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THE CLOCK TOWER AT DELHI, INDIA.

The city of Delhi is one of the oldest in all the provinces of Hindostan, and the sanguinary fighting under its walls in the days of the Sepoy mutiny, is still fresh in the memory of most of our readers. Since the establishment of a large depot of the East Indian Railway there, many improvements in the streets and buildings of the ancient city have been made. Of these additions, the most noticeable from a distance is the new clock tower, which stands in the center of the Chandnee Chowk, opposite the town hall. Of this a photograph is given in "Professional Papers of Indian Engineering," and from the London *Builder* we extract the accompanying engraving.

This building is erected on an appropriate site at the crossing of four streets, and stands 110 feet high, exclusive of the gilt vane and finial. The lowest story is about 20 feet square externally. The materials used in its construction are brick, red and yellow sandstone, and white marble. The capitals surmounting the main corner pillars are 4 feet 2 inches wide at top, and 4 feet 6 inches deep; they are carved out of solid blocks of white sandstone, and each of them weighs about two tuns.

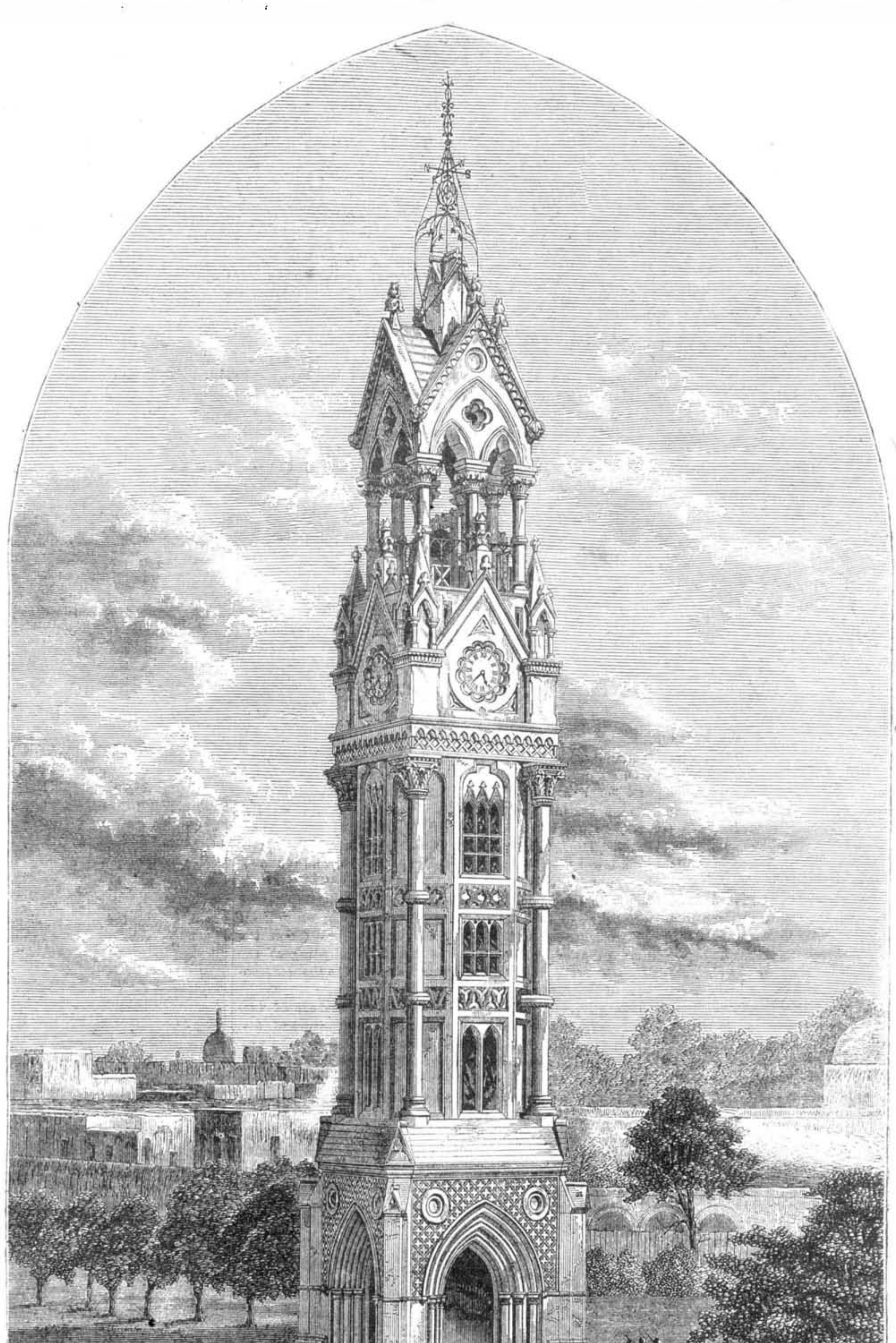
The dials of the clock are sufficiently elevated to be visible from the East Indian Railway station, and from other prominent points in the city. The clock is constructed to work five bells, placed in the open canopy above it; these give out a different peal for each quarter, the largest bell striking the hours.

The building was completed in 18 months, at a cost, including clock and bells, of $14,000, the whole of which amount was provided from the municipal funds of Delhi.

The tower was designed and built by Mr. E. J. Martin, Executive Engineer of the Rajpootana State Railway.

Railways without Switches, Turnouts, or Crossings.

Mr. Charles Jordan, Newport, England, proposes to stop one extensive source of railway accidents in what is certainly a thorough manner. He proposes to make the up and down main lines without the usual switches, turnouts, and crossings, the lines being continuous from end to end, and to work such road by transferring a train or trains at stations, or where shunting is necessary, or at junctions with other railways, from the main line to the adjacent siding, by lifting the train bodily from one line to the other. The lifting will only be an inch or two, and the hydraulic apparatus as now constructed will make nothing of the weight, while as to time, Mr. Jordan calculates that a few minutes will suffice to transfer a train from one road to another without disturbing a single passenger. The whole work of a station, as regards the hydraulic apparatus, may be done by one, or, at large stations, two lads. The time saved in switching will be very great, and the risk of collision reduced.



TOWER AND CLOCK AT DELHI, INDIA.

Reproduction of Photo-Negatives.

The sensitive compound I have hitherto employed for coating the plates is made up of dextrin, 4 grammes; ordinary white sugar, 5 grammes; bichromate of ammonia, 2 grammes; water, 100 grammes; glycerin, according to the condition of the atmosphere, 2 to 8 drops.

A new, well cleaned, patent plate is coated with the sensitive chromium solution; and after the superfluous liquid has been allowed to flow off at one of the corners, the plate is dried in the dark by being placed upon a lithographic stone or metal plate, a period of ten minutes being sufficient for the purpose, with a temperature of 120° to 160° Fah.

The film being perfectly dry, the plate, still warm, is put under a negative and printed in the shade for ten or fifteen minutes. As soon as it comes out of the printing frame the plate is again slightly warmed; the brush is dipped into the graphite and applied over the surface of the image, which should be just slightly visible. The application of the powder is carried on in a shaded corner of an ordinary room illuminated by daylight. You must not press hardly upon the film with the brush, but move the same over the surface as lightly as possible; nor will it do to hurry the operation.

In proportion as the film cools so the image appears. By carefully breathing or, better still, blowing upon the film, you will be able to accelerate the process, and when the picture has attained sufficient vigor you take off the superfluous graphite powder with a clean brush.

A normal collodion is now applied; such as I use is composed of: Alcohol, 500 parts; ether, 500 parts; pyroxyline, 15 to 20 parts.

When this film has set and hardened, the margins are cut round with a knife, and the plate put into a porcelain dish of cold water. In three minutes the picture will be free from the glass, and the film may be employed in this position or reversed with a soft brush, and taken out of the water adhering either to the same glass plate or to another. A gentle stream of water falling upon the film will remove any chromium salts still remaining in it, and will also press down the loose film uniformly upon the glass surface. Finally, the plate is allowed to dry in a perpendicular position. Further treatment of the plate with varnish follows as a matter of course.

The image upon the collodion film is very thin; but you need be under no apprehension of its tearing while in the water, when it may be easily manipulated. I have to do with films of this kind measuring three feet square.—*J. B. Obernetter.*

NEW ANTIDOTE FOR ARSENIC.—The only antidote for arsenic heretofore known has been hydrated peroxide of iron, which must be freshly made by mixing carbonate of soda or potash with a solution of either sulphate (copperas) of iron or muriate. A French experimenter, M. Carl, says that sugar mixed with magnesia serves as an antidote for arsenious acid.

IN Europe the multiplication of photo prints is extensively done by mechanical means, with printing ink, and the copies, equal or superior to silver prints, are supplied at half the cost of the latter.

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Contents:

(Illustrated articles are marked with an asterisk.)

THE END OF VOLUME XXX.

The thirtieth volume of the present series of the SCIENTIFIC AMERICAN closes with the present issue, and, completed, joins its predecessors as another milestone, recording the progress made by mankind in the path of Science during the six months which have just passed. It is hardly necessary to point out that, in the pages now finished, it has been our endeavor, as it will be in those to come, to popularize scientific knowledge, and to make the same generally available to the masses; not aiming to supply information valuable alone to the engineer, to the chemist, or indeed exclusively to any profession or calling, but rather to glean from the whole broad field of Science and Art the richest sheaves of genius, and to present, winnowed therefrom, the kernels of wisdom, unmixed with the chaff of technicality and abstruseness. That such a course has met the public approval, our increasing circulation and the many letters of which we are constantly in receipt, offering us pleasant wishes of encouragement, are the best and most flattering evidence.

In glancing back over the contents of the past volume, we feel that we may confidently assert that in no other periodical now extant is there to be found a wider range of topics, treated in popular and readable form, the perusal of which will add more largely to the stock of valuable knowledge of any reader.

In the pages now closed we have presented 258 illustrated subjects, in many cases with not merely a single cut, but with a series of engravings. These embrace the most recent mechanical inventions, patented in this country and abroad—new steam engines and boilers—new weapons of war—new tools for every variety of industrial employment—new household implements—new machinery of every kind for especial purposes—illustrations of new scientific experiments—views of new buildings, bridges, and monuments—pictures of rare and new plants, fossils, and animals—of queer freaks of Nature in the animal and mineral world—lucid diagrams, explanatory of mathematical demonstrations, and new theories of natural phenomena.

As for miscellaneous information, we would refer the reader to the columns of fine type, attached to this number, which form the index, in order to gain an idea of the number and variety of the matters he has examined.

No great discoveries have been made during the past six months; but the progress of Science has been uniform, and stopping, as we now do, for a momentary breathing spell, we can look back and see a notable advance. Professor Thurston has sent us a large amount of important and valuable news regarding the behavior of metals under stress, and how to test them—facts of the liveliest interest to every engineer and mechanic. Professor Orton has continued his letters, telling us about the little known resources of Central South America. In astronomy, we have presented our monthly notes, regarding positions of planets, times of phenomena, etc.; abstracts of Professor Proctor's excellent lectures during his late visit to this country, and also an account of Professor Wright's discovery of the cause of the zodiacal light. We have also noted the discovery of new planets and comets, announced the donation of $700,000 by Mr. James Lick, of San Francisco, for a gigantic telescope, and illustrated an ingenious plan for the manufacture of that great instrument, the device of Mr. Daniel Chapman. Our abstracts from the proceedings of the British Association, the French Academy of Sciences, and our own scientific associations, have been very full and accurate, while reducing the new topics discussed for ready comprehension by every one. Engineering subjects have been so extensively treated that it is hardly possible to particularize. We have illustrated the 1,000 foot tower proposed for the coming centennial, called attention to new processes of tunnel boring, bridge building, and railroad construction, mentioned some important works in hydraulic engineering in the West, and, in a multiplicity of articles from the pens of expert writers, considered topics of a timely and lively interest to the profession. Chemical matters have received their full share of attention, and so also the important subjects of electricity and magnetism, in which notable advances have been made.

With the end of this volume many subscriptions expire, which we hope to see speedily renewed. In accordance with our rule, the paper is not sent after the subscribed-for term has expired; so that those who have failed to remark the notice on the wrappers of the copies received lately will be warned, by the cessation of our visits, that the time has come for them once more to express their appreciation of our efforts by sending us their substantial support.

HOW TO ATTAIN HIGH TEMPERATURES.

In his recent interesting address before the *Société des Ingénieurs Civils*, M. Jordan spoke at some length of the methods now adopted of attaining high temperatures in metallurgical operations, and of the bearing of chemical principles and recent discoveries upon the subject. The learned engineer speaks of the "duel," as he terms it, between the fire on the one hand and the refractory materials used in the arts on the other, and recognizes the serious difficulties which impede the effort to utilize high temperatures, when it is possible to attain them.

The Siemens regenerative furnace and its modifications represent the most successful means yet in general use for producing extremely high temperatures, and the difficulty most frequently met is that of finding fire brick or other material capable of withstanding the heat of the ignited gases We have known of instances in which the lining of steel-melting furnaces has been melted down like wax before this tremendous heat. Assuming, however, that we may expect to find sufficiently refractory materials to permit the utilization of still higher temperatures, the problem, to determine how to reach a higher limit, presents itself.

Under ordinary conditions, we cannot much exceed the temperature of a steel melting furnace, since dissociation occurs at a temperature supposed to be in the neighborhood of 4,500° Fah., for oxygen and hydrogen; consequently all combustion must be checked at some lower point on the scale, so long as no external force aids that of chemical affinity. The temperature of dissociation of carbonic acid is even lower than that for hydrogen and oxygen, and is shown to be not far from 2,500° Fah. Finally the presence of nitrogen in atmospheric air reduces the maximum temperature attainable, by furnishing a mass of gas which, while itself adding nothing to the supply of heat, abstracts (from the heat supplied by combustion of carbon and hydrogen) the larger amount required for its own elevation to the temperature of the furnace.

Elevation of the limit to increase of temperature of furnaces may be obtained by elevating the temperature of dissociation, and this, it has been found, may be done by producing combustion under pressures exceeding that of the atmosphere. Mr. Bessemer, the well known inventor who so nearly antedated our countryman Kelly in the invention of the pneumatic process of manufacture of iron and steel, which is generally known as the Bessemer process, has patented a method of increasing the pressure under which such operations occur. In the ordinary pneumatic process, this increase of pressure occurs to some extent in consequence of the small area of the opening by which the gases leave the converter, and it is stated that the pressure within the converter sometimes becomes double that of the external atmosphere. We may doubt if the increase ever becomes so great as this; yet there can be no doubt that it is sufficiently great to have an important influence in elevating the limit of dissociation and in giving the very high temperature which holds nearly pure iron within the converter in a condition of fluidity never observed elsewhere.

It is readily seen that the conclusions of M. Jordan, in the address to which we alluded above, are justified both by Science and by practical experience. He advises: The choice of a combustible which may be consumed in a bath of metal furnishing a non-volatile residue without injuring (*sans dénaturer*) the metal, and the adoption of a form of furnace which, heated by gas or otherwise, may be worked with an internal pressure of several atmospheres. He refers to the marvelous discoveries, recently made, relative to temperature and pressure on the surface of the sun and other heavenly bodies as affording illustrations of the possibilities in the direction of attaining high temperatures.

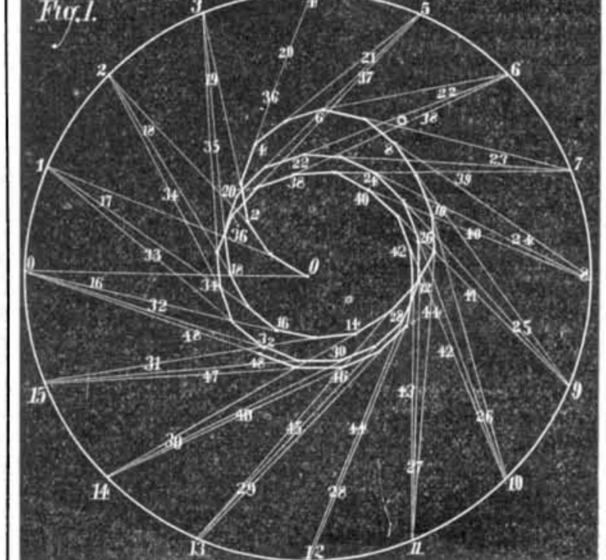
The problem presented is as interesting and attractive as it is important; and the inventor of new methods or of perfected apparatus, and the discoverer of more refractory materials than those now used, will aid greatly in its solution. Powerful intellects and ingenious minds are at work upon it; and we hope that our readers will be able to find in our columns evidence that the ingenuity which has made our people famous as a nation of mechanics, and the growth of Science which is gradually becoming so noticeable among us, have assisted to a valuable extent in effecting so important an advance in this direction. Any improvement or discovery which assists in the production and the economical application of high temperatures aids every branch of industry, and promotes our material welfare in an inconceivable number of ways.

A CURIOUS PROBLEM.

In our queries of last week's issue a correspondent, B. F. B., says: "There is a problem, which some one has found in a work published many years since, which is as follows 'A man, at the center of a circle 560 yards in diameter, starts in pursuit of a horse running around its circumference at the rate of one mile in two minutes; the man goes at the rate of one mile in six minutes, and runs directly toward the horse, in whatever direction he may be. Required the distance each will run before the man catches the horse, and what figure the man will describe.' I hardly think it admits of a solution under the above conditions; but were they reversed, that is, if the man were running at the rate of one mile in two minutes, and the horse one mile in six minutes, what would the answer be?"

This problem gives rise to an interesting investigation of a curve, which at first sight appears to be similar to the spiral of Archimedes, but on further examination proves to be totally different. The spiral of Archimedes is the track of a point which moves with uniform velocity along the radius from the center to the circumference, while, at the same time, the end of the radius travels round the circumference. In this problem, however, the point moving from the center does not move uniformly in the direction of the radius, but more and more obliquely toward a uniformly progressing point in the circumference, giving rise to an intricate application of the differential calculus, which finally proves that the man will never reach the horse, but that the curve described by him will, after three revolutions of the horse, be nearly identical with a circle, the circumference of which he will approach more and more, and of which the radius is one third of that in which the horse moves. The most interesting fact revealed, however, is that, if the velocity of the man is half that of the horse, he will, after two revolutions, be near the circumference of a circle of half the radius of the outer one; and when he moves with one fourth the velocity he will, after four revolutions, be very near a circle of one fourth the size, and so on.

In order not to burden our readers with extended calculations in the field of the higher algebra, we have solved the problem in the graphic method. In our first figure we hav



divided the circumference of the circle into sixteen equal parts, 0, 1, 2, 3, 4, etc., and taken one third of such a part and set it out on the radius from the center, 0 to 1. While the horse has moved along the circumference from 0 to 1, the man will have traveled from the center 0 to 1; while the horse is traveling from 1 to 2, the man will have traveled along the line 1, 2, 2; while the horse travels from 2 to 3, the man will travel in the direction 2, 3, 3, and so on; the only difference between our engraving and the reality being that the short lines representing the road traveled by the man will be slightly curved, instead of straight as we have represented them. By making these lines smaller, we may come sufficiently near to the reality, but the final result will not essentially differ. If the reader follows the different tracings for three revolutions, as represented here, he will see that finally the man will walk in a circle one third the size of that in which the horse moves, and will constantly see the horse in a direction tangential to the circle in which he walks; and therefore he never can reach it if he always moves directly toward the horse.

It is quite otherwise when the problem is reversed, and