives.

Headaches of Different Kinds.*

No more frequent ailment of a nervous character presents itself for treatment to the refractionist than cephalalgia or headache. The sufferers from this affliction are everywhere. Subjects of chronic headache have often inherited the tendency and are of a highly nervous temperament. They have tried all kinds of treatment, sometimes with partial relief, but never with permanent benefit, because the underlying cause of the trouble has not been removed. Hence, on slight excuse, the old trouble has returned.

Headache is of various kinds, according to the exciting cause. Thus there are catarrhal, gastric, and nervous headaches; and again, some headaches are caused by tumors of the brain. In most cases the seat of the pain is in the scalp, or the occipito-frontalis muscle, which lies just beneath the scalp. For this reason pressure or hot or cold applications give temporary relief. In no case, however, is the trouble local, except when there is intracranial disease. The pain is always of a reflex character, and we must look to a point more or less remote for its origin. Again, in those cases where the trouble frequently recurs, there is, besides the direct exciting cause, some deeper seated predisposing agency. Anything which reduces the reserve nervous power to such an extent that it is insufficient for an emergency may be the underlying cause of headache. Rectal disease, female complaints, secret vice, and a score of lesser evils act in the manner indicated. There is, however, no more frequent source of nerve waste than that which comes from some defect in the refraction, accommodation, or convergence of the eyes. The organs of sight are in constant use, adapting themselves instantly to every change of position and distance of the object looked at.

If an eye is defective anatomically—too short from before-backward, as in far-sightedness (hypermetropia), too long, as in near-sightedness (myopia), with an irregular curvature of the cornea, as in astigmatism, or if the two eyes are not evenly balanced in muscular development (heteraphoria), we have in such cases a causative factor of headaches which is permanent, is usually inherited, and is a constant source of waste of nerve power, and the removal of which in ninety-six cases out of a hundred has been found to relieve a coexisting chronic headache. Hence, from practical results, we are warranted in saying that every case of headache should apply to the skillful refractionist, before wasting time and money and nerve power in seeking relief with medicine. Our present civilization and school system have a marked influence in producing and perpetuating neuropathic tendencies. The close room into which threescore children are packed at the period of physical development, the close application to books which is expected of them, the defective light, the bending position which from very weariness they assume, and the incentive to stand at the head of their class to which neurasthenic children always respond, are potent factors in producing eye strain and its many reflex disorders. It is to this period of youth that most sufferers with chronic headache can point as the time at which their trouble began.

Symptoms.—Pain in temples, over eyes, and at the back of the head, rarely on top. Paroxysmal, either at regular intervals, or after some especial excitement, care, work, or strain. In women there is often great pain at the seventh cervical vertebra at the base of neck and also at the lower point of shoulder blade or scapula. Others have pain between the two scapulae or in the lower part of the back. In men the pain is in the occipital muscle, and is spoken of as if at the "base of the brain."

Chronic headaches cause a feeling of lassitude, incapacitating the person for mental labor and often causing them to exclaim: "I fear I am going insane."

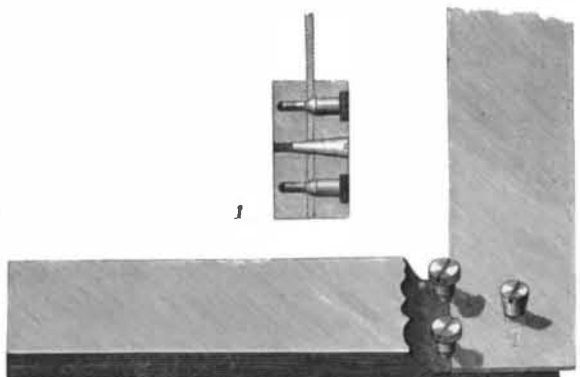
Migraine, or sick headache, is a more severe form of the trouble and recurs with great frequency. The eyes become painful, especially when turned quickly or pressed upon. There is often dimness of vision, glimmering or even momentary vanishing of sight, so that the patient speaks of the attacks as "blind headaches." The torture usually reaches the point where the patient must go to bed in a room protected from light, noise, or a draught of air, which sometimes become unendurable. Occasionally the pain is so intense as to draw the head backward between the shoulders, and it may result in total nervous prostration for the time being. Temporary relief is at times obtained from traveling, from medicine, or from prolonged rest. After years of suffering, the form of the disorder may change to a neuralgia, asthma, or other ailment, but this is not a cure. Nothing will cure the affection permanently until the underlying cause is removed. Unlike ordinary headache, migraine does not so often yield to refractive correction, because it is more often due to a muscular heteraphoria and can only be cured with higher prisms or by a tenotomy.

IT is proposed to erect a monument over the grave of the electrical discoverer, Georg Simon Ohm. Subscriptions will be received by the Königliche Filiabank, Munich.

* By E. T. Allen, M.D., Ph.D., editor of the American Jeweler.

AN ADJUSTABLE SQUARE.

Nothing can produce more vexation and unnecessary labor in mechanics than the use of a square which, through some accident or defect in manufacture, is slightly out of truth. Its effects are cumulative and it compels the workman to perform his work by the cut and try method, which belongs to the past. Our engraving shows a square devised and made by Mr. D. H. Dugar, a mechanician of the Watertown Arsenal. This square has a blade pivoted on a conical screw and adjusted by two conical screws inserted in the heavy part of the square and bearing against the inner edge of the blade, as shown in Fig. 2, in which a portion of the square is broken away to more clearly show the construction. By slightly turning in one of these screws



AN ADJUSTABLE SQUARE.

and unscrewing the other the blade may be adjusted as desired, and when so adjusted it is securely clamped by the pivotal screw.

A NEW BALL BEARING INSPECTION CAR.

At the recent roadmasters' convention at Niagara Falls the Railway Cycle Manufacturing Company, of Hagerstown, Ind., exhibited two of their Hartley and Teeter inspection cars. A novel experiment was tried with one of them on the famous Gorge road. The car was run down the steep incline to the cantilever bridge and back. Our engraving shows the general appearance of the double seated inspection car. Ball bearings are used, the car being provided with a self-contained bearing case which covers the axle. In this case are placed the ball bearings, composed of two parts. All side strains caused by the weight of the rider are thrown upon the bearing case and do not bind upon the bearings or the axle. The axle itself is independent of the frame and can be removed by loosening the set screws

THE NEW HARTLEY & TEETER BALL BEARING INSPECTION CAR.

on the sprocket wheel and removing one nut. The car is light, but is exceedingly practical and durable.

How to Prepare Calcium Tungstate for X Ray Screens.

BY C. E. TENNANT, M.D.

As the readers of the Electrical Engineer may be interested in the subject, I give the results of my recent experiments with the calcium tungstate. I find that the compound made after this manner gives the most satisfactory results of any fluorescent substance now known, especially on large screens, the size of the body, and these screens can be made for a price not to exceed 25 cents each, by any novice.

The spreading of the calcium tungstate evenly over the surface offers the greatest difficulty, but with a little practice can be readily overcome.

To two parts of sodium tungstate add one part of calcium chloride; fuse the mass to a red heat. A resulting compound of calcium tungstate and sodium chloride is formed. This latter salt exerts active hydroscopic properties and, as a result, renders the calcium tungstate quite negative to the X rays. But immersing the fused mass in water for an interval of forty-eight hours disposes of the salt, as well known by its property of solubility, while the insoluble calcium tungstate remains a precipitate. This latter is now separated by filtration, and when dry assumes a crystalline formation and is very sensitive to the X rays.

An amorphous preparation of calcium tungstate may be obtained by adding a saturated solution of sodium tungstate to a solution of calcium chloride, which results in the precipitation of the calcium tungstate, but this amorphous crystalline form is absolutely worthless for use with the X rays.—The Electrical Engineer.

The Amount of Water in the Earth's Crust.

In order to ascertain the amount of mechanically contained water in the earth's crust, I recently made the following computation, says W. B. Greenlee, of Ithaca, N. Y., in the American Geologist.

I considered it safe to assume that the crust of the earth is filled with water and that the maximum porosity of rocks which can be obtained in the laboratory, though not the greatest possible porosity, is less than that of the crust of the earth for a distance of one mile from the surface.

One mile is taken as an approximate thickness, since that seems to be a fair average of the thickness of sedimentary rocks over the surface of the earth.

Assuming, then, that the earth is saturated with water to the depth of one mile, we have next to determine the relative amounts of its constituent rocks and their respective porosities.

The surface of the earth may be divided into two divisions, first, that covered with sedimentary rocks, and, second, that covered with igneous and metamorphic rocks. To ascertain the relative areas, the United States and Europe were selected as typical of the land surface. The United States was divided into three regions: (1) that east of the Mississippi River; (2) that between the Mississippi and Colorado; and (3) that between Colorado and the Pacific. The first region was divided as to the relative amounts in each State and the results added. The central region was bulked as sedimentary rocks, and the western region was called half sedimentary and half igneous and metamorphic. The results showed that 31·2 per cent of the surface of the United States is covered with igneous and metamorphic rocks.

In Europe each country was separately divided and the percentage of the respective sums taken. This proved to be 19·8 per cent. An average of these results, by coincidence, is 25·5 per cent, or, roughly speaking, three-fourths of the land surface of the earth is covered with sedimentary rocks having an average thickness of one mile.

Difficulty was encountered in ascertaining an average porosity. Sections were taken in various parts of this country, notably the 127,000 feet generalized section of the Rocky Mountains, a generalized section through New York, Pennsylvania and Ohio by various authorities and Fairchild's section at Rochester, N. Y. A mean and average rock would appear to be a fine-grained sandstone or limestone.

The most accurate determination of the porosities of rocks has been made by Prof. Bauschinger, of Munich. He found the average porosity of upward of 300 specimens of sandstones and limestones to be 20 per cent of their volumes. Two per cent may be taken as a low average for igneous and metamorphic rocks.

The most recent and careful computation of the respective areas of sea and land on the earth's surface is that by M. Thoulet in his "Oceanographie." This he gives as 368,000,000 kilog. for the sea and 142,000,000 kilog. for the land, or, reduced to square miles, 142,084,860 and 54,826,200 respectively. Three-fourths of the land is 41,119,650 square miles and one-fourth 13,706,550 square miles. Taking 20 per cent of the former and 2 per cent of the latter and adding we get 8,498,061 cubic miles of water.

Thoulet estimates the volume of the oceans at 1,347,874,850 cubic kilometers, which, reduced to English measure, equals 318,191,728 cubic miles.

The estimated amount of mechanically contained water in a section of a mile over that part of the earth's crust covered by land is thus 2·7 per cent of the water now on the earth's surface, or a layer 88 feet deep over its entire surface.

There is undoubtedly a large amount of water below one mile, but we can only conjecture as to the amount, nor does this estimate include that chemically contained. No estimate was made of the amount of water beneath the bed of the ocean, as we have no way of knowing of what it is composed or how thick the permeable layer is. This, too, would increase the total.

IF castor oil is applied to a wart once a day for a month the wart will entirely disappear. In many cases it will not require so long a time.