



**PDHonline Course S256 (4 PDH)**

---

## **Gustav Eiffel and the 300-Meter Tower**

*Instructor: Jeffrey Syken*

**2020**

**PDH Online | PDH Center**

5272 Meadow Estates Drive  
Fairfax, VA 22030-6658  
Phone: 703-988-0088  
[www.PDHonline.com](http://www.PDHonline.com)

An Approved Continuing Education Provider



# Gustav Eiffel and the 300-Meter Tower

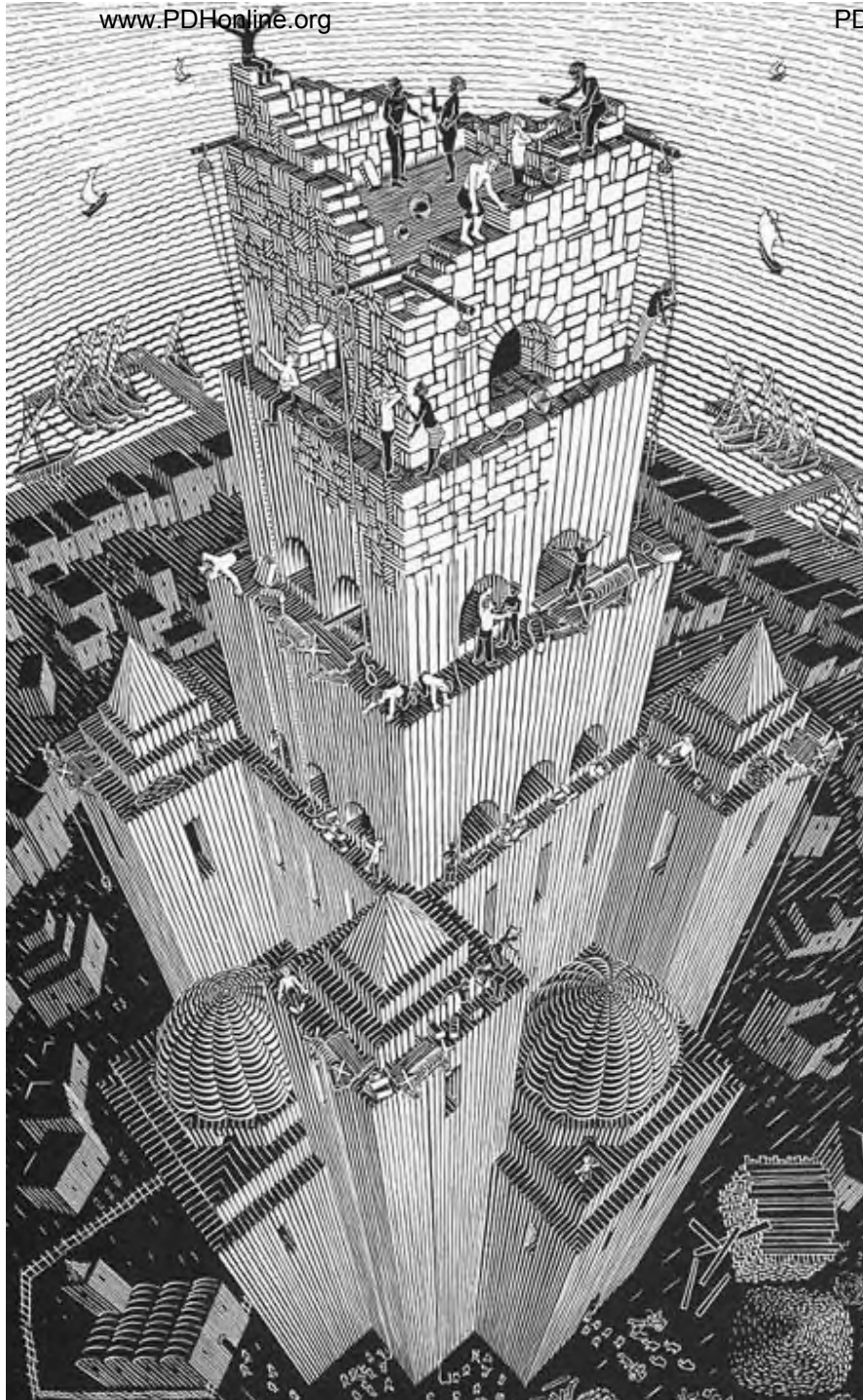
# Table of Contents

<u>Slide/s</u>	<u>Part</u>	<u>Title/Description</u>
1	N/A	Title
2	N/A	Table of Contents
3~41	1	Art vs. Industry
42~82	2	Le Magicien du Fer
83~154	3	Exposition Universelle de 1889
155~248	4	La Tour de 300-Meters
249~280	5	Wonder of the World
281~301	6	War & Peace
302~350	7	Icon

# **Part 1**

## **Art vs. Industry**



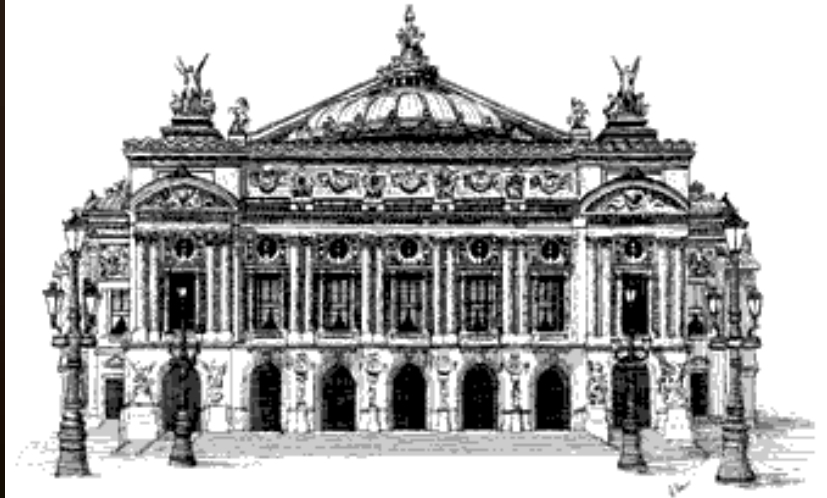


***Come, let us make a city and a tower, the top whereof may reach to heaven; and let us make our name famous before we be scattered abroad into all lands...But God confounded their tongue so that they did not understand one another's speech, and thus scattered them from that place into all lands, and they ceased to build the city.***

**Genesis 11:5-7**

www.PDHonline.org PDH Course 6356 www.PDHcenter.com  
***“Honored compatriot – authors, painters, sculptors, architects, enthusiastic lovers of beauty, which has hitherto been respected in Paris – we wish to protest with all our energy, and with all the indignation of which we are capable, in the name of art and of French history now menaced, against the erection in the heart of our capital of the useless and monstrous Eiffel Tower, which public satire, often full of good sense and a spirit of justice, has already christened the ‘Tower of Babel’...Does the City of Paris really want to be linked with the overwrought, wild fancies displayed by this mechanical construction – or its designer – and in this way disgrace and dishonor herself forever?”***

**RE: *Protestation des Artistes* (47 of them) as published in *Les Temps* – February 1887**



**Charles Garnier (left), architect of the *Paris Opera House* (above) and leader of the *Artist's Protest***

***“Without rebuilding the Tower of Babel, one can see that the idea of constructing a tower of very great height has for a long time haunted the imagination of mankind. This kind of victory over the terrible law of gravity which attaches man to the ground always appeared to him a symbol of the forces and the difficulties to be overcome. To speak only of our century, the thousand-foot tower which would exceed by twice the highest monuments it had been possible hither to construct, was a problem set down to be solved in the minds of English and American engineers. Besides, the new use of metals in the construction industry made it possible to approach it with a chance of success.”***

**Gustav Eiffel**



***“...high growths of  
iron, slender,  
strong, light,  
splendidly uprising  
towards clear  
skies...”***

**Walt Whitman**

**RE: excerpt from his  
poem *Manhattan*, 1881**





***“It seems to me that it had no other rationale than to show that we are not simply the country of entertainers, but also that of engineers and builders called from across the world to build bridges, viaducts, stations and major monuments of modern history, the Eiffel Tower deserves to be treated with consideration”  
Gustav Eiffel***



***“The tower was the greatest affront not only to the architecture of Paris, but also to the eye of the Parisian, for whom its structural logic and revolutionary aesthetic language was incomprehensible.”***

**CHEMINS DE FER PARIS-LYON-MÉDITERRANÉE**

# EXPOSITION UNIVERSELLE

1889 DE PARIS

**INAUGURATION DE L'EXPOSITION**

BILLET D'ALLER & RETOUR

## 25% DE RÉDUCTION

Délivrés du 1<sup>er</sup> au 15 Mai 1889

**POUR PARIS**

PAR TOUTES LES GARES DU RÉSEAU

**VALIDITÉ**

Jusqu'à 200 kilom. ... 4 Jours	De 201 à 400 kilom. ... 5 Jours
De 401 à 600 ... 6 ...	De 601 à 800 ... 7 ...
De 801 à 1000 ... 8 ...	De 1001 à 1200 ... 9 ...
De 1201 à 1400 ... 10 ...	De 1401 à 1600 ... 11 ...
De 1601 à 1800 ... 12 ...	De 1801 à 2000 ... 13 ...
De 2001 à 2200 ... 14 ...	De 2201 à 2400 ... 15 ...
De 2401 à 2600 ... 16 ...	De 2601 à 2800 ... 17 ...
De 2801 à 3000 ... 18 ...	De 3001 à 3200 ... 19 ...
De 3201 à 3400 ... 20 ...	De 3401 à 3600 ... 21 ...
De 3601 à 3800 ... 22 ...	De 3801 à 4000 ... 23 ...
De 4001 à 4200 ... 24 ...	De 4201 à 4400 ... 25 ...
De 4401 à 4600 ... 26 ...	De 4601 à 4800 ... 27 ...
De 4801 à 5000 ... 28 ...	De 5001 à 5200 ... 29 ...
De 5201 à 5400 ... 30 ...	De 5401 à 5600 ... 31 ...
De 5601 à 5800 ... 32 ...	De 5801 à 6000 ... 33 ...
De 6001 à 6200 ... 34 ...	De 6201 à 6400 ... 35 ...
De 6401 à 6600 ... 36 ...	De 6601 à 6800 ... 37 ...
De 6801 à 7000 ... 38 ...	De 7001 à 7200 ... 39 ...
De 7201 à 7400 ... 40 ...	De 7401 à 7600 ... 41 ...
De 7601 à 7800 ... 42 ...	De 7801 à 8000 ... 43 ...
De 8001 à 8200 ... 44 ...	De 8201 à 8400 ... 45 ...
De 8401 à 8600 ... 46 ...	De 8601 à 8800 ... 47 ...
De 8801 à 9000 ... 48 ...	De 9001 à 9200 ... 49 ...
De 9201 à 9400 ... 50 ...	De 9401 à 9600 ... 51 ...
De 9601 à 9800 ... 52 ...	De 9801 à 10000 ... 53 ...

TOUTES LES GARES DU RÉSEAU

LES BILLETTS D'ALLER ET RETOUR SONT ÉMIS

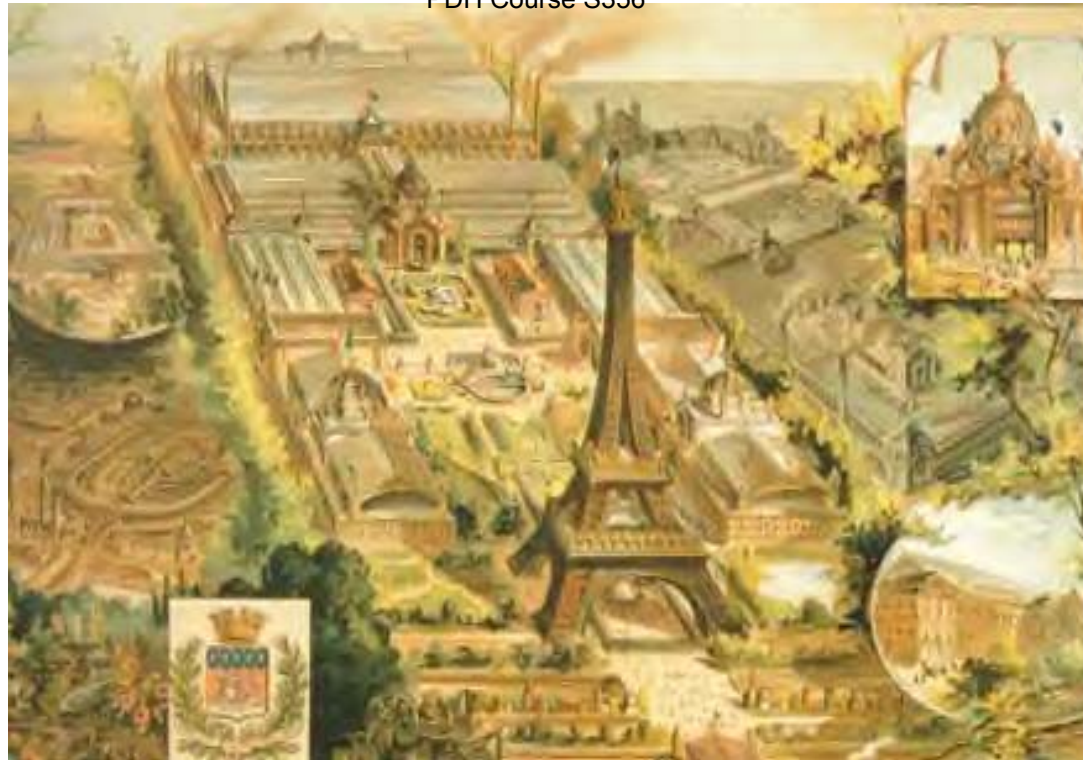
**Tous les Trains (Express & Rapides compris)**

FRANCHISE DE **30 K<sup>g</sup>** DE BAGAGES

*“A worse sign still is the Eiffel Tower – an iron tower some thousand feet high, ugly in itself and certain to make everything else look ugly in its neighborhood, which the organizers of the Exhibition of 1889 are determined, in the face of all opposition, to set up in the very midst by way of a centerpiece...”*

**RE: American observer of contemporary life and thought in France**





***“We come, lovers of the beauty of Paris which was until now intact, to protest with all our strength and all our indignation, in the name of the underestimated taste of the French, against the erection in the very heart of our capital this arrogant iron mongery, this disgraceful skeleton...Even commercial America wouldn't want it...”***

**RE: excerpts from: *The Protest Against the Tower of Monsieur Eiffel – a.k.a. The Artist's Protest***

***“Similar exaggerations can be excused on the part of the artists, painters, sculptors and even composers: for them, anything is allowed; they have the monopoly of taste; only they have feelings of beauty; their vocation is infallible; their oracles are indisputable...”***

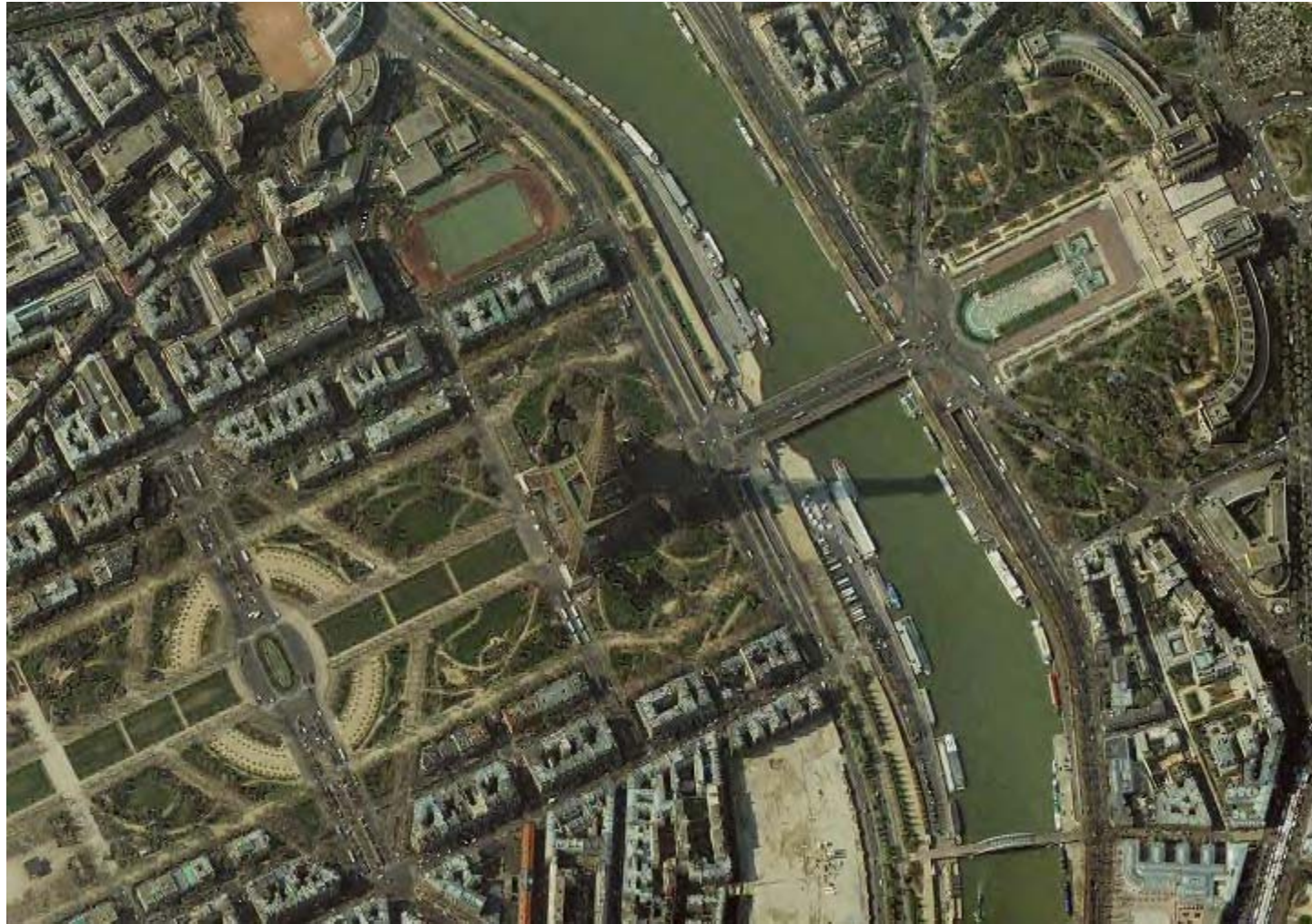
**Gustav Eiffel**

**RE: response to cultural elitists condemnation and attacks on the Eiffel Tower before it was even built**

***“Not that I fear for Paris. Notre-Dame will remain Notre-Dame and the Arc de Triumphe will remain the Arc de Triumphe. But I could have saved only part of this city which is seriously in danger; that incomparable sand pile called the Champs de Mars, such an inspiration for our poets and so attractive to our landscape painters...Above all do not say that it is unfortunate that the exhibition is being attacked by those who should be defending it; that a protest signed by such illustrious names will echo throughout Europe and may be used as a protest by some nations not to take part in our celebration; that it is bad to attempt to ridicule a peaceful undertaking which the French nation is so attracted to...”***

**Edouard Lockroy – Minister of Commerce & Industry**

**RE: sarcastic response to cultural elitists’ attacks on the Eiffel Tower**





**The year 1889 would be the centennial of the *French Revolution* of 1789. To celebrate (and try to forget their humiliating defeat in the Franco-Prussian war of 1870), the capital city of Paris would host an international exhibition on the *Champs de Mars* (a military parade ground) which would feature a central monument selected from the results of a design competition. One-hundred and seven bids were considered ranging from a giant guillotine to an enormous water sprinkler. As Gustav Eiffel's 300-meter tower began to emerge as the winning design, the cultural elitists; including a committee of prominent French architects, cried foul, deriding Eiffel personally as: *"a mere engineer and builder of railway bridges."* They attacked the aesthetic design of the tower as: *"an odious column of bolted metal,"* unworthy of a central place in Paris. If that wasn't enough, they resorted to attacking the safety of even contemplating constructing a 300-meter tower in the first place: *"The construction of a safe one-thousand foot tower is technically impossible, as no building that tall could resist the power of the wind."***

In response, Eiffel stated: *"Now to what phenomenon did I give primary concern in designing the tower? It was wind resistance. Well then! I hold that the curvature of the monuments four outer edges, which is as mathematical calculation dictated it should be, will give a great impression of strength and beauty, for it will reveal to the eyes of the observer the boldness of the design as a whole."*

***“All the houses in Paris will suffer from a St. Vitus’ dance, and, gradually attracted toward the Champs de Mars will finally find themselves stuck to the tower. As for locomotives entering Paris, it will be found impossible to stop them at the various termini; they will rush through Paris, and dash themselves to pieces against the center of attraction.”***

***Scientific American, 1886***

**RE: prediction from a French servant that the Eiffel Tower would spontaneously polarize becoming a 1,000 foot magnet drawing all things towards it**

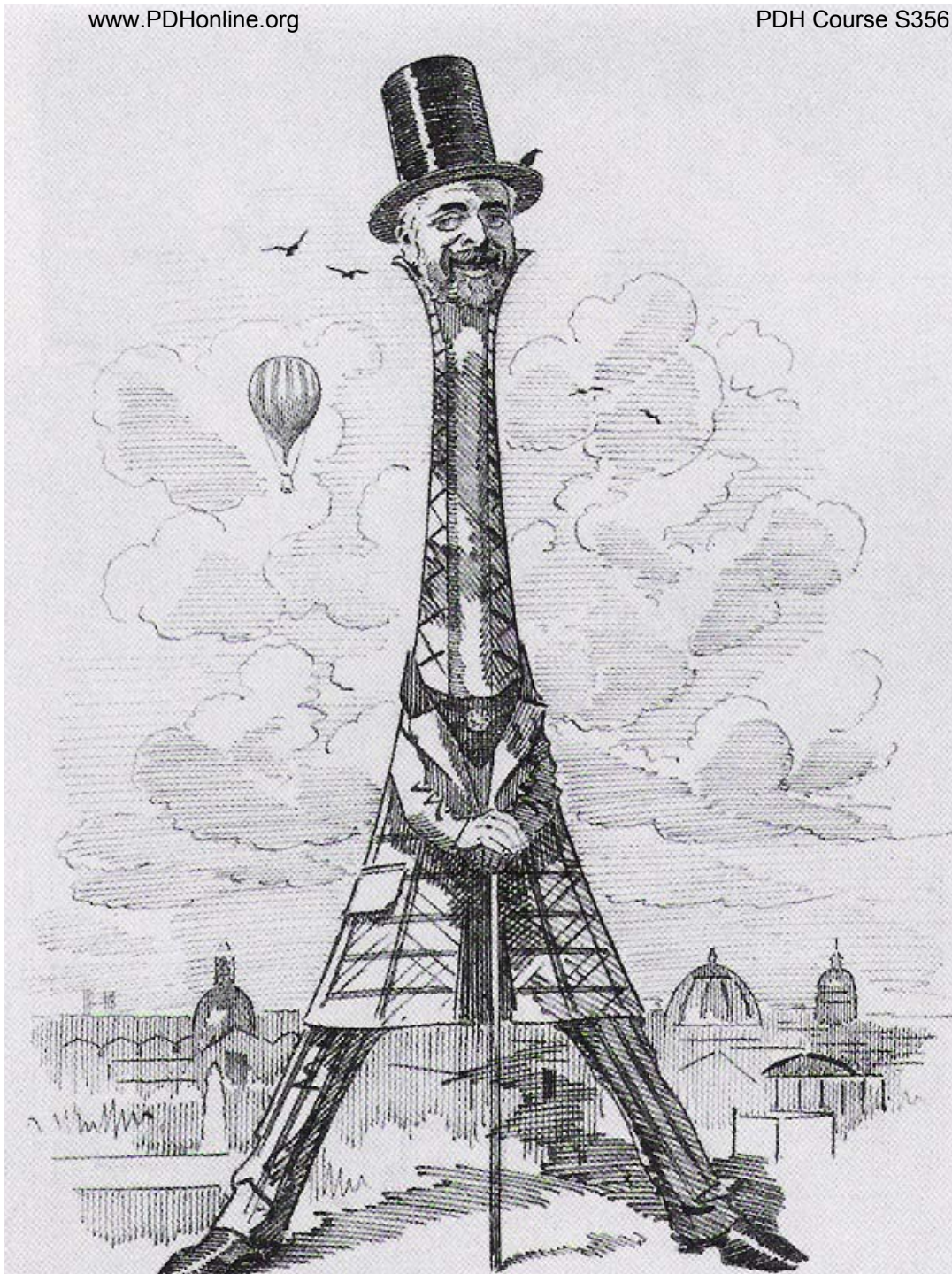


***“The Eiffel Tower is seriously charged with having changed the electrical condition of Paris, and this is why there have been so many heavy storms...M. Eiffel laughs at this theory, alleging that his tower is only doing on a larger scale what every lightning conductor does”***

***“I left Paris and even France because of the Eiffel Tower. Not only is it visible from every point in the city, but it is to be found everywhere, made of every known material, exhibited in every shop window, an unavoidable and tormenting nightmare. I wonder what will be thought of our generation if, in some future riot, we do not unbolt this tall, skinny pyramid of iron ladders, this giant and disgraceful skeleton with a base that seems to support a formidable monument of Cyclops and which aborts into the thin ridiculous profile of a factory chimney.”***

**Guy de Maupassant, 1890**





***“Can one think that because we are engineers, beauty does not preoccupy us or that we do not try to build beautiful, as well as solid and long lasting structures? Aren’t the genuine functions of strength always in keeping with unwritten conditions of harmony?”***

**Gustav Eiffel 20**





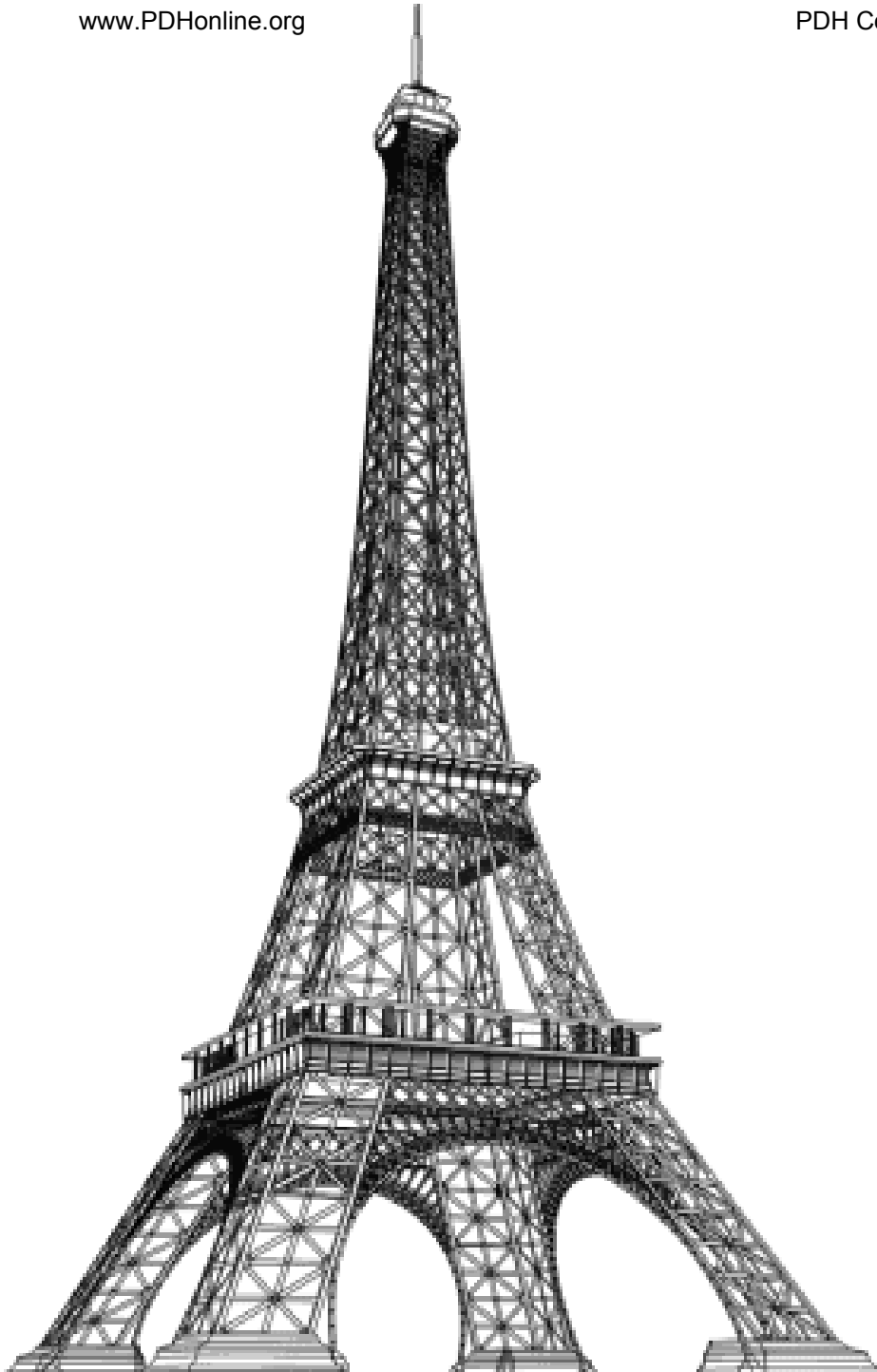


***“I believe that my efforts have not been fruitless and we can tell the world that France remains at the forefront of progress...Man has always sought to erect buildings of a great height as a manifestation of power...it is only by the progress of science and art and of the metallurgical industry, which distinguishes our century, that we are able to overtake preceding generations by the construction of this tower”***

**Gustav Eiffel**

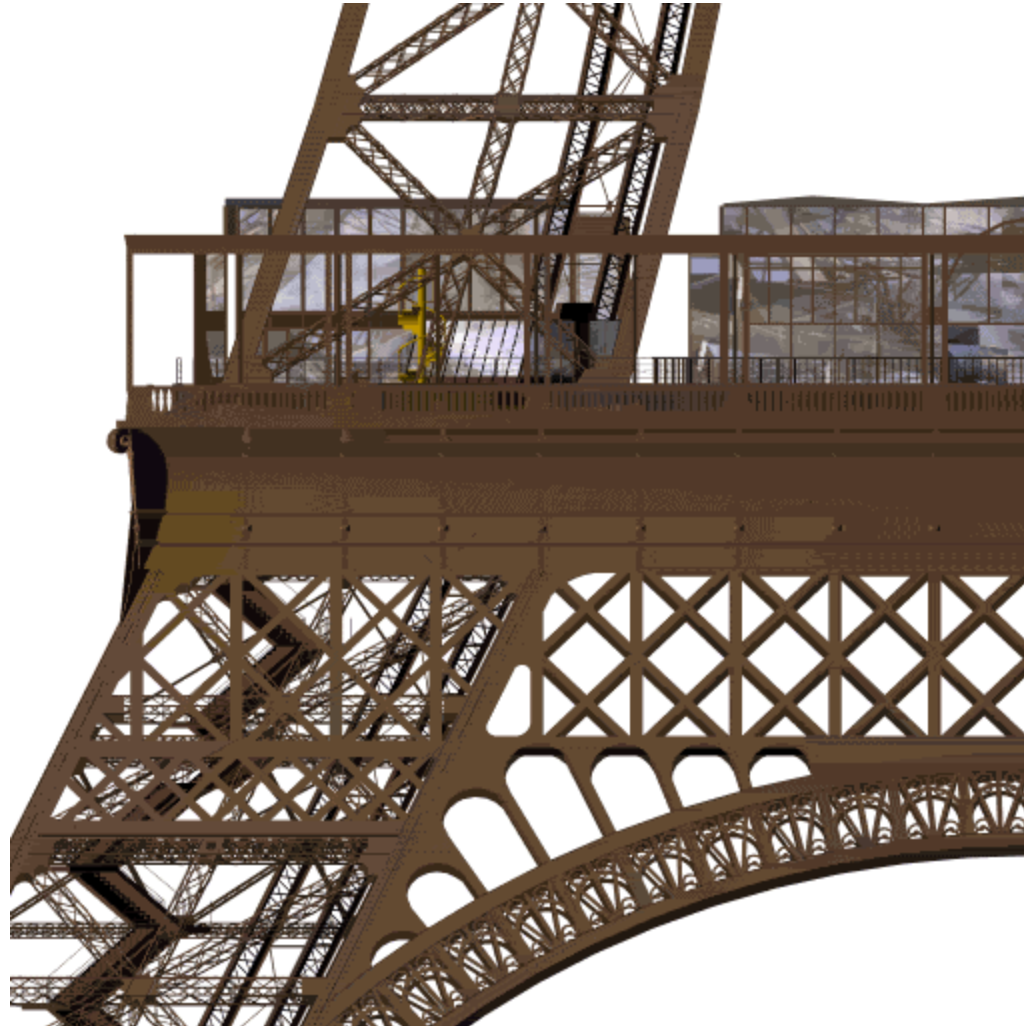






***“...Likewise, the many empty spaces built into the very elements of construction will clearly display the constant concern not to submit any unnecessary surfaces to the violent action of hurricanes, which could threaten the stability of the edifice. Moreover, there is an attraction in the colossal, and a singular delight to which ordinary theories of art are scarcely applicable.”***

**RE: Eiffel’s response to the Artist’s Protest in *Le Temps* – February 14, 1887**









***“So much had been said against it that a visitor to the Exposition might have been excusably surprised not to find the Eiffel Tower vulgar. But the unprejudiced visitor must have been still more surprised to find it a positively agreeable object”***  
New York newspaper correspondent, 1889<sub>27</sub>







***“It is not M. Eiffel who is to blame for his tower. Why were the government of France and the municipality of Paris willing to pay 16,000 pounds in order that the Eiffel Tower should be put up? Nobody pretends that it is or will be of the slightest use...Those who sanctioned and paid for the building can have been influenced only by the desire of putting up the tallest structure ever designed, and how is it that such a fancy pleases them? Their vanity is gratified? In what way?”***

***The Spectator***



**Strategic Operations:** In case of war or siege it would be possible to watch the movements of an enemy within a radius of 45 miles, and to look far beyond the heights on which our new fortifications are built

**Meteorological Observations:** It will be a wonderful observatory in which may be studied the direction and force of atmospheric currents, the electrical state and chemical composition of the atmosphere, its hygrometry etc.

**Astronomical Observations:** The purity of the air at such a height, the absence of mists which often cover the lower horizons in Paris, will allow many physical and astronomical observations to be made which would be impossible in our region

**Scientific Experiments:** May be made, including the study of the fall of bodies in the air, resistance of air according to speed, certain laws of elasticity, compression of gas and vapors, and, using a large-scale pendulum, the rotation of the earth

***“It will be an observatory and a laboratory such as has never been placed at the disposal of scientists”***

**Gustav Eiffel**

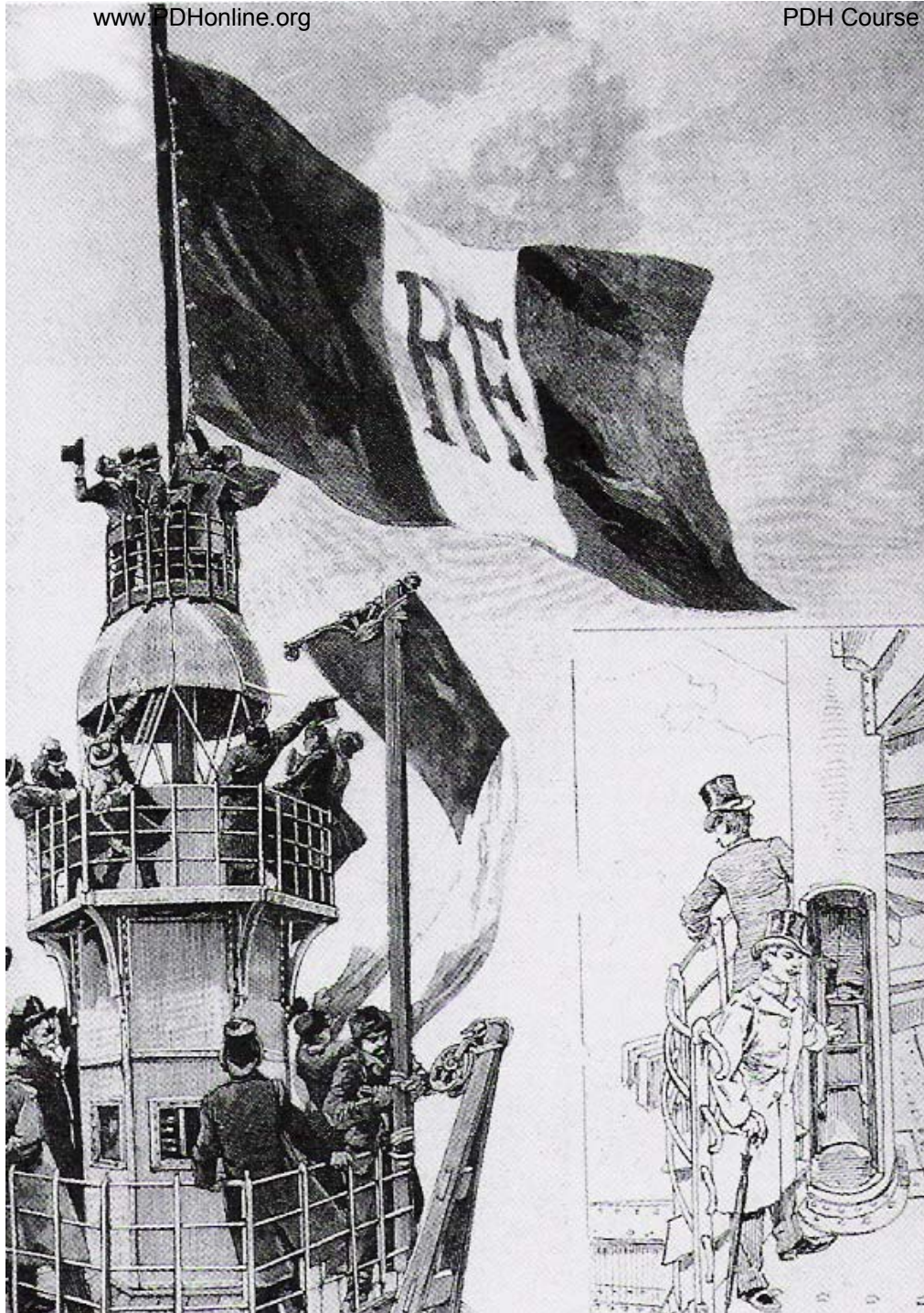
**RE: proposed uses of the tower**



***“As a witness in iron raised by man towards the azure to testify to man’s immutable resolution to pass to there, and to establish himself there. Behold, the point of view which reconciled me to this monster, this conqueror of the sky...I feel consoled by the proud joy common to all to see the French flag float higher than all other flags in the world.”***

**M. Sully Prudhomme (Poet) – Academie Francaise, 1889**

**RE: one-time critic of the Eiffel Tower and signer of the Artist’s Protest**



***“The French flag is the only one with a 300 meter pole”  
Gustav Eiffel***

***“The first flag that was hoisted to the summit of the Eiffel Tower had the saddest fate. Some Englishmen, armed with penknives, scissors and other cutting tools, cut it to pieces as souvenirs. On May 5<sup>th</sup>, the national centenary, the national colors flew again from the summit. Everyone was astonished to see that only a shred of blue fabric remained on the flagstaff. Everybody thought the English secretly climbed the tower again to add to their trophy, but it was nothing like that; only the wind was to blame.”***



***“This truly tragic street lamp...this mast of iron gymnasium apparatus, incomplete, confused and deformed...a half-built factory pipe, a carcass waiting to be fleshed out with freestone or brick, a funnel-shaped grille, a hole-riddled skeleton...”***

**RE: assorted criticism of the Eiffel Tower by French poets, novelists, intellectuals, artists, architects etc.**

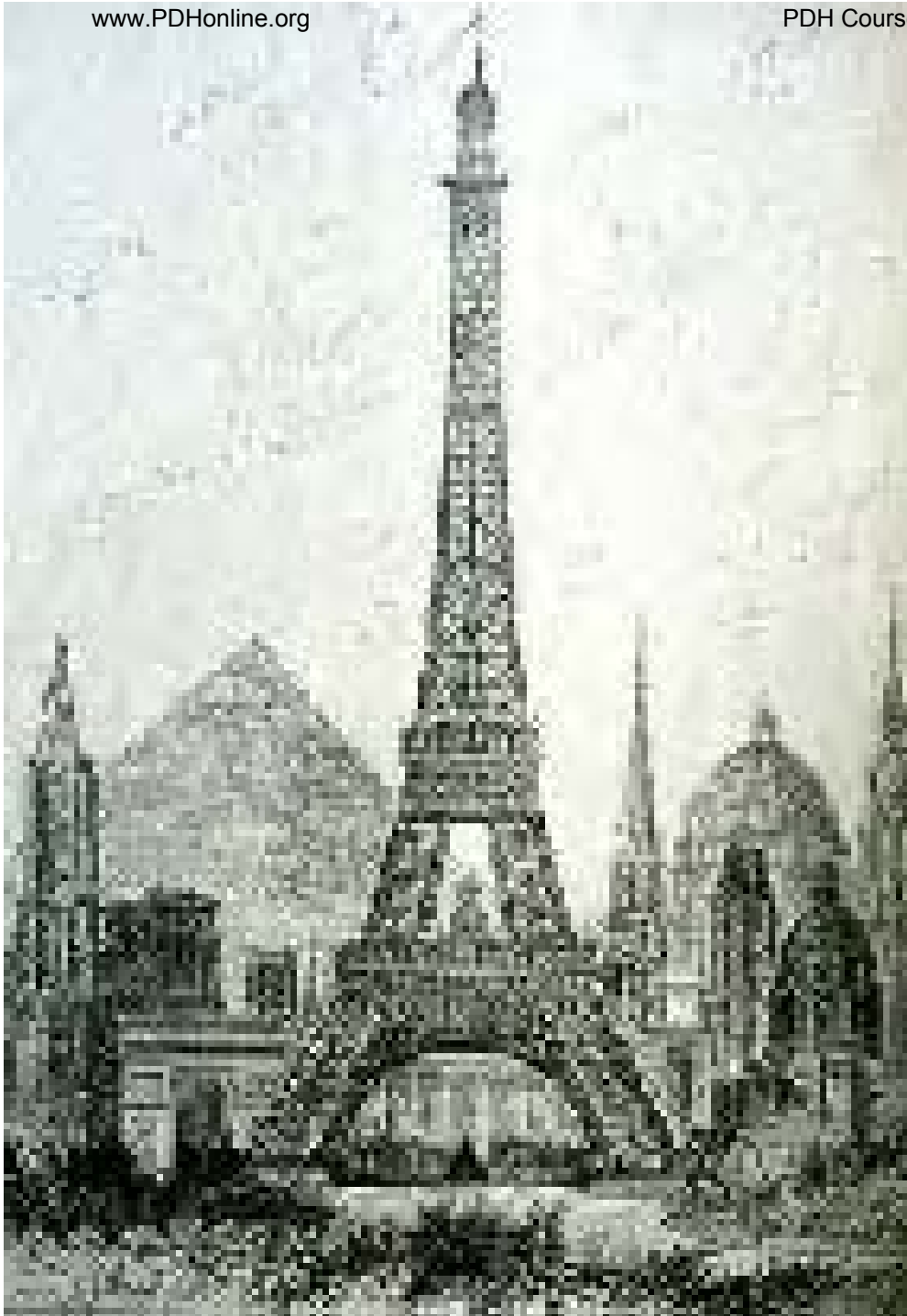


**Charles Gounod**  
**Composer and arch-critic of the Eiffel Tower**

***“Old abandoned towers, no one listens to you any more. Don’t you see that the earth’s poles have changed and that the world now rotates round my axis? I represent the power of the universe disciplined by calculation. Human thought runs along my members. My brow is encircled with rays stolen from the sources of light. You were ignorance; I am knowledge. You enslave men; I free him.”***

**Eugene Marie Melchior, Marquis de Vogue**

**RE: historian, writer & enthusiast for the Eiffel Tower – an imagined dialogue between the Eiffel Tower and the stone pillars of Notre-Dame**



***“There is an attractive element in the colossal... What visitor is insensitive before the pyramids? And what is the source of this admiration if not the immensity of the effort and the grandeur of the result? The tower will be the tallest structure ever built by man. Will it not be grand in its own right?”***

**Gustav Eiffel**



***“The beginnings were painful, and criticisms were addressed to me that were impassioned as much as premature...I tried, by the good progress of the works, to reconcile if not the opinion of the artists, at least that of engineers and scientists. I made a point of showing, that France continued to hold one of the top places in the art of metal construction where, right from the start, its engineers were particularly distinguished and covered Europe with the product of their talents”***

**Gustav Eiffel**





***“Rising above the plaster palaces with their twisted décor, it looks as pure as crystal...everywhere and among the humble as among the others, the tower is in everyone’s heart as the sign of a beloved Paris, beloved sign of Paris”***

**Le Corbusier, 1925**

# **PART 2**

## **Le Magicien du Fer**

***“From my father I inherited a taste for adventure,  
from my mother a love of work and responsibility”***  
**Gustav Eiffel**

***Alexandre Gustave Eiffel*** was born in 1832 in the city of Dijon, France. His mother was French, but his father's family was of German heritage (*The Eifel Region* is a highland area in western Germany). In 1855, he graduated from the *Ecole Centrale des Arts et Manufactures*, in Paris. Upon graduating, he went to work for a Belgian firm specializing in railway equipment and in 1864 he established an independent practice as an engineer/contractor. He became famous for his wrought-iron latticed bridge structures, but his firm also designed structural systems for buildings, train stations, lighthouses and even the frame for the *Statue of Liberty*. He is also widely recognized as a pioneer and innovator of pre-fabricated construction techniques.

# STRUCTURES

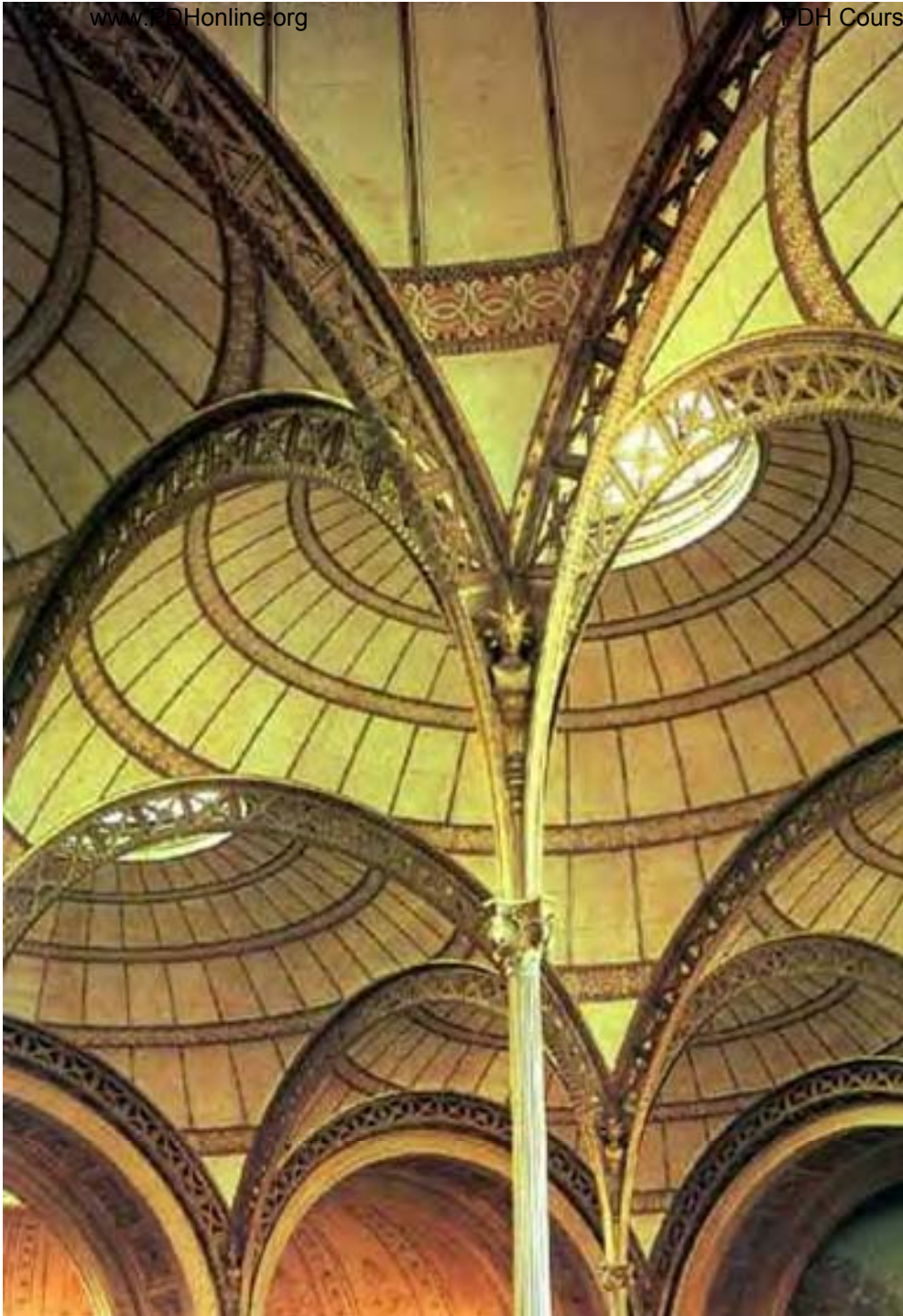




**Statue at 1889 Exposition:  
*The Age of Iron***

***“I have mentioned, so far, only wrought iron, but metal constructions can also be established out of cast iron or steel. Those out of cast iron are oldest, then came wrought iron constructions and, more recently, those of steel. If one compares these three metals, one can say that, in large work, the use of cast iron has tended to disappear, except for columns or supports, because it resists tractive forces very badly. In addition, it is in general so brittle that under the influence of vibration its breaking-point is heightened.”***

**Gustav Eiffel**



## National Library Paris (1868)

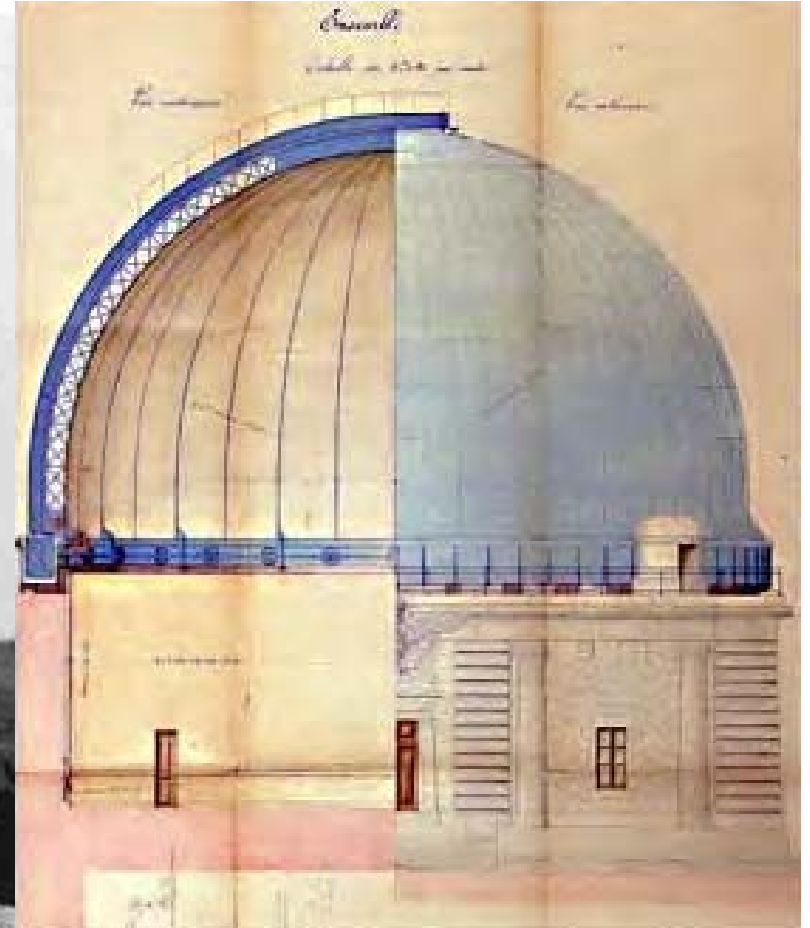
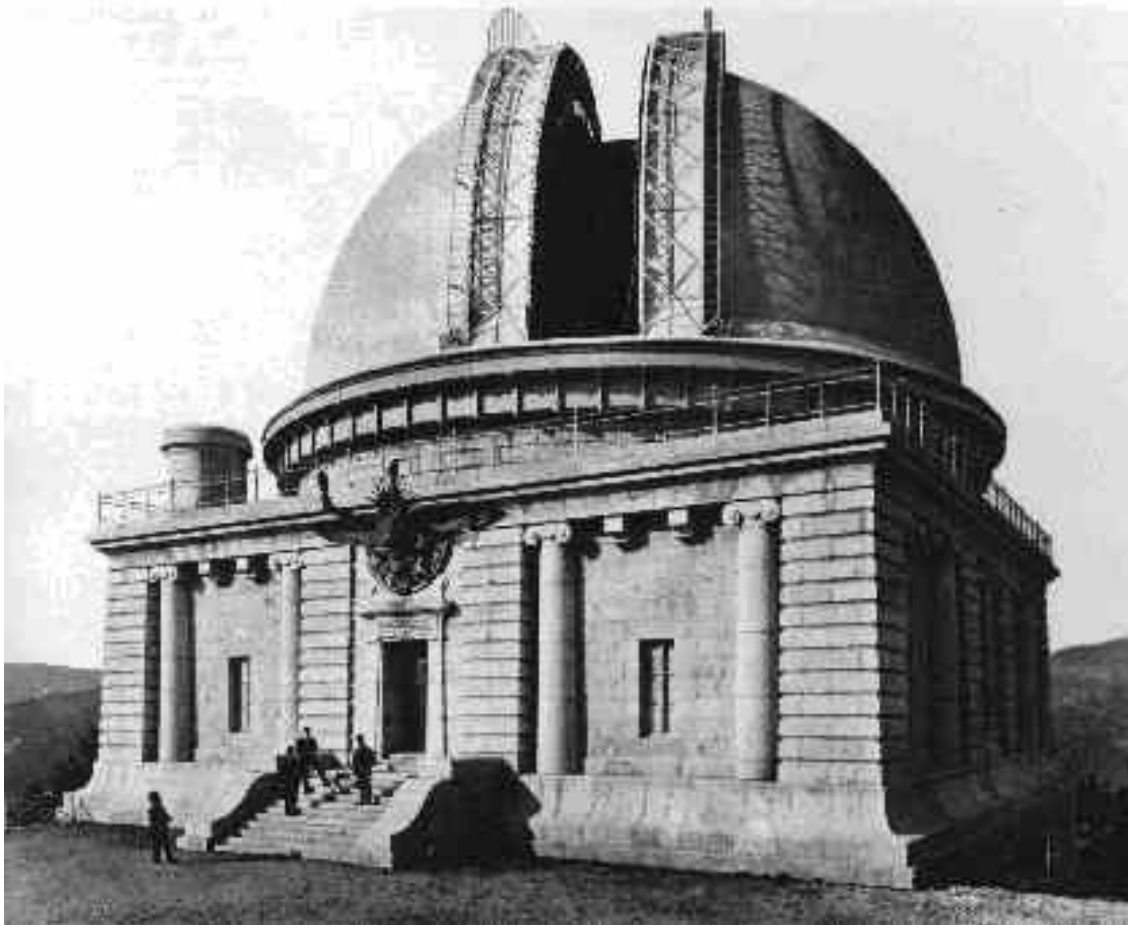


## Dining Room Glass Dome Roof Hotel Vernet, Paris





## **Hotel Hermitage Monte Carlo, Monaco**



# Observatory Dome Nice, France (1886)





## Chocolate Storehouse Paris (1884)



**St. Rosalia "Kit" Church  
Baja, Mexico**

***“The manufacture of steel is very delicate, and it is only in recent years that it has been possible to produce a metal of which we can be confident and which perfectly offers the special qualities required. There is a marked tendency in the construction industries increasingly, day by day, to replace iron with steel, and there are already a great number of very important steel structures. One can say without contradiction, I believe, that steel is the metal of the future.”***

**Gustav Eiffel, 1884**



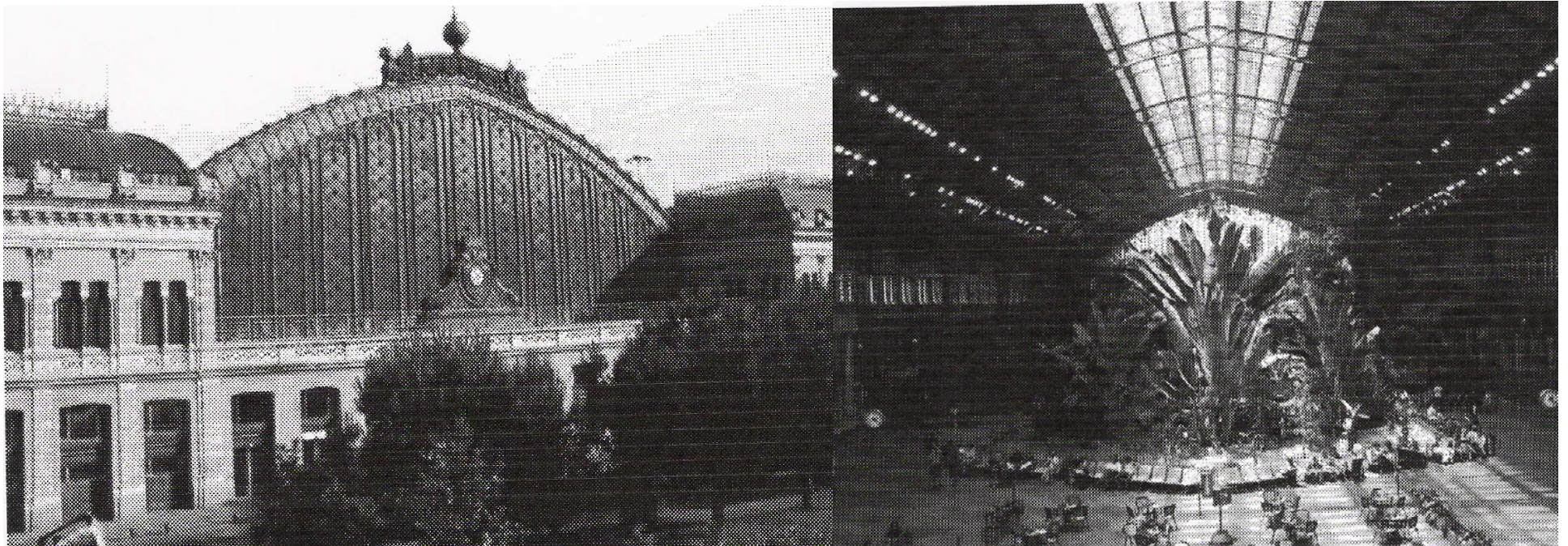
**West Station  
Pest, Hungary**





**Train Station  
Santiago, Chile**





## **Atocha Train Station Madrid, Spain**



## **Palacio de Ferro – Luanda, Angola**

**Constructed by Gustav Eiffel's company for the 1900 Paris Exposition. *Companhia Comercial de Angola* bought it after the exposition and relocated it to Luanda, the capital city of Angola in southwest Africa**





**General Post Office  
Saigon, French Indochina (1891)**



## **Mercado Sur Quayaquil, Ecuador**



## **Toro Point Lighthouse Fort Sherman, Panama**



# BRIDGES

***“The properties of steel are more difficult to define; it is a metal of very variable resistance and properties; its breaking strength can double, according to its mode of preparation; its impact resistance is generally weaker than its elevated breaking point. The resistance of the steel used today in the construction industries is not much higher than that of iron, but its superiority lies in its elastic limit; i.e. the point where the deformations persist under the effect of a load is much higher than for iron. We can thus be reassured on the future fate of our steel constructions, on condition of course, that they are preserved from the rust which is their mortal enemy.”***

**Gustav Eiffel**



## **Bridge over the Dordogne River Bordeaux, France (1860)**



## **Ponte Vecchio Viaduct Corsica**

***“From the early 1870’s, Eiffel lent his engineering genius to the French government’s colonization of Cochin China (now Vietnam). To facilitate rapid troop movements across river deltas, Eiffel’s firm produced scores of lightweight iron bridges. Designed like giant erector sets, these bridges could be assembled in a single day by a dozen workmen. In less than a decade, the French Bureau of Native Affairs built two and one-half miles of these modular spans. Eiffel’s ‘pret-a-porter’ bridge soon found a ready international market among railroads, armies and public works administrations.”***





**Rach Lang Bridge**  
**District of Saigon, French Indochina**



**Suspension Bridge  
Egypt**



## **Railroad Bridge Chile**



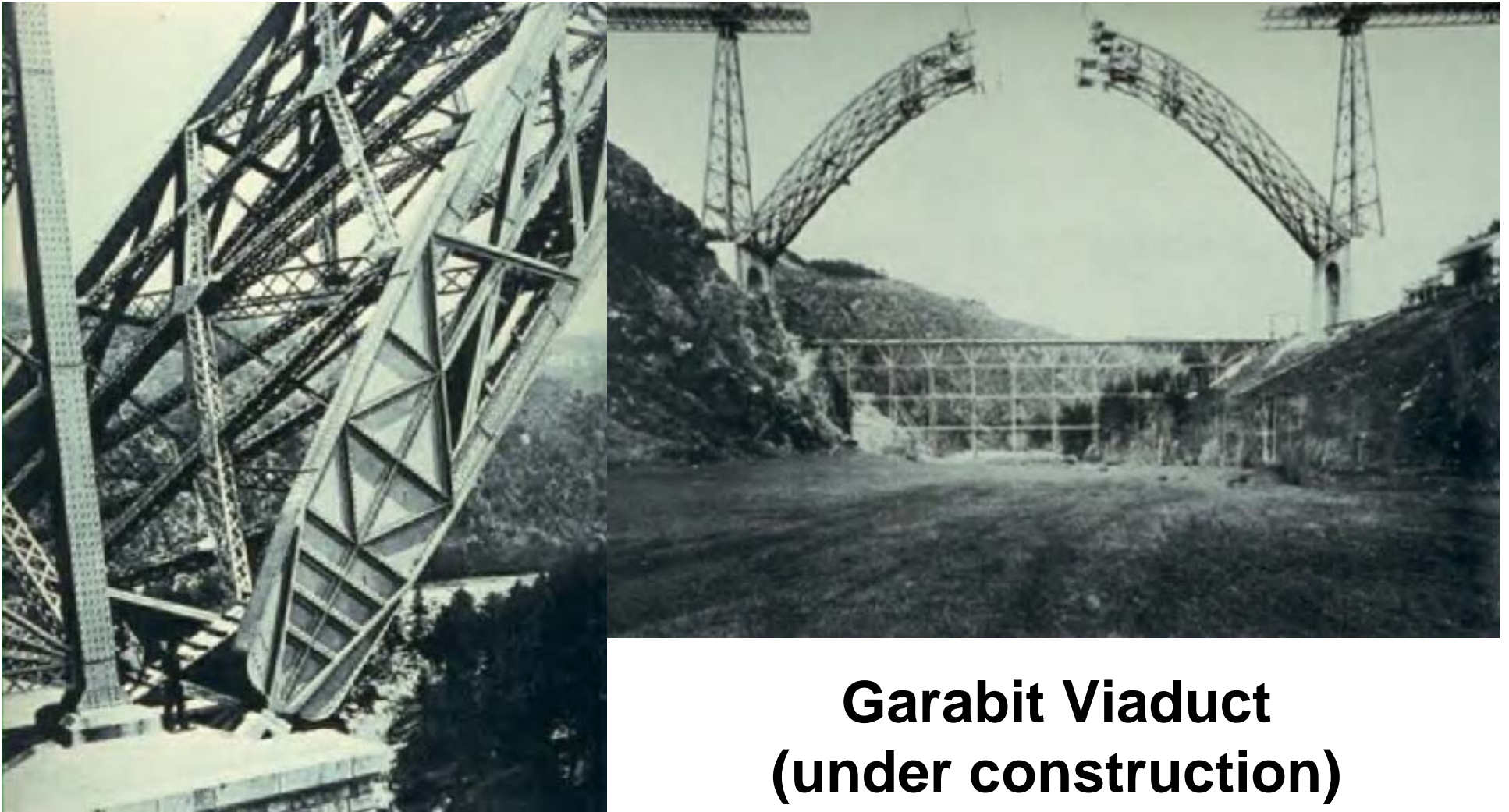
## **Maria Pia Bridge over the Douro River, Portugal**

***“...because M. Eiffel has constructed similar work, and only he has experience of the new assembly methods of which he is in large part the inventor, and for which he also has the equipment which was used to erect the bridge over the Douro”***

**French Ministry of Bridges & Roads, 1879**

**RE: award of contract to Gustav Eiffel for the Garabit RR viaduct**





**Garabit Viaduct  
(under construction)**

***“These viaducts on the line from Commentry to Gannat led to serious progress because of the care and attention with which their engineer, M. Nordling, studied the different forces that occur in structures of that type. The dangers of insufficient study of these forces were shown a few years ago at the great Tay Bridge in Scotland, where a violent wind, acting on the deck, overturned the cast-iron piers supporting it, just as a train was crossing.”***

**Gustav Eiffel**

**RE: Rouzat & Neval Viaducts (1867) – spanning the *Massif Central*, thus connecting rail lines on either side of the valley**





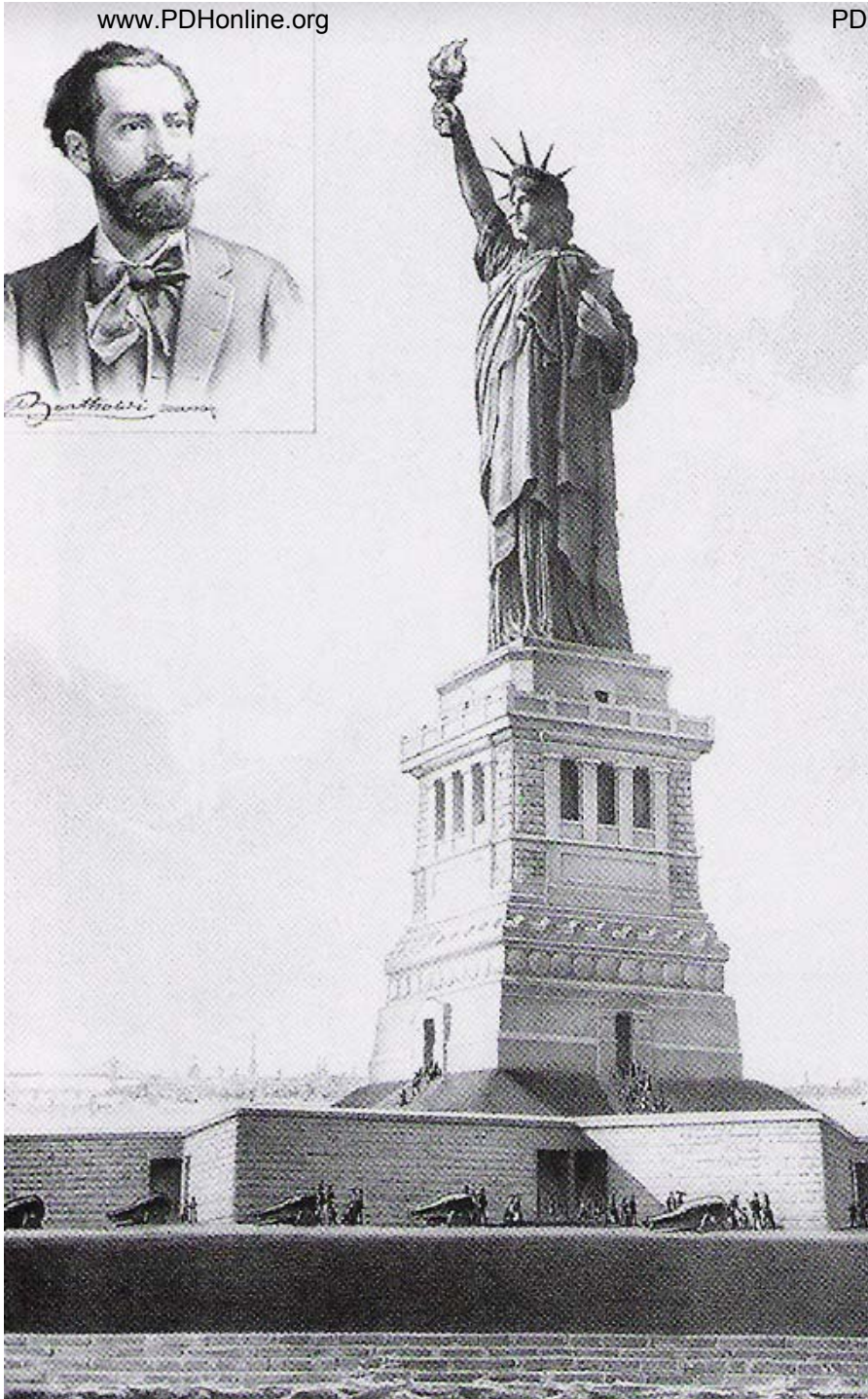
**Garabit Viaduct**  
**(spanning the *Massif Central*)**



***“Essentially rigid tubes laid flat, Eiffel’s spans were just one step removed from the giant office towers soon to come. Re-engineered and stood on end, his bridges would grow into skyscrapers.”***

# STATUE OF LIBERTY

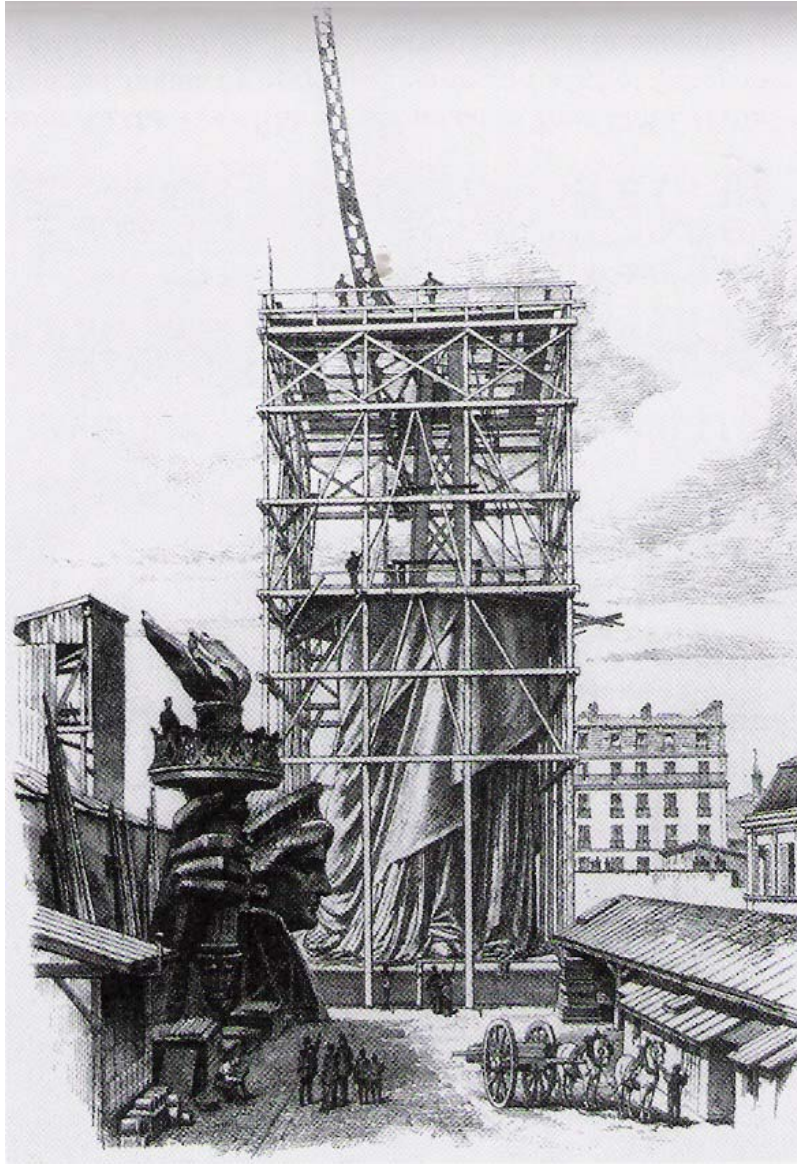




***“There exists a mistaken idea among the people here that the colossal Statue of Liberty, to be erected in our harbor on Bedloe’s Island, is to be presented by the French government to the United States. This is not the case; the government has nothing to do with it. The project was started by the French people, and it was intended that the French and American people should, by their joint efforts, cause a lasting monument to celebrate the triumph of liberty in their respective countries.”***

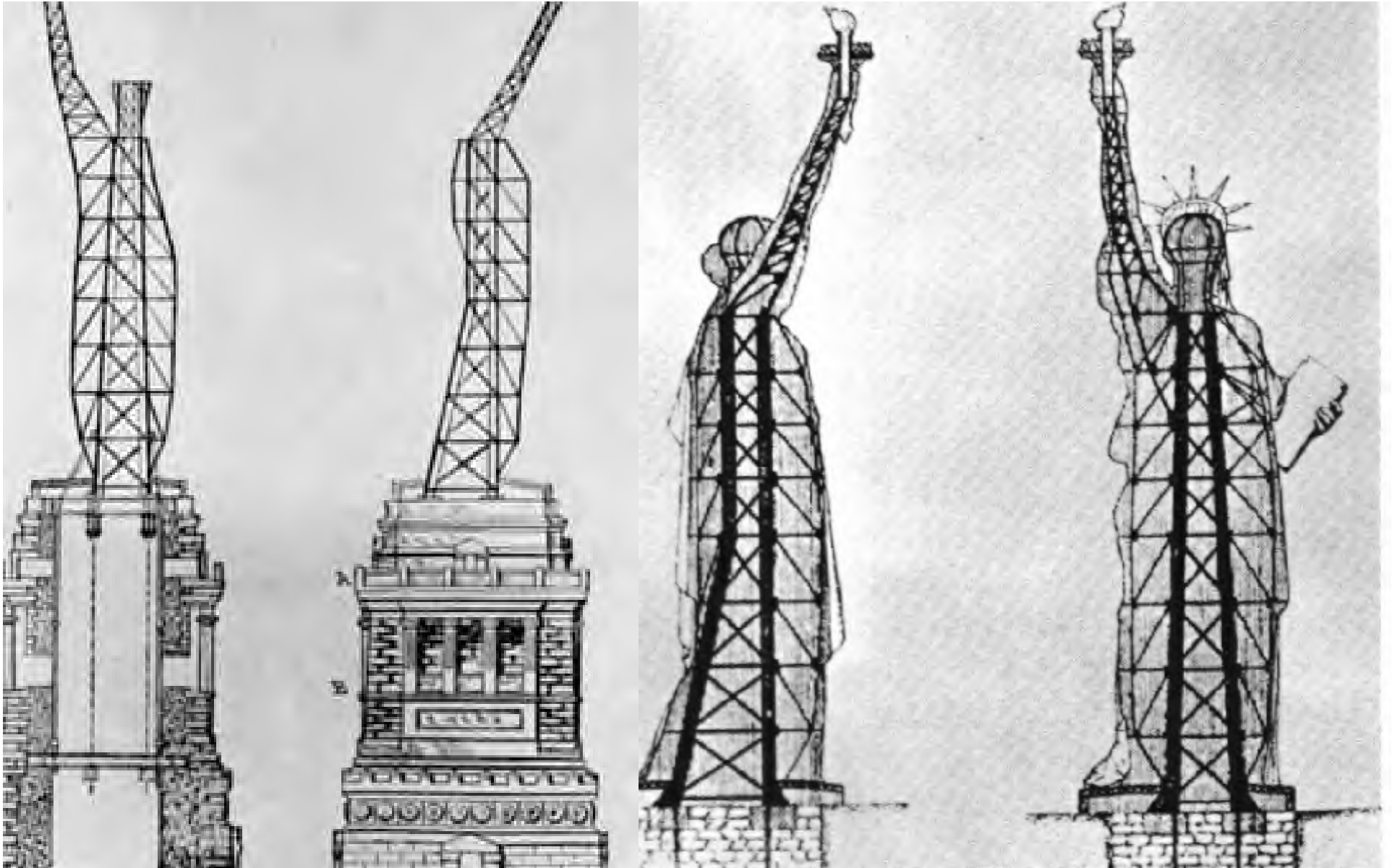
**Newspaper Editorial**







***“The iron braces uniting the copper shell with the supporting trussworks were forged to the form of the copper sheets after the latter had been entirely completed. The finished pieces were finally carried into the court of the workshop, and there assembled and fastened to the frame.”***





***“Not to a man, not to a nation, the statue was raised. It was to an idea – an idea greater than France or the United States: the idea of Liberty”***

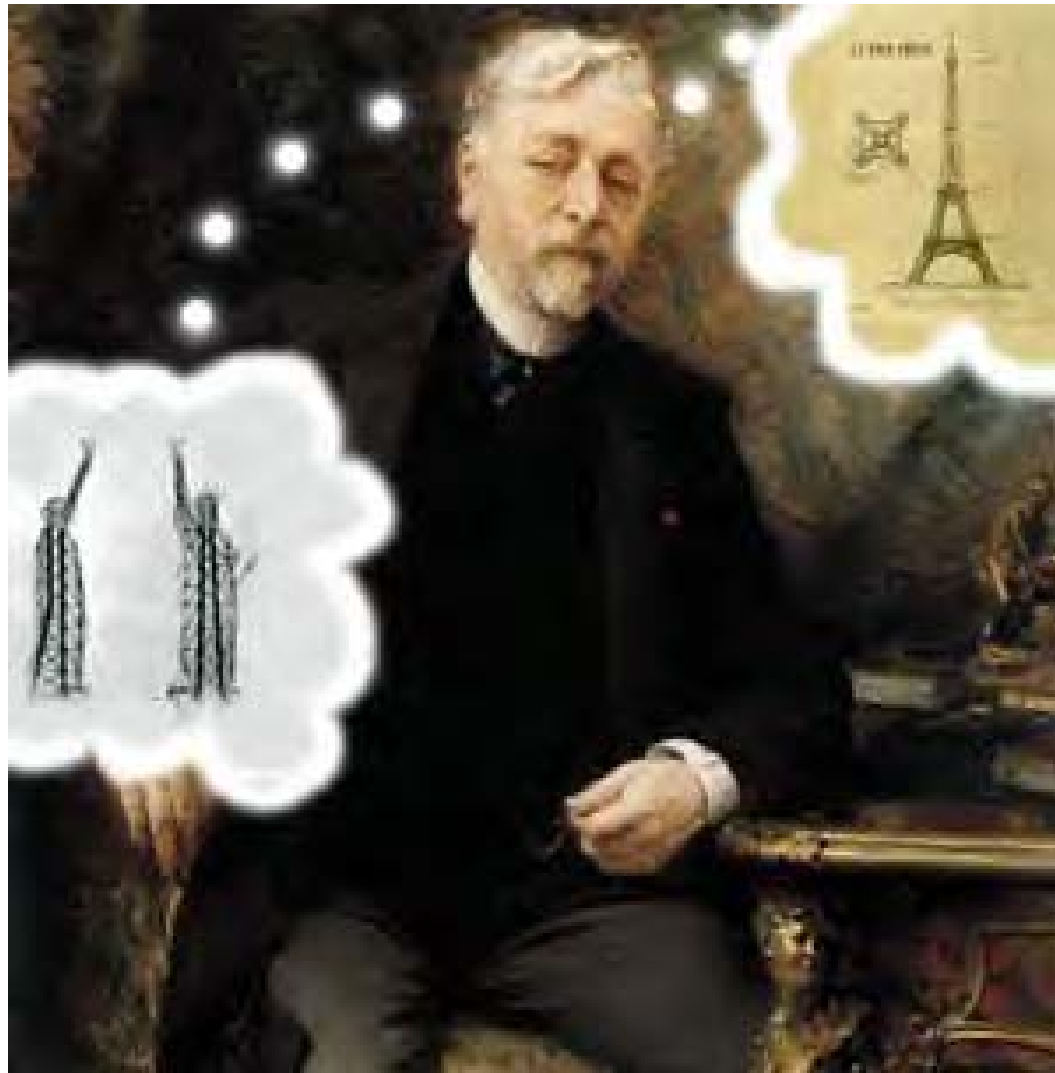
**French Ambassador to the United States, 1916**

**RE: on the occasion of Liberty’s torch being converted from gas to electricity**





## **Statue of Gustav Eiffel (near the *Statue of Liberty*)**



## **Part 3**

# **Exposition Universelle de 1889**

***“It will be the biggest and the most unusual exhibition the world has ever seen. The French love great size; once again, they are proving that this is something they understand...their exhibition celebrating the 100<sup>th</sup> anniversary of 1789 is already astounding. No money or effort has been spared. Nothing shabby spoils the view. Down to the smallest iron trestle, artistic awareness and good taste are most evident...half the civilized world will be lured to Paris, and most certainly with good reason, for this is the most beautiful exhibition the world has ever seen.”***

***Julius Price - Pall Mall Gazette, 1889***







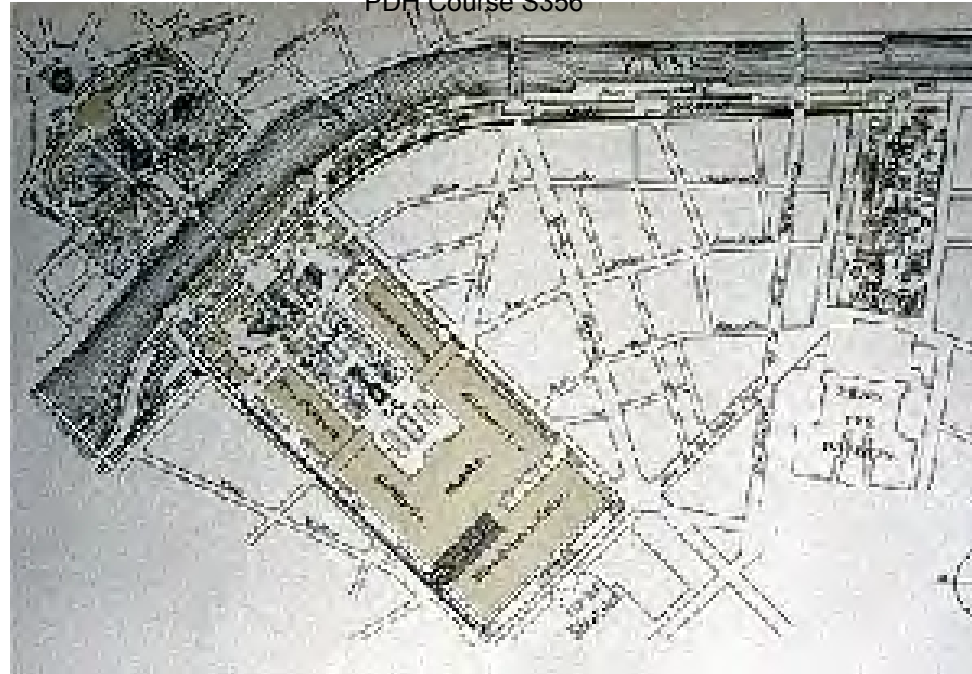
***“They see in this marvelous exhibition, this obedience of the nations to their summons, this thronging of all peoples...proof positive that their city, which they are as proud of as Americans of their 40 states...and think with a pitying kindness of all those to whom fate has denied the privilege of belonging to such a city”***

***The Spectator***

EXPOSITION UNIVERSELLE DE 1889



**“Land of the Fairies”  
(Enchanted Garden)**



***“Study the possibility of erecting on the Champ de Mars an iron tower with a base 125 meters square and 300 meters high”***

**Eduouard Lockroy – Minister of Commerce & Industry**

**RE: invitation to architects & engineers published in the government publication: *Journal Official*, for a tower which was intended to be the central feature for the 1889 *International Paris Exposition Universelle* celebrating<sub>88</sub> the centennial of the French Revolution**





***“Expositions had developed from a single structure (i.e. London’s Crystal Palace of 1851) to many buildings distinguished by classification of exhibits – such as the Vienna Exposition of 1873, to buildings separated by nation demonstrated at the 1889 Paris Exposition.”***

***“It is proposed to build an enormous tower of the materials of the glass palace, preserving as much as is consistent with the new design, all the features of that structure, with a view of perpetuating the great event of the year 1851 and forming a depository of every branch of art and manufacture our own kingdom produces, as well as a choice of exotics from the four quarters of the globe”***

**Charles Burton – Architect, 1852**

**RE: proposal to demolish London’s Crystal Palace and construct in its place a 47-story, 1,000-foot tower with elevators**



**Charles Burton's design for a 47-story (1K-foot) metal & glass tower to replace the original crystal palace – recognized as the first actual design for a *Skyscraper* (though it was never built)**



**London's Crystal Palace, 1851  
(it was dismantled and relocated)**

***“It seems incredible that all these beautiful buildings should have sprung up in such a short time within the desert of mud and sand known as the Champs de Mars, and that this waste should in two years have been converted into an oasis of shady walks, flower beds and bright lawns...The buildings are remarkable for their graceful lines...Even the Eiffel Tower does not seem out of place, thanks to its vast proportions.”***

***The Times (London)***

**RE: 1889 Paris Exposition**









***“One could believe that one was transported into the orient by the magic carpet of ‘One Thousand and One Nights’...the fair has no reality: it is as if one were walking in the set of an oriental play”***



**“A Street in Cairo”**



***“Back to Auteuil on foot, through the crowds of people. A mauve-colored sky, as one sees with an enormous fire... the Eiffel Tower looks like a lighthouse which a lost generation had left on Earth, a generation of people who were seven meters tall”***

**Edmond de Goncourt**

**RE: diary entry for May 6, 1889**





***“The national and foreign buildings; including 17 from the ‘Histoire de Habitation Humane’ exhibit designed by Charles Garnier, represent popular conceptions of different cultures in their style and imagery.”***



**Monaco Building**



**Venezuela Building**



## Russian House



**Gallo-Roman House**





**Siam Pavilion**



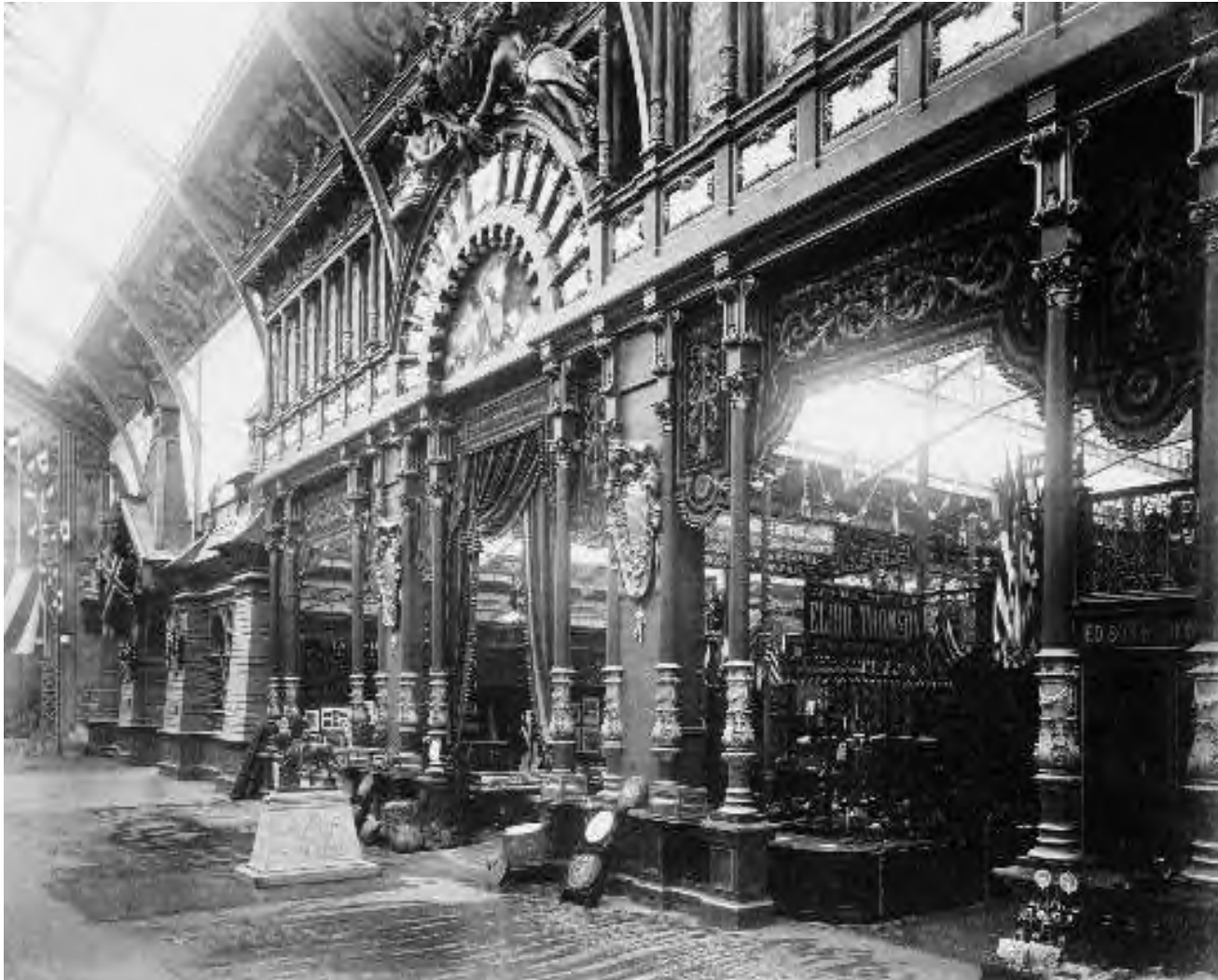
**Egypt House**



## **Pavilion des Pastellistes (Pastel Artists' Pavilion)**



**Swiss Chalet**



## **American Pavilion (Palace of Industries)**





***“The Dome Central is flanked by the Palais des Beaux-Arts and the Palais des Arts-Liberaux forming the ‘U’ which opens to the Eiffel Tower. The Dome Central provided the entry to a large gallery displaying industrial products. Adjoining it – at the eastern end of the Champs de Mars, was the 423 meter long innovative Galerie des Machines.”***



**The Eiffel Tower as seen from the *Dome Central***

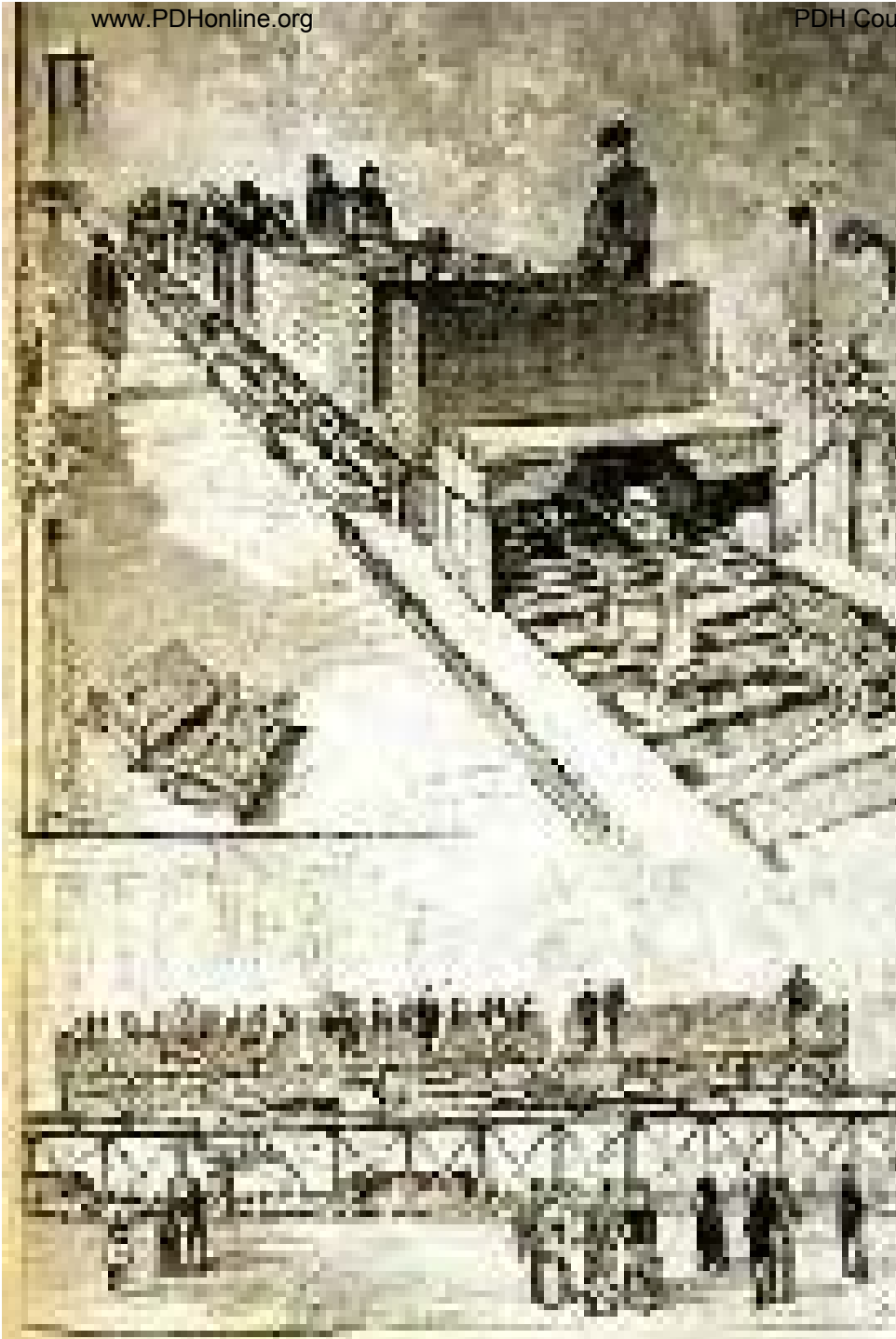


Entrée de l'exposition universelle (Paris, 1889)

**The *Dome Central*  
(Exposition Entry)**

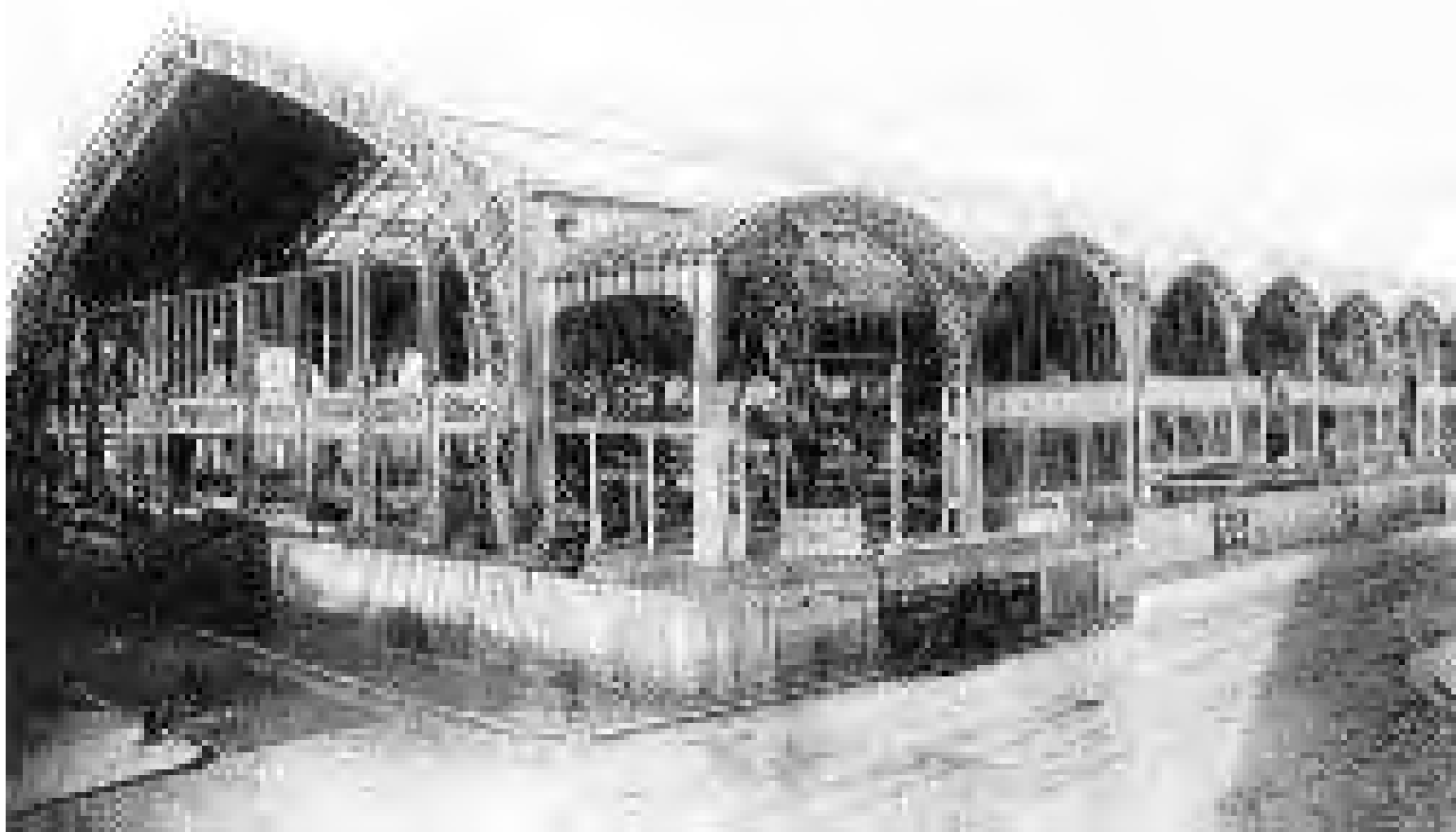


**View of the exposition from the *Trocadero Palace*  
(opposite/west-side of the Siene River)**



***“To overcome the problem of the large distances between the Esplanade des Invalides and the Champs de Mars, an engineer named Girard constructed the hydraulic railway. The train glided on a thin film of water over iron plates powered by a water-powered propeller. Though popular with the public, the idea never caught on.”***





**The *Galerie des Machines* (Machinery Hall)  
(under construction, January 1888)**

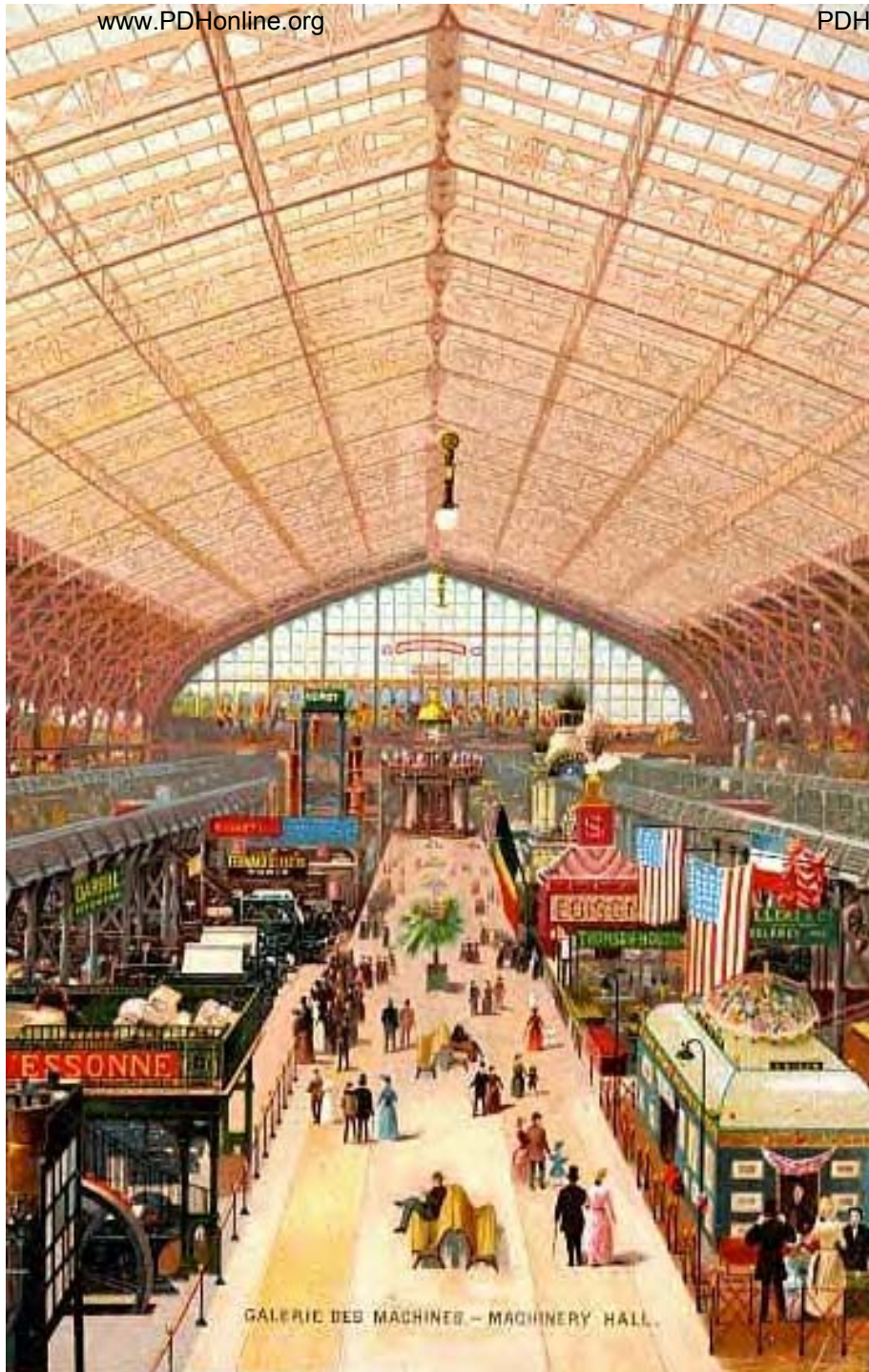
**Designed by F. Dutert, The *Galerie des Machines* was of significant importance as a demonstration of the potential of iron as a building material, just like the Eiffel Tower<sup>114</sup>**



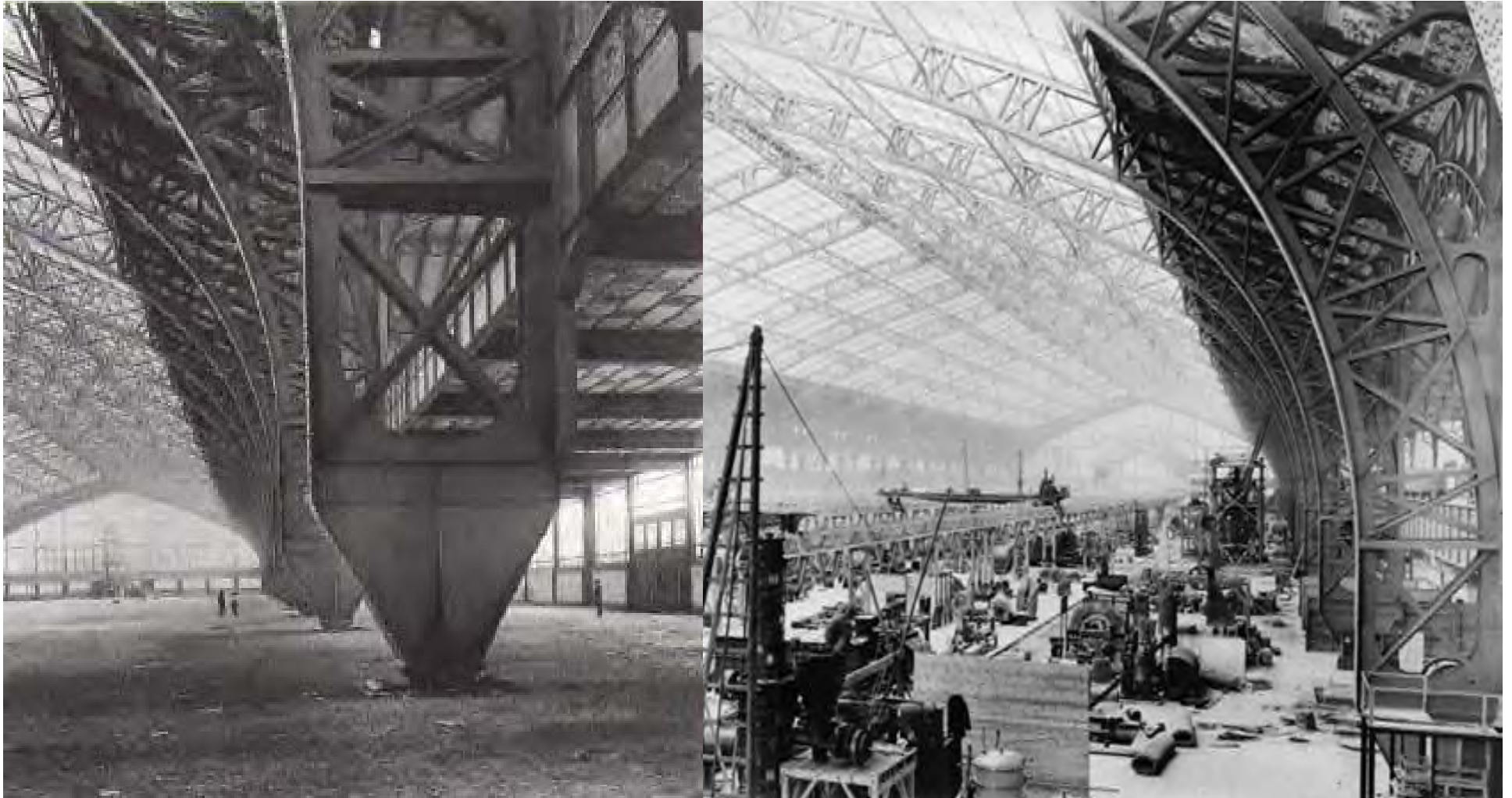
***Galerie des Machines***

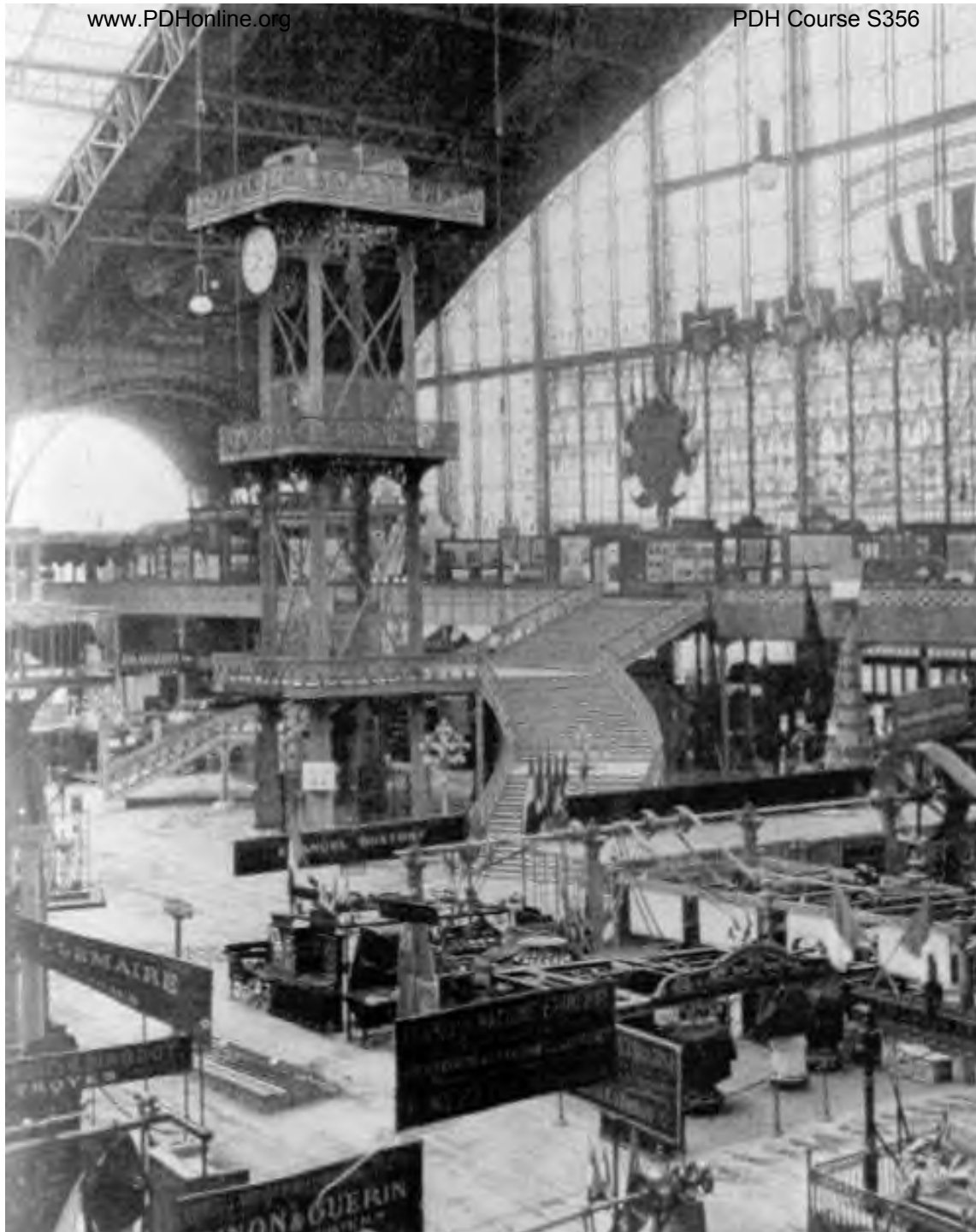
***“For the Galerie des Machines, Architect Dutert sought to bridge the widest span possible. To this end, he and his engineer developed a truss system consisting of 20 main girders joined together by truss girders. The main girders formed three-pinned arches, with movable resting points on concrete pedestals 110 meters apart and bolted at the ridge point 43 meters above allowing for movement due to temperature variations. One-fifth of the roof was covered with sheets of corrugated metal and the wide middle area with sliding glass plates to allow for movement. The sides and end-walls were also made of glass with iron supports. The apparent lightness of the structure, flooded with natural light, impressed visitors and journalists.”***

116









***“The largest electro-dynamos and steam engines were dwarfed by the size of the exhibition hall. The one-hundred thousand visitors had a birds-eye view of the machinery exhibited from an electrically powered moving platform on tracks ten meters above the hall’s floor. Most notably, Thomas Alva Edison exhibited his new invention: the light-bulb.”*** 118





**Edison Exhibit**

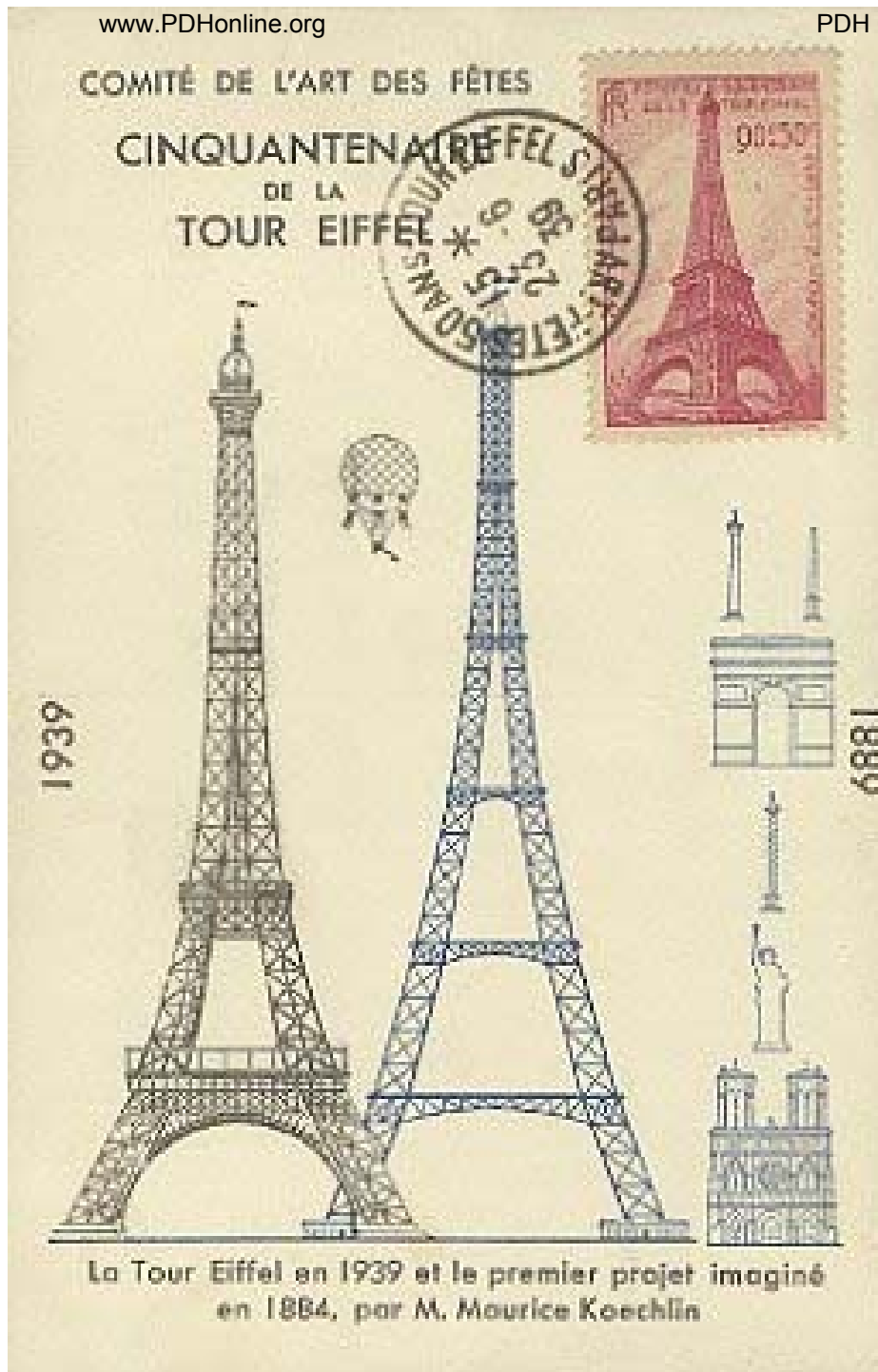


## Lifting Machine

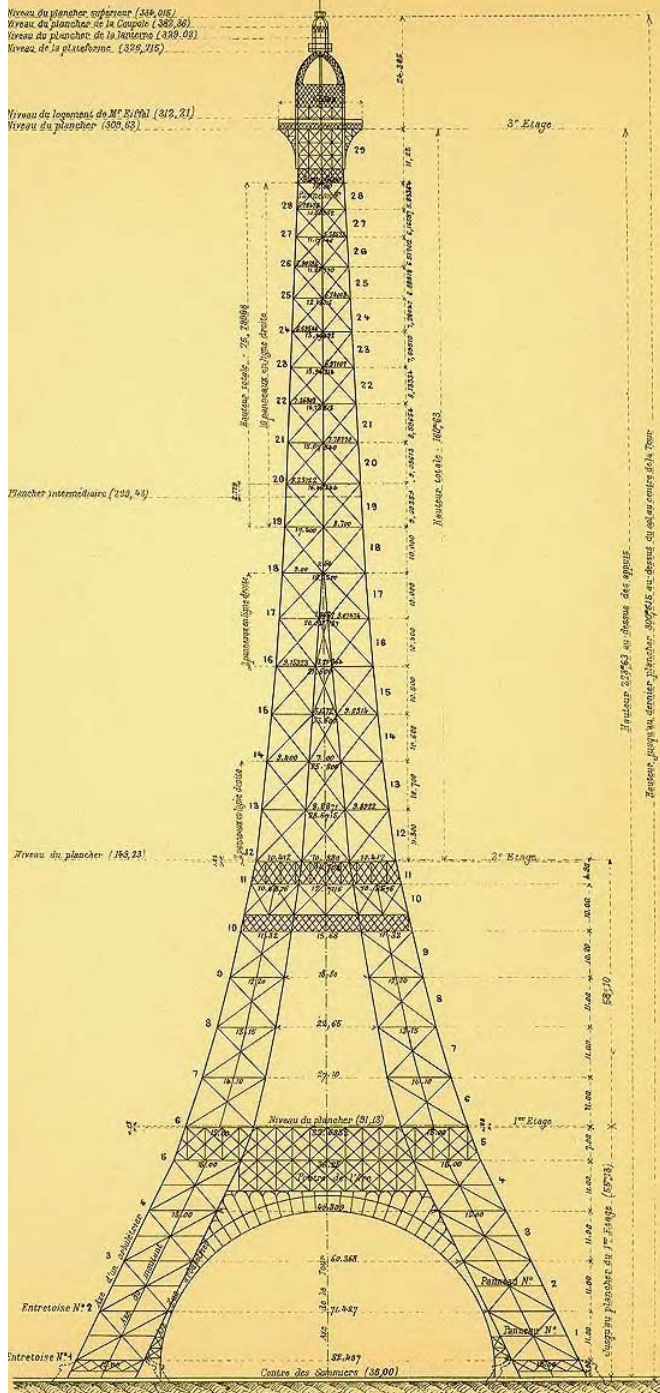


***“...the tower to be built for the 1889 Exposition Universelle should clearly have a distinctive character, and should be an original master-piece of work in metal, and that only the Eiffel Tower seemed to satisfy these requirements fully”***

**RE: decision by the Paris Committee on June 12, 1885 to use Gustav Eiffel’s design for the centennial tower. 700 ideas were narrowed down to 107 serious applicants, then narrowed down to just nine – including Jules Bourdais’ *Tour Soleil* (Tower of the Sun)**



**50<sup>th</sup> Anniversary Postcard  
(1889-1939)  
Showing the original  
design submittal  
(at right, in blue)**



A public competition was held in the spring of 1886. Since Eiffel's plans for the tower had progressed to the working drawing/s stage (structural elevation at left), the outcome of the two-week long competition was never in doubt. Eiffel would be given rights of use to the tower until the year 1910. In return, he was to cover the estimated construction cost of 6.5 million francs from his own resources (apart from a state subsidy of 1.5 million francs). At first, Eiffel was not interested in the design competition for the 300-meter tower. It was due to the initiative and efforts of his subordinates (and the realization that the tower would make him both rich and famous) that he took part and won the competition.





***“The tower would seem to be worthy of personifying the art of the modern engineer and the century of industry and science, for which the road was prepared by the Revolution of 1789, to which this monument will be erected as testimony of the gratitude of France”***

**Gustav Eiffel**

**RE: response to arch-traditionalist architect Jules Bourdais’ contention that the offensive iron tower would cost 7x his proposed granite tower: *Tour Soleil***

***“He decided to take an extraordinary risk by floating a company to distribute ten thousand shares of 500 francs each. He planned to retain half the shares in his own name, and by estimation of attendance figures, he calculated the likely profit. As it happened, he covered his costs during the first year, and subsequent profits, and associated worldwide fame, made him extremely wealthy.”***

**RE: with the government providing a grant of only 1.5 million francs, Eiffel took a risk by privately funding the construction of the Eiffel Tower – it paid off handsomely garnering all entrance fees, revenues from restaurants, cafes, theaters and any other commercial business he chose to operate as well as images of the tower during the exposition. After the first year, the tower became the property of the *City of Paris* but Eiffel continued to receive all income until 1909. The Eiffel Company received all income from 1910 to 1980.**

***“He seems not to be in the enjoyment of all his mental faculties”***

**RE: newspaper describing the would-be assassin of French President Marie Francois Carrot on the exhibition’s opening day: May 5, 1889 (he failed in his attempt)**

***“Ten minutes to twelve, May 15, 1889. The Tower is opened to the public. At last!”***

**Gustav Eiffel**

**RE: Eiffel’s entry into *Le Figaro de la Tour’s* guestbook (on 2<sup>nd</sup> platform). The Eiffel Tower opened ten days after the Exposition without elevator service.**



***“No, no. It is a great idea. The glory of Eiffel is in the magnitude of the conception and the nerve in the execution. That admitted, and the money found, the rest is, if you like, mere bridge-building.”***

**Thomas Alva Edison, May 1889  
RE: response to his companion’s remark while breakfasting on the first platform that the work was that of “a simple bridge-builder”**





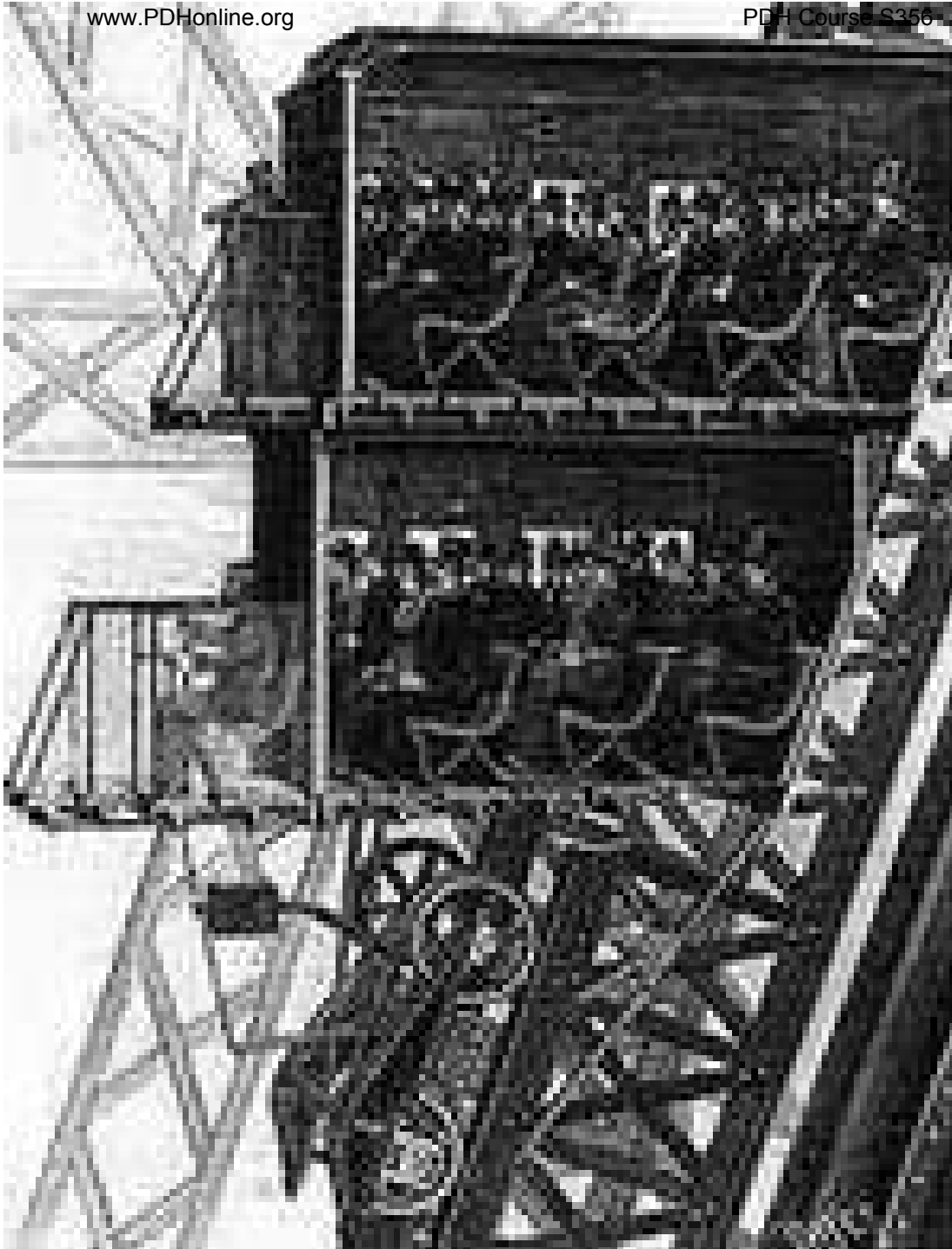
## **First Platform Restaurant**

**Thomas Edison attended the 1889 Paris exposition and was treated like a royal prince. On display was his newest invention; the phonograph, which attracted 10K visitors per day to listen for the first time to recorded music. Edison wrote in the Eiffel Tower's guestbook: *"Mr. Eiffel, engineer, builder of the brave and extraordinary creatures great modern engineering from someone who is respected and admired by all engineers, including the Great Engineer of the Lord God."***

***“This evening dinner on the platform of the Eiffel Tower with Zola and Dayot. Going up in the lift, the feeling of a ship pushing through the ocean waves, but no dizziness. Only when you are at the top do you first get a real impression of the size, the spread, the Babylonian immensity of Paris. In the rays of the sinking sun some walls and angled alleys are bathed in a light that gives them an aura of ancient Rome. The clear straight lines of the horizon are broken by a picturesque arc – the Montmartre hill which looks like a large, illuminated ruin in the twilight. Then the descent on foot, almost like diving into endlessness – these steps as light as day in the night, and, again and again, a view into boundless space.”***

**Edmond de Goncourt**

**RE: diary entry for July, 2, 1889**



## Double-Deck Lifts



***“At the first level, where it was expected most visitors would remain, there was an outer nine foot-wide promenade area with decorative arches on each side, totaling 900 feet in length. This is where the public would stroll and get their first panoramic views of Paris.”***





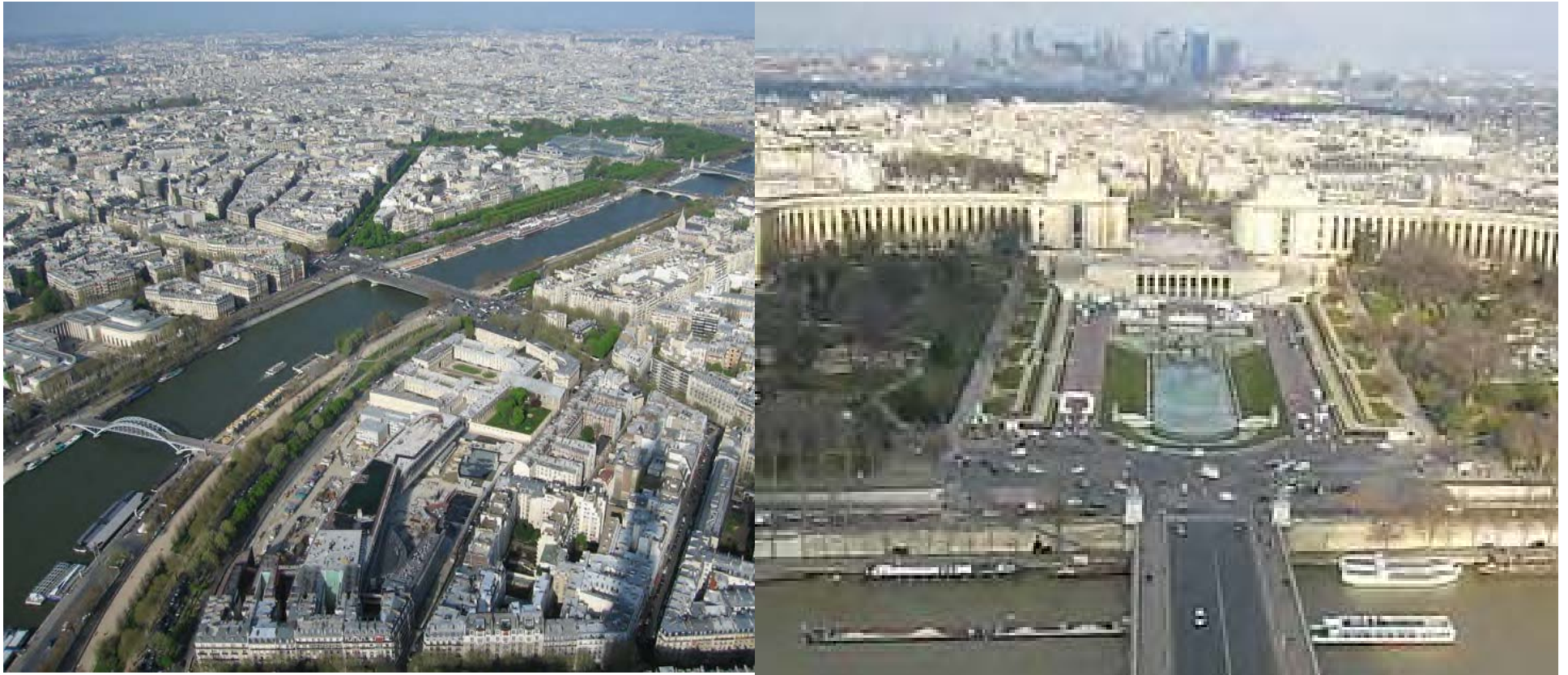






***“The vista is superb. Mont-Valerien, Montmartre, Sannois seem small gray blots; the forest of Saint-Germain grows blurred in the blue clouds; The Seine becomes a quiet brook, furrowed by the boats of Lilliput, and Paris a cardboard model”***

**RE: reporter’s impressions of the view from the top of the Eiffel Tower, March 31, 1889**









***“At a height of 350 feet, the earth is still a human spectacle...But at 1,000 feet, I felt completely beyond the normal conditions of experience. At 350 feet one can admire the fact that such a puny being as man has accomplished the marvelous work that this infinite city represents; at 1,000 feet one no longer understands why man went to the trouble.”***

**RE: *Le Temps* journalist’s impression of the Eiffel Tower’s height, March 1889**

***“At the top of the tower, one would be in a kind of climate comparable with that of much higher mountains...The opinion, expressed by several doctors, that one could remain on the third platform with a therapeutic purpose...Indeed, the staff, and in particular women employed in the shops on the various platforms, and even patients or convalescents, notice a very significant improvement of the general condition, in particular an increase in appetite and the regulation of nutrition in general”***

***“There were two staircases from the ground to the first platform, one each for up and down traffic; they were wide, easy to negotiate and were provided with numerous landings as the direction changed. Between the first and second platforms, two up and two down spiral staircases two foot wide were provided; stairways from ground to second platform were designed to accommodate 2,000 people per hour. From the second platform to the peak a staff-only spiral staircase 196 feet high was built.”***











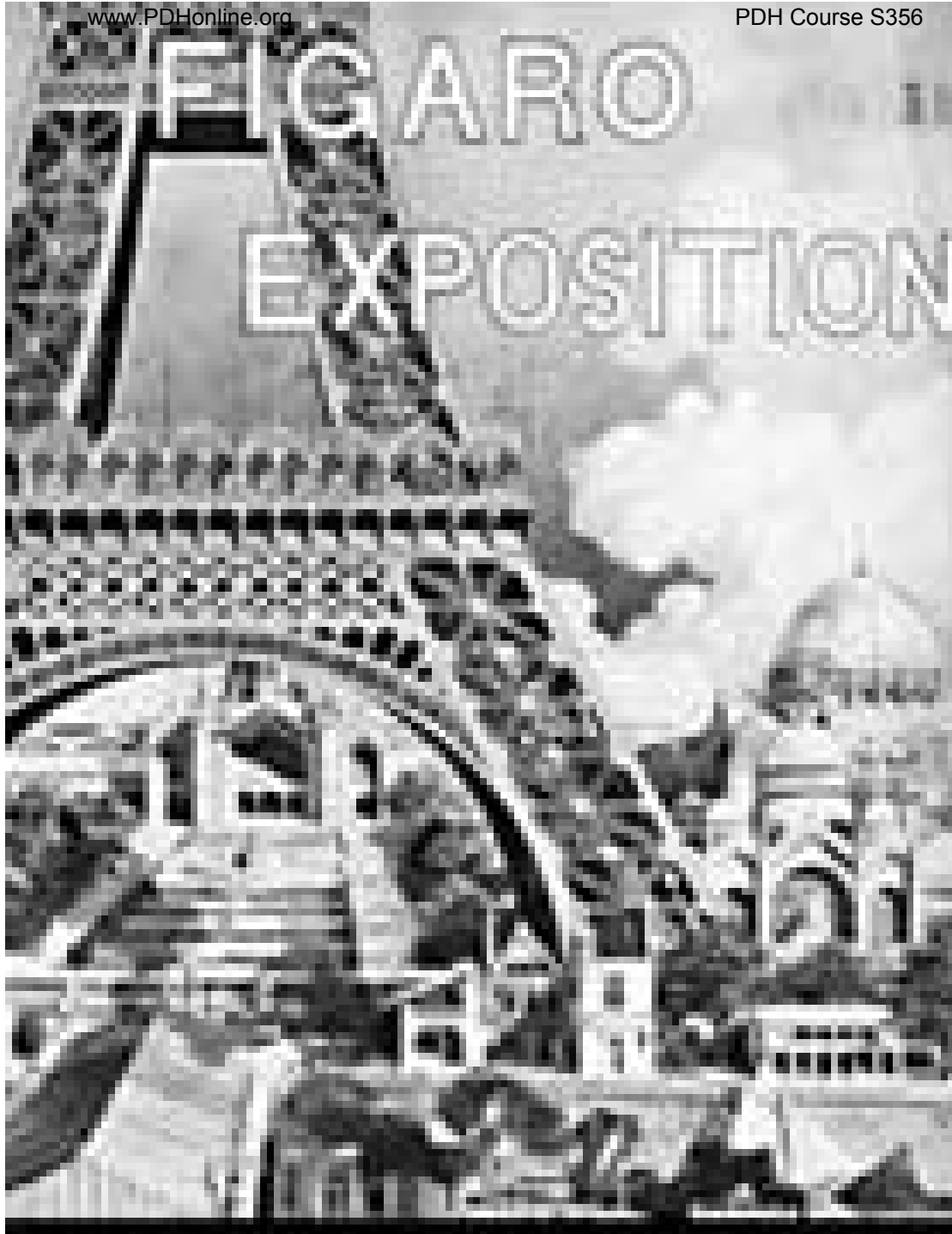




**The exhibition was a financial success with attendance totaling 32.5 million and a profit of 8 million francs. The Eiffel Tower attracted an average of about 12K visitors per day. Its income (for the seven months of the exposition) totaled 6.5 million francs, just one million francs short of the actual construction cost.**







**The Paris daily *Le Figaro* installed a printing press and newspaper office on the second platform where it produced special editions during the exposition (a patisserie and refreshment area was also located on the second platform)**







***“Outside on a surrounding balcony were installed tracks for the operation of two high-powered mobile spotlights with a range of seven miles (the electric lamp on top of the campanile was visible from a distance well over 100 miles). These were to be used to illuminate the city’s monuments in evening performances...this would be the year (1889) that Paris would adopt the lighting of public buildings on a grand scale and thereafter be known as: ‘The City of Light.’”***



**Illustration of the Eiffel Tower's electric lights from *Le Figaro*, 1889**

***“The most irresponsible loafer could not fail to pay a tribute of admiration to France for the magnificent scope of plan and completeness of execution which give this a place above former world’s fairs. The achievement was not cosmopolitan, but French – a worldwide manifestation of French genius, to which the nations of the earth have lent helping hands. It is the outcome of her best qualities – method, organization, executive ability, a liberal conception, exactness of detail, finish, industry, the desire for knowledge and for its diffusion, the love of art, and above all, taste.”***

**RE: much acclaimed success of the 1889 Paris Exposition**



**One sour note concerned the marginalization of the *Impressionist* painters at the 1889 Paris Exposition. It was only through the efforts of Paul Gauguin that grudgingly, impressionist works appeared on the walls of the café. Whistler displayed at the American Pavilion, but withdrew under protest when not enough of his works were displayed (he then accepted a display in the British Pavilion). Van Gogh had planned to attend and display several works, but his mental state was too precarious.**





# Part 4

## La Tour de 300-Meters

# THE SITE





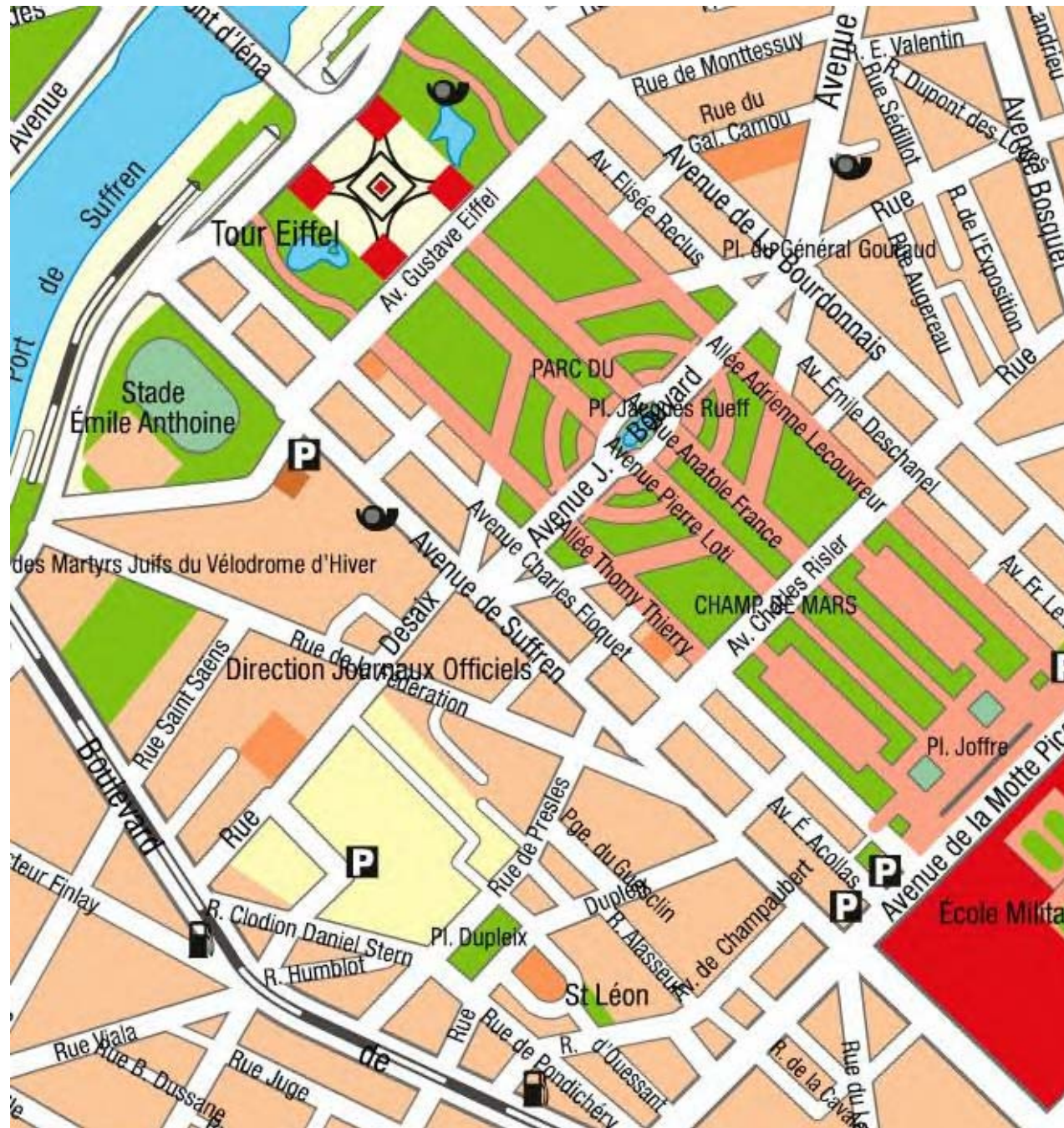




***“What attracts the attention about it is its height. It is 300 meters high! But a high monument ought to be built on a height...But no, it has been placed on the banks of the Seine.”***

**Charles Gounod, Composer**

**RE: debate over locating the Eiffel Tower on the *Champs de Mars* – where the exposition was to be held, rather than on high ground such as near the *Trocadero Palace***









**View of the Eiffel Tower  
from the *Trocadero Palace*  
1889 (left) / Present Day (above)<sup>162</sup>**

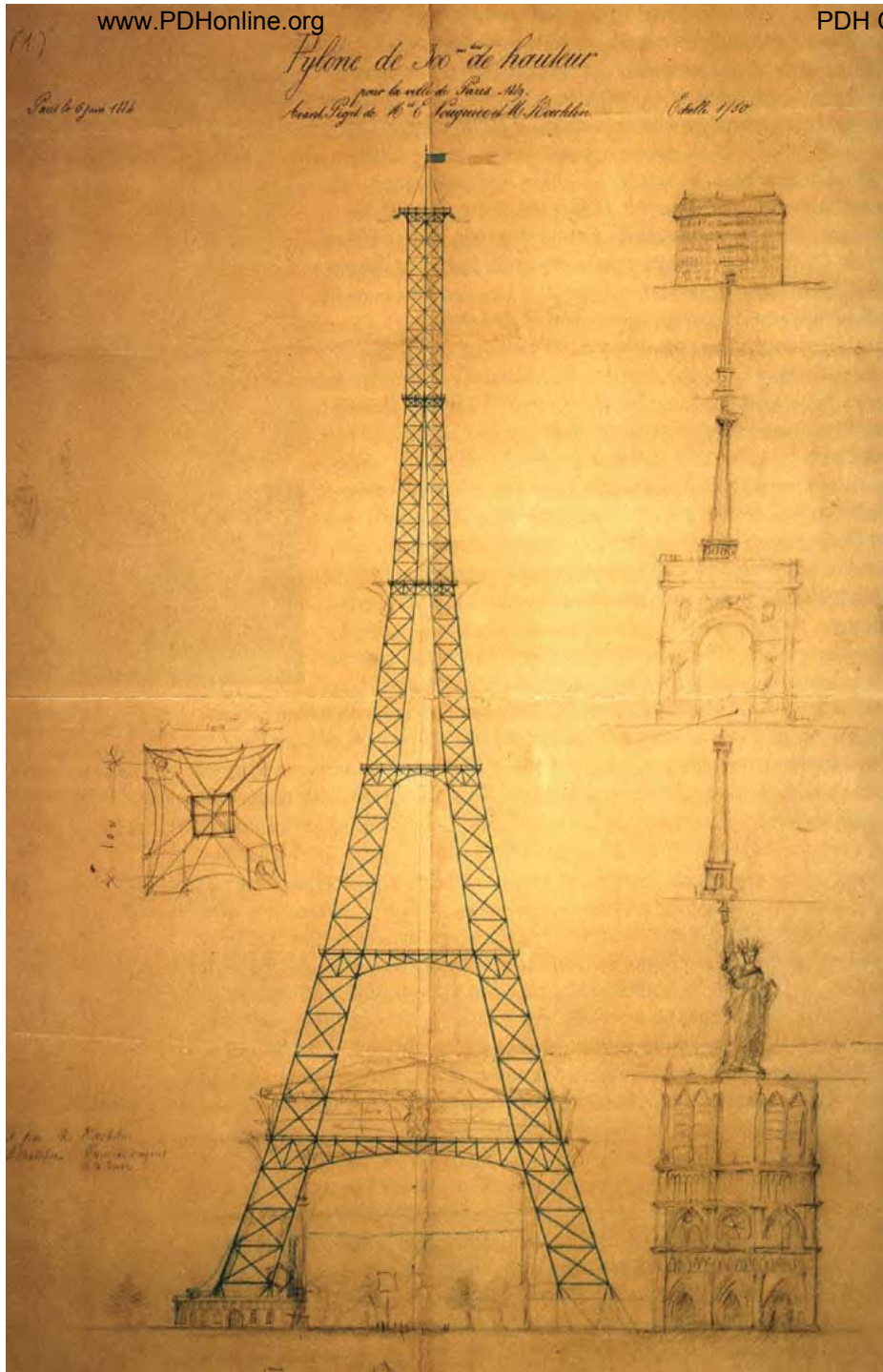


## Modern-Day Trocadero Palace





# THE DESIGN



***“...consisting of four lattice girders standing apart at the base and coming together at the top, joined to one another by metal trusses at regular intervals”***

**Maurice Koechlin, 1889**

**RE: recollection of M. Eiffel’s colleague for their entry in the 300-meter tower competition**

www.PDHonline.org PDH Course S356 www.PDHcenter.com  
***“...the preliminary draft for the construction of a large 300-meter pylon that two of my company’s more distinguished collaborators, MM. Emile Nouguier and Maurice Koechlin, presented to me for the exhibition of 1889 recognized, after our shared study, the problem of a 1,000-foot tower. They associated the architect M. Sauvestre with the architectural part of the project. I did not hesitate to assume company responsibility for the enterprise...Though I myself directed the final studies and the execution of the work with the assistance of the company’s engineers, I happily give my usual collaborators MM. Nougier and Koechlin their due acknowledgement...M. Maurice Koechlin principally followed all the studies with a scientific zeal to which I gladly pay homage.”***

**Gustav Eiffel**

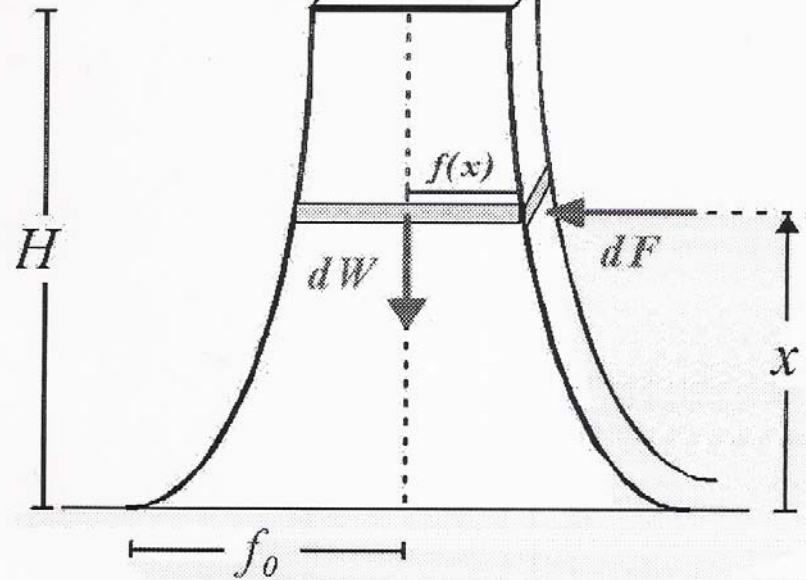
**RE: Eiffel bought the patent rights from his three colleagues on 12/12/1884. Their names would be associated with the project and be paid 1% of the cost estimate. Under a settlement reached in 1888, each received 50K francs.**





***“He employed the concept of a wind of 148 mph at the top of the tower, reducing to 105 mph at the base; not only that, he assumed for the purposes of calculation that the structure was to be solid, instead of the open lattice that he intended; in addition, he made an allowance of 800-tons for the weight of the visitors.”***



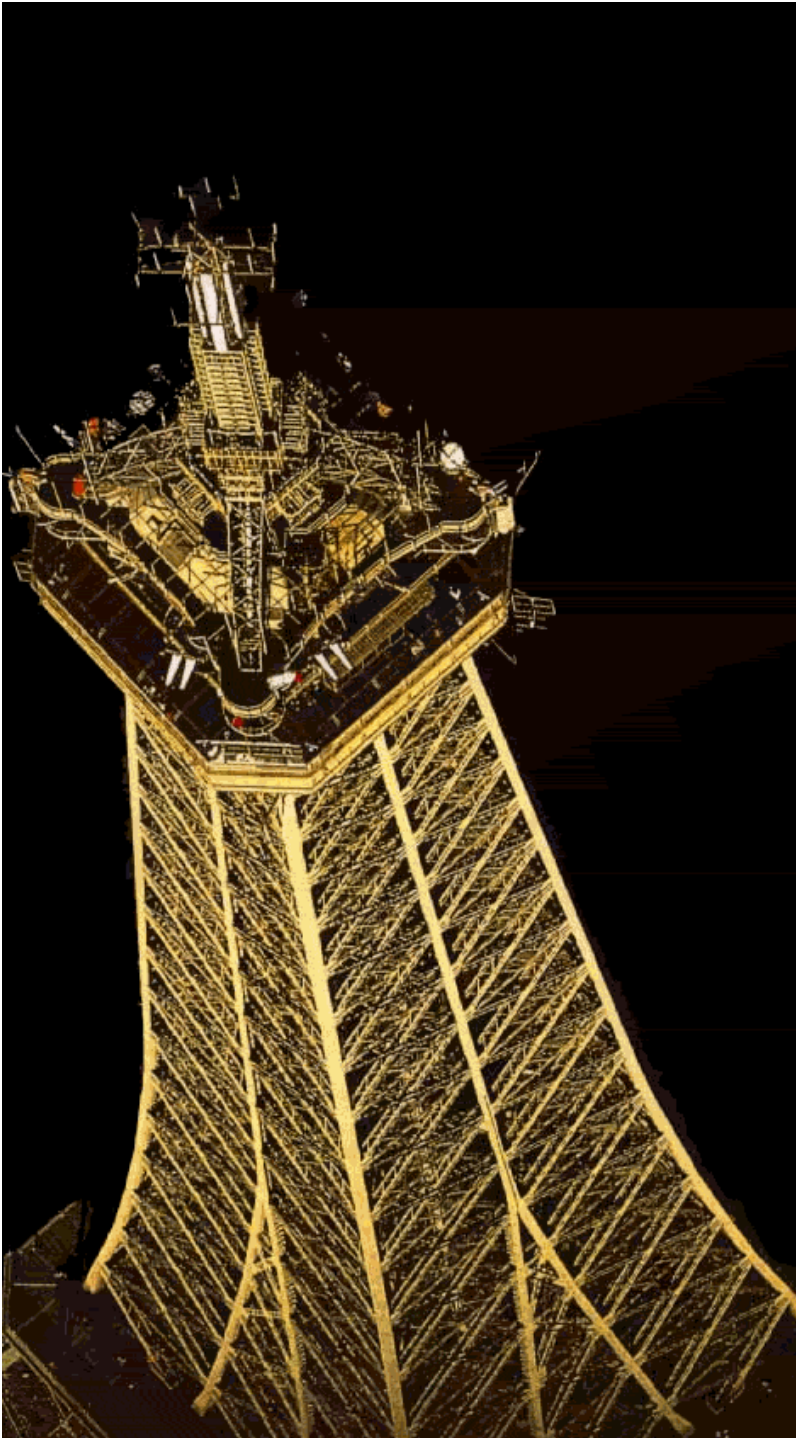


***“All the cutting force of the wind passes into the interior of the leading edge uprights. Lines drawn tangential to each upright with the point of each tangent at the same height, will always intersect at a second point, which is exactly the point through which passes the flow resultant from the action of the wind on that part of the tower support situated above the two points in question. Before coming together at the high pinnacle, the uprights appear to burst out of the ground, and in a way to be shaped by the action of the wind.”***

**Gustav Eiffel**

***“...to give the angles of the tower such a curve that it should be capable of resisting the transverse effects of wind pressure, without necessitating the connection of the members framing these angles, by diagonal bracing. The Eiffel Tower, therefore, consists essentially of a pyramid composed of four great curved columns, independent of each other, and connected together only by belts of girders at different stories, until the columns unite upwards towards the top of the tower, where they are connected by ordinary bracing.”***

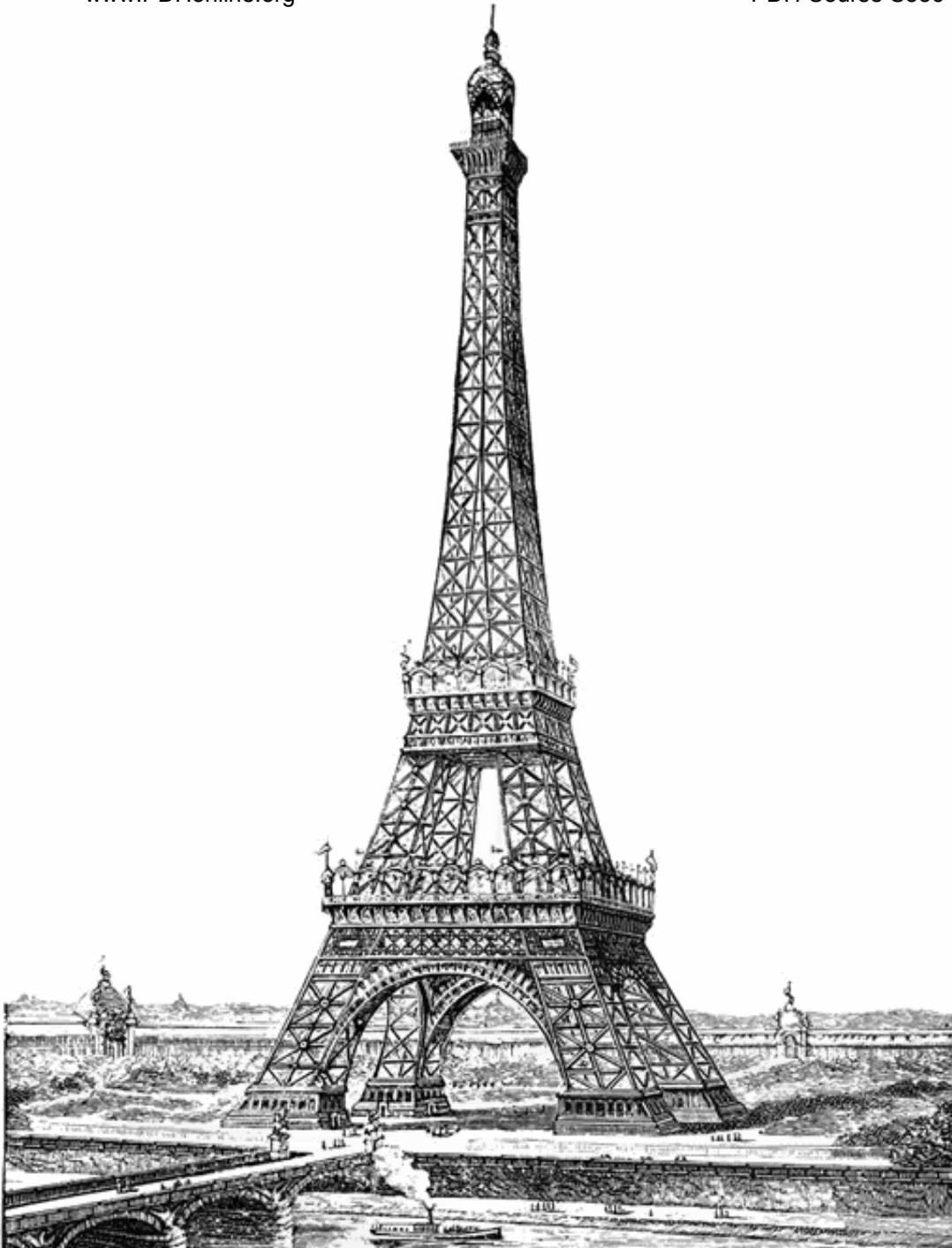
***Journal Engineering***



***“This unusually high building, as proposed by us, therefore required an otherwise new material, but one that at least the industry had not made available to the engineers and architects who had preceded us...it would have to be exclusively wrought iron or steel, by the use of which the most difficult problems of construction are simply resolved, and which we fluently construct frameworks or long-span bridges that would have appeared oppressive”***  
**Gustav Eiffel**





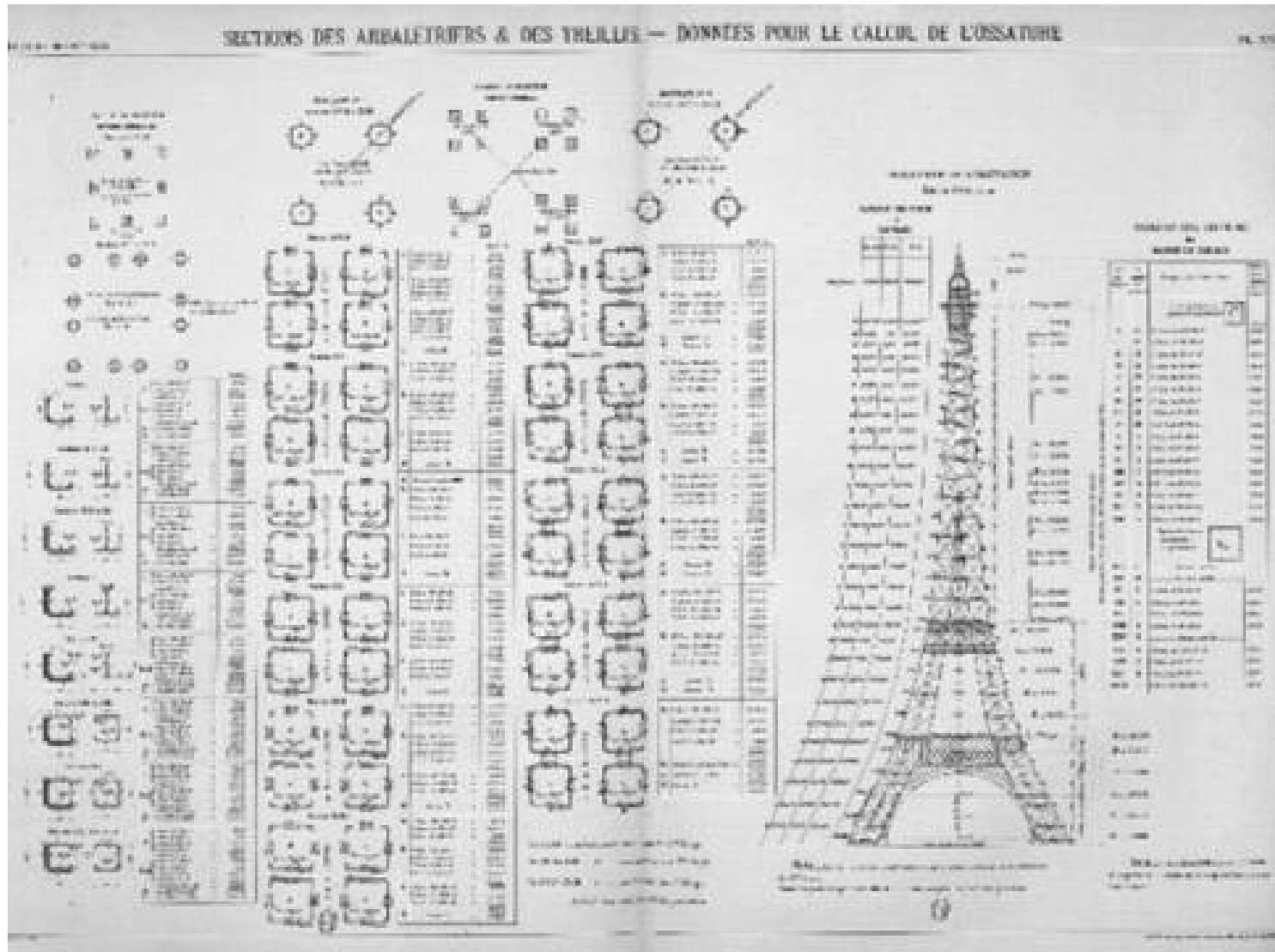


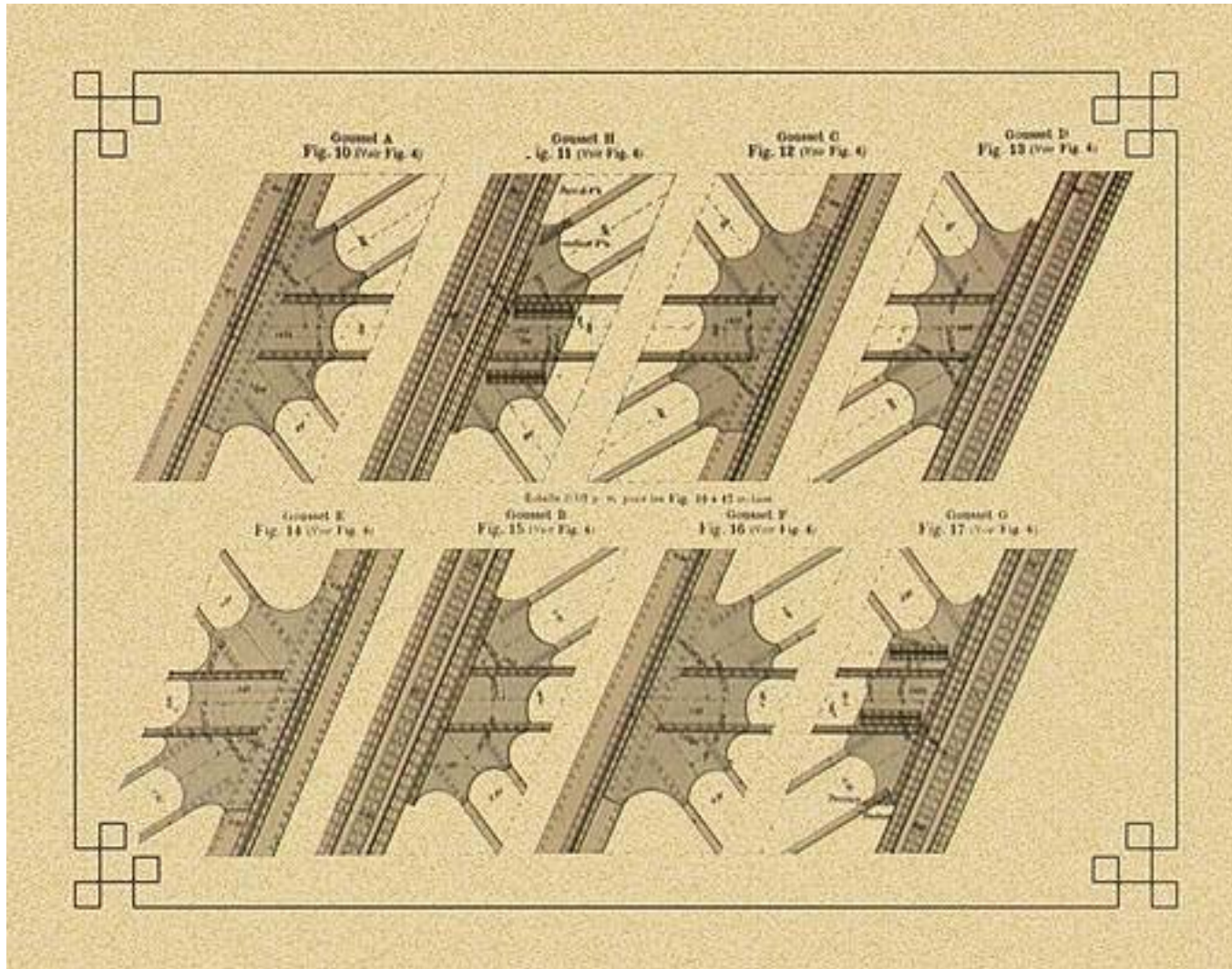
***“Many beautiful designs are founded upon the tapering forms of flowers and leaves...In building to secure safety from the action of the elements, M. Eiffel has perhaps unintentionally followed the methods of nature, and thus the architectural beauty of his work has the best possible confirmation”  
Atlantic Monthly***



***“We established by the drawings of each isolated part, calculated with a rigor requiring the constant use of logarithms, the positions of each different rivet-hole by which its relationship to its neighboring part would be achieved. The spacing of the holes was calculated mathematically to a tenth of a millimeter. Each part thus required a particular study and an individual drawing usually drawn half-size for the small parts and one-fifth for larger parts.”***

**Gustav Eiffel**





# Gussets

### Détail J (voir Fig. 1 et 2)

Échelle 0<sup>m</sup>10 p. m. (1/10)

Fig. 33. Élévation latérale      Fig. 34. Élévation de face  
10 consoles pareilles

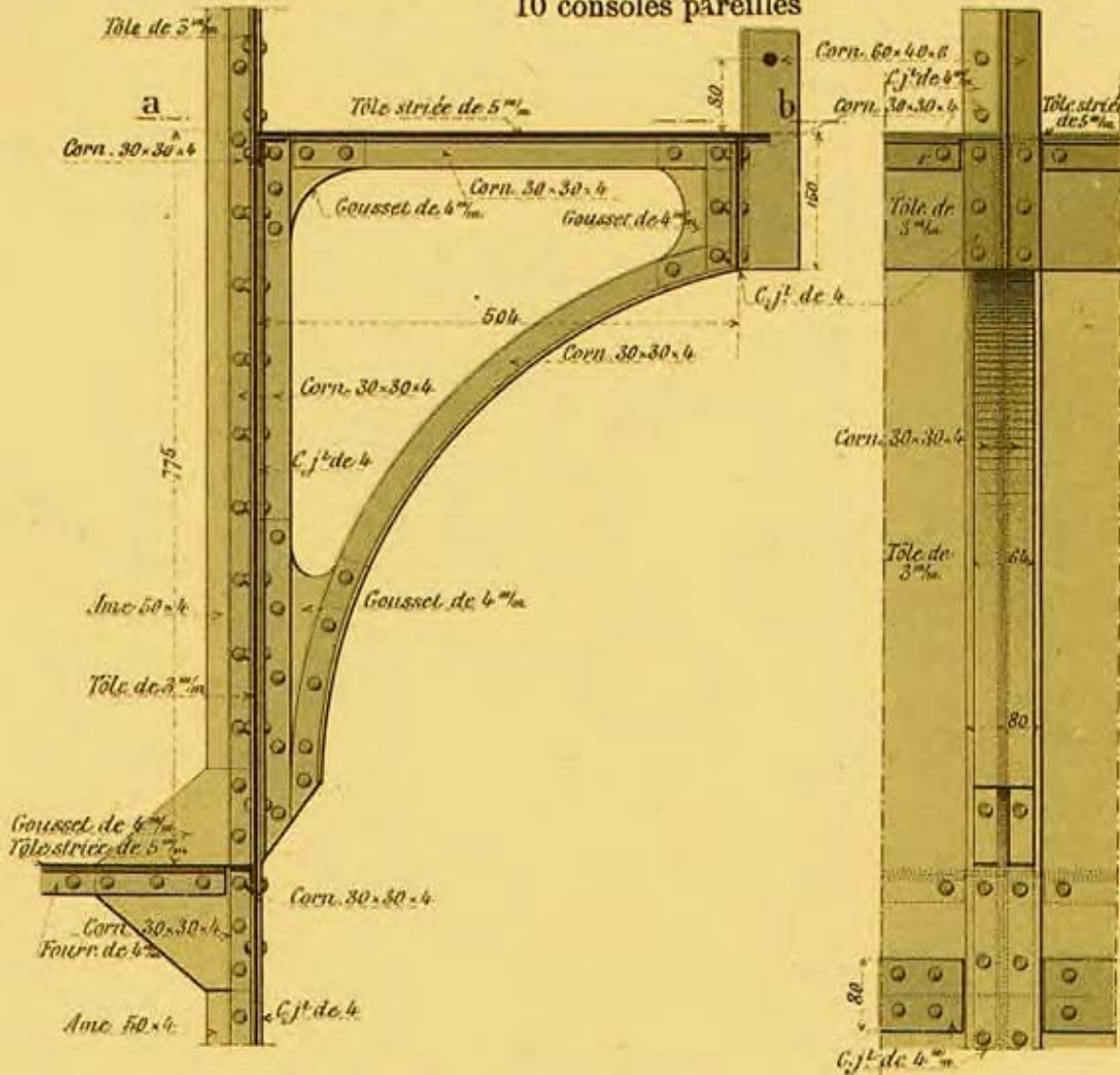
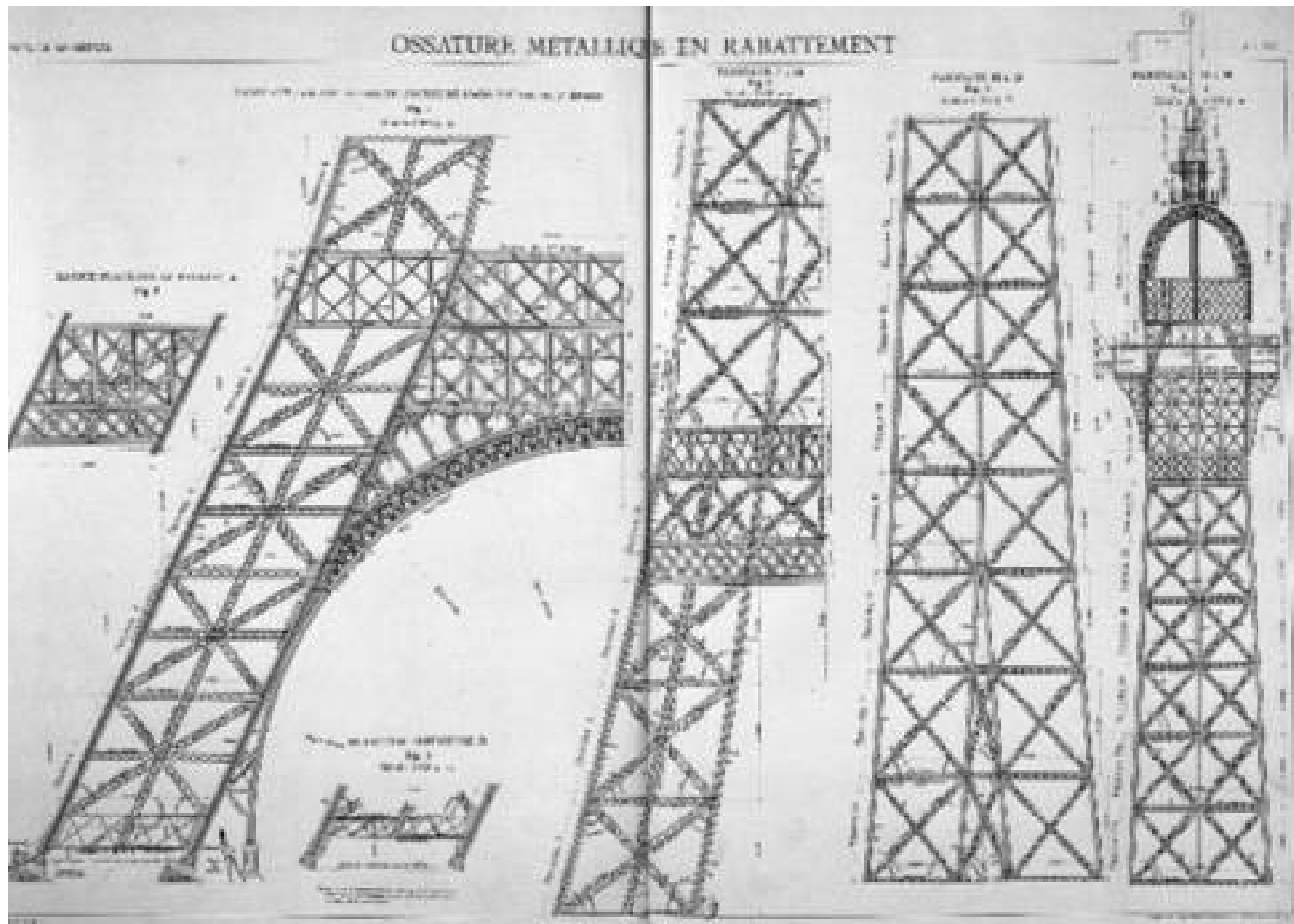
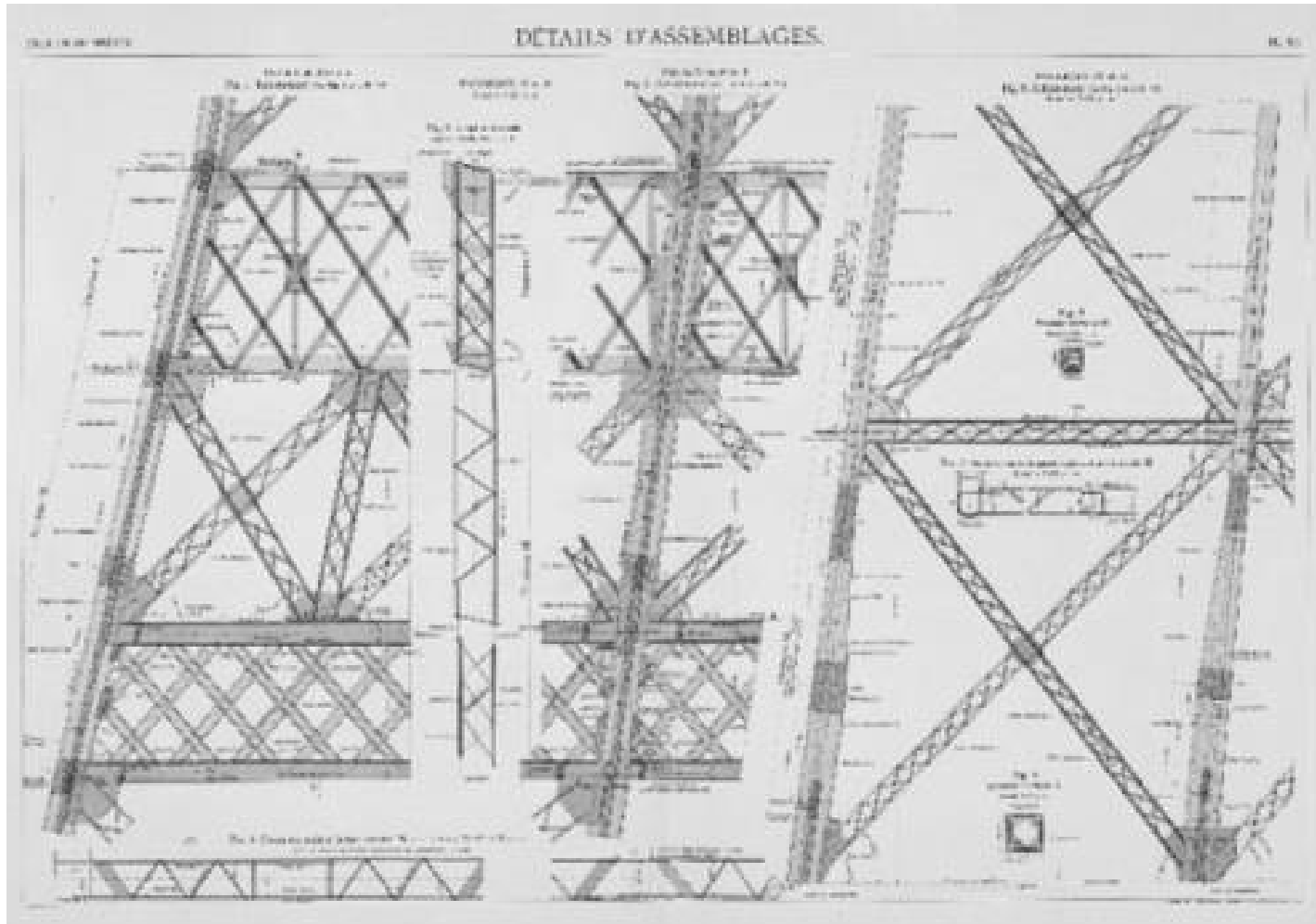


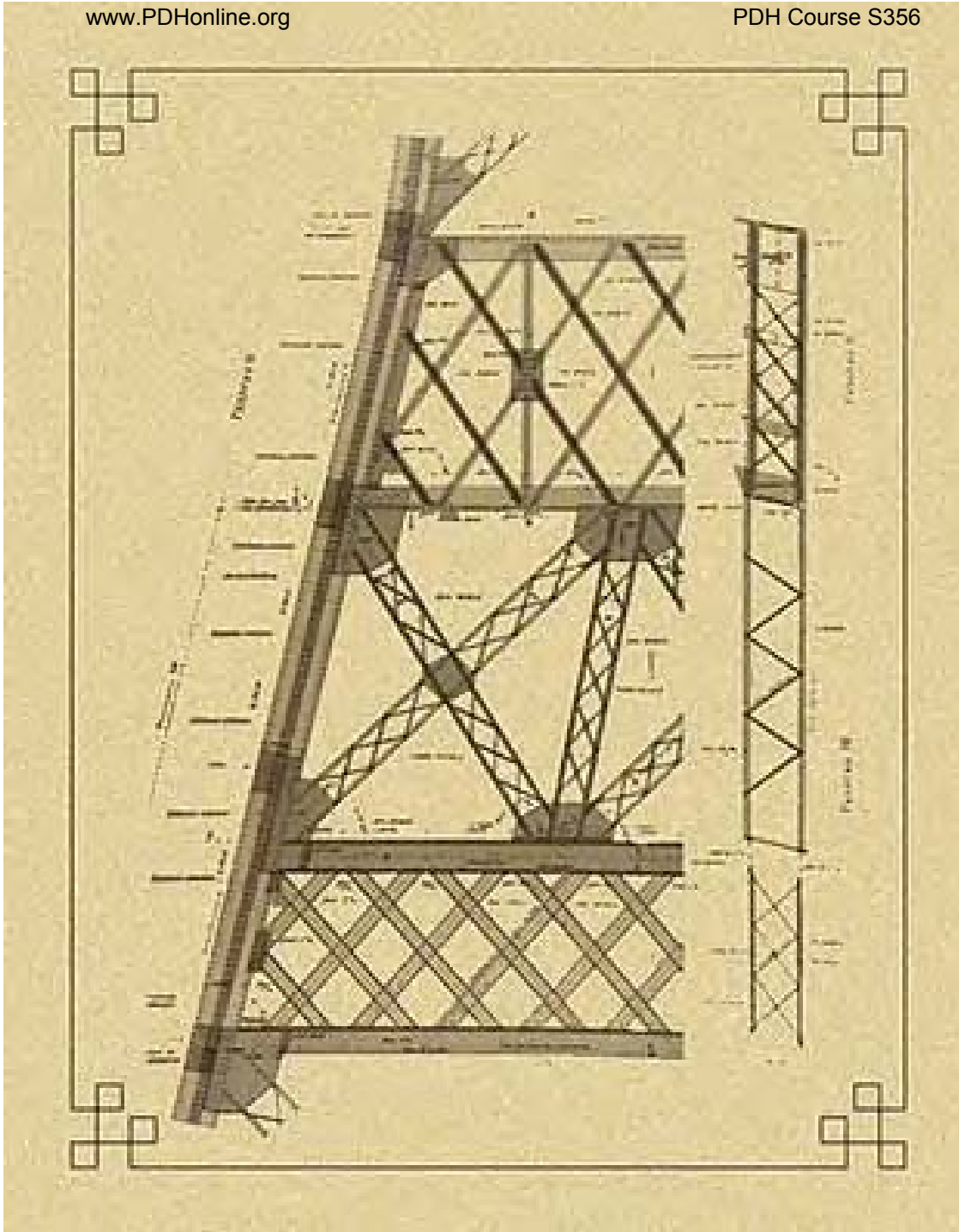
Fig. 35. Coupe horizontale **a b** (voir Fig. 33)  
(Les tôles striées enlevées)

# Gusset Details

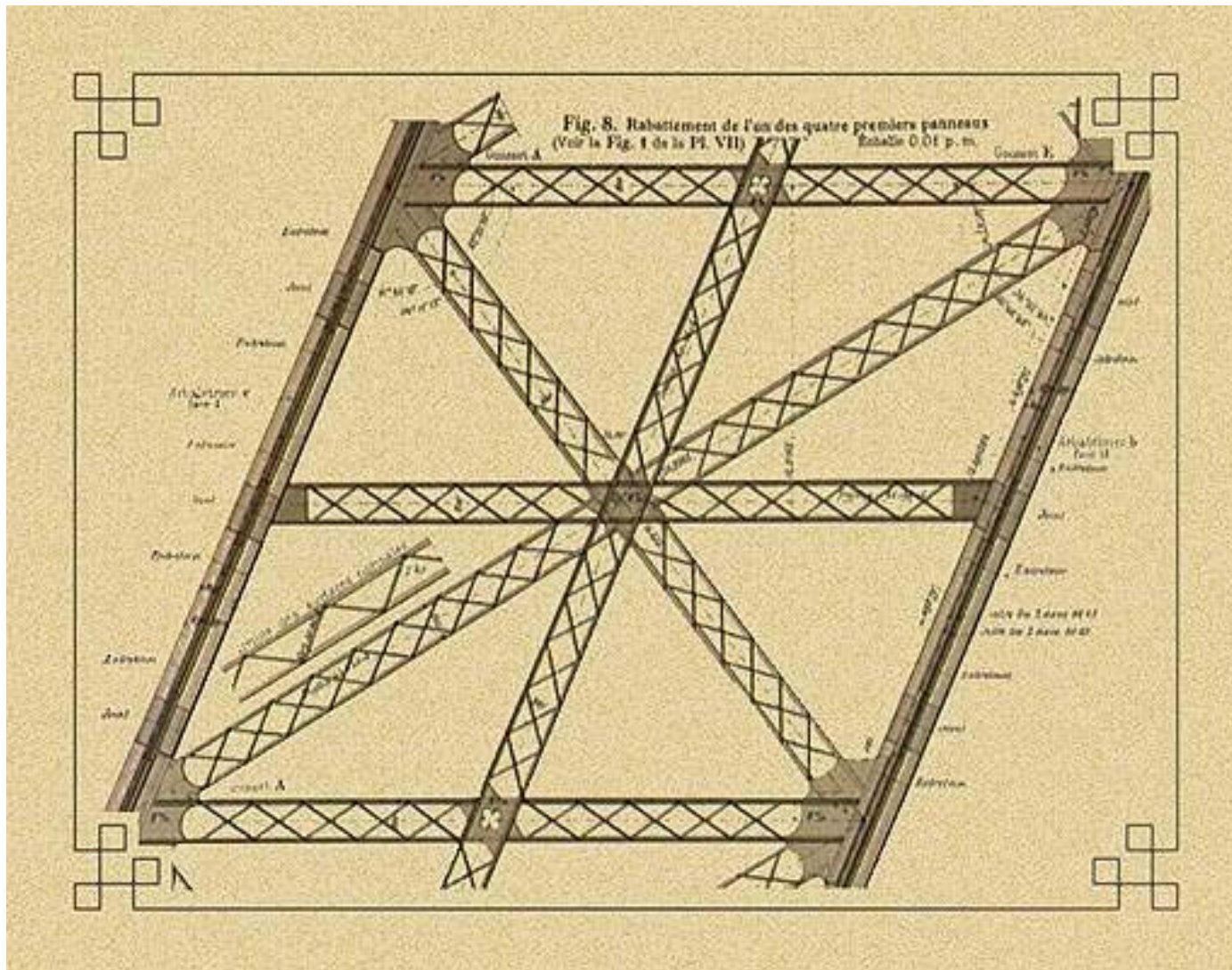




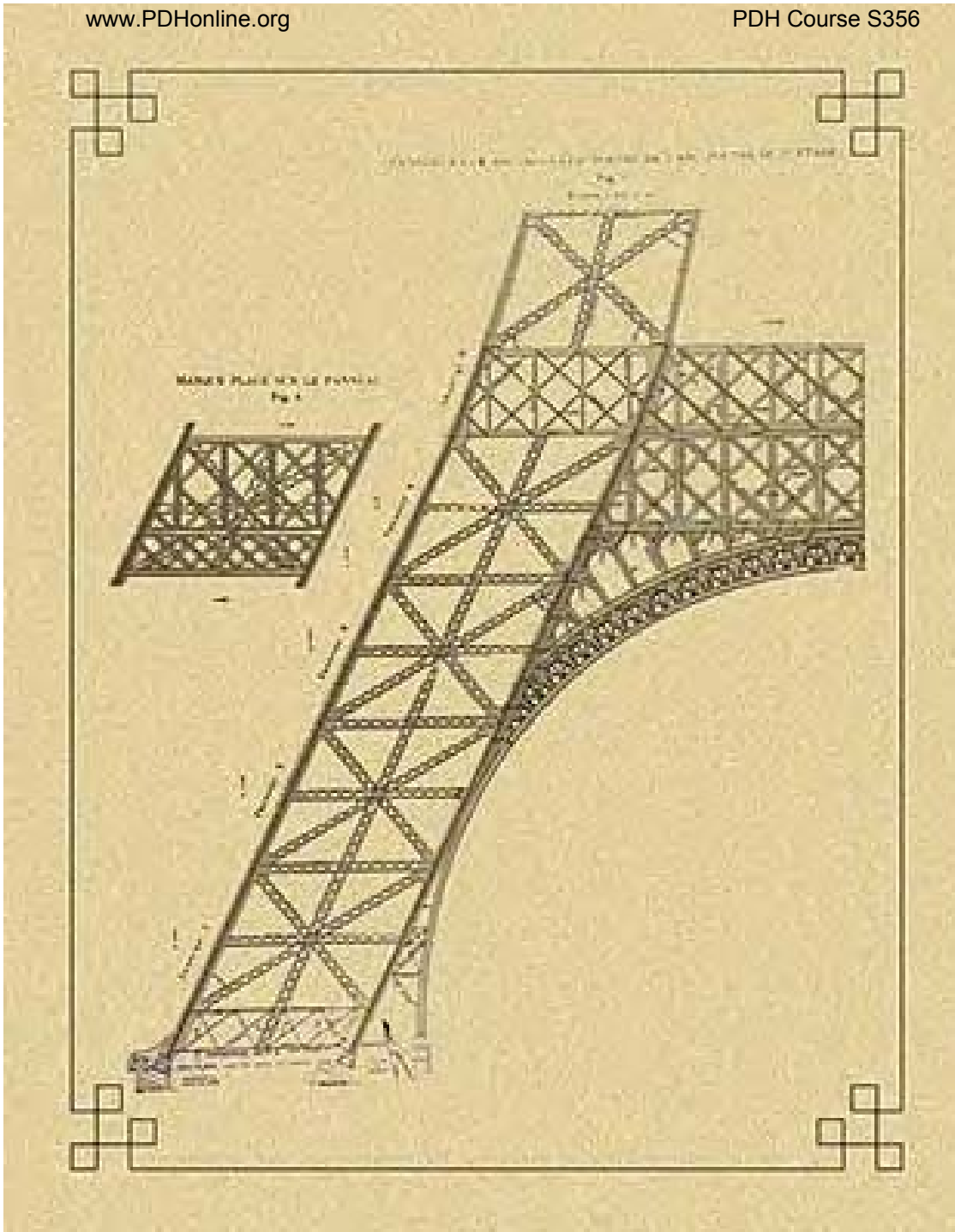




## Detail of the First Floor Structure



# Rotation Movement of one of the four First Panels



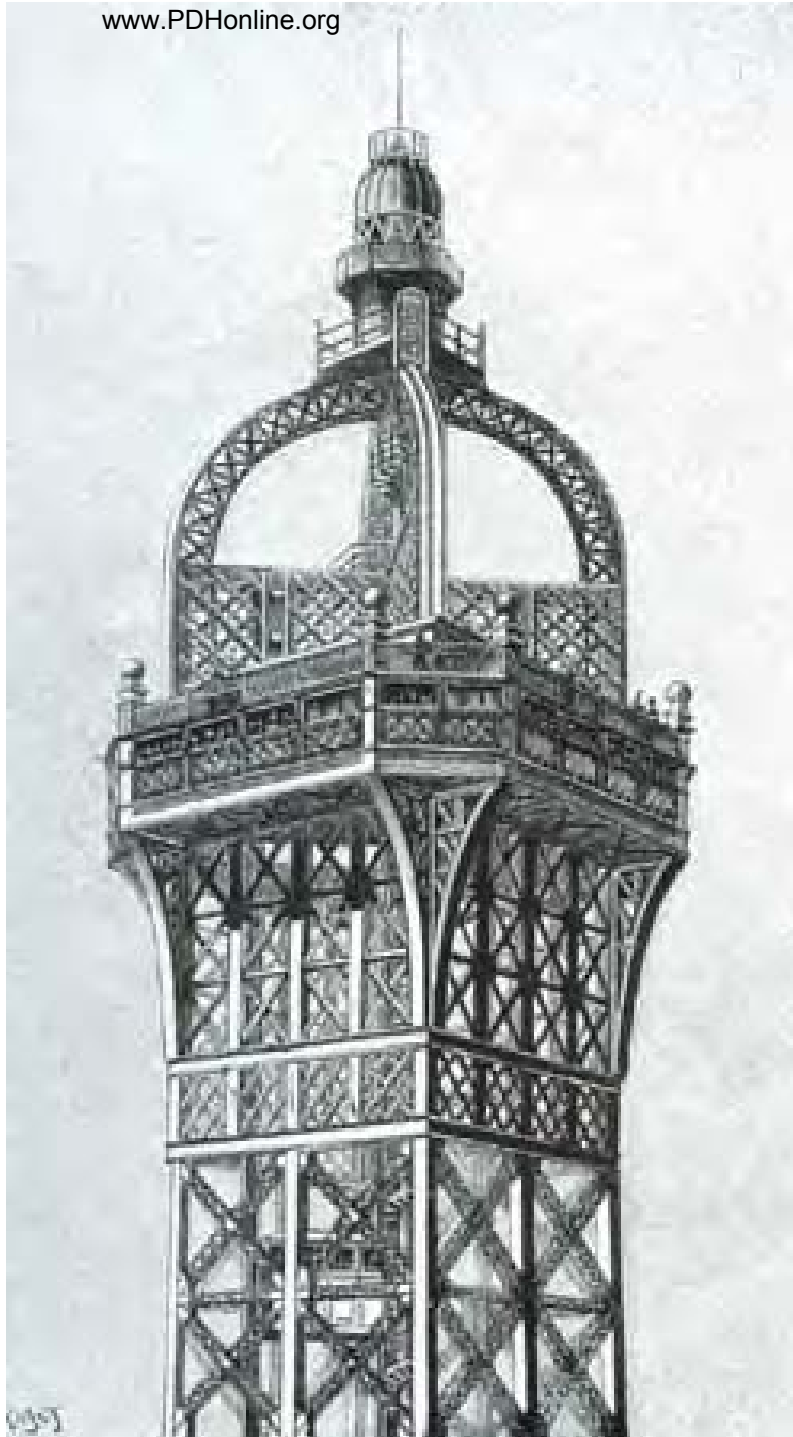
***“The curves of the four piers rising from an enormous base and narrowing toward the top, will give a great impression of strength and beauty”  
Gustav Eiffel***



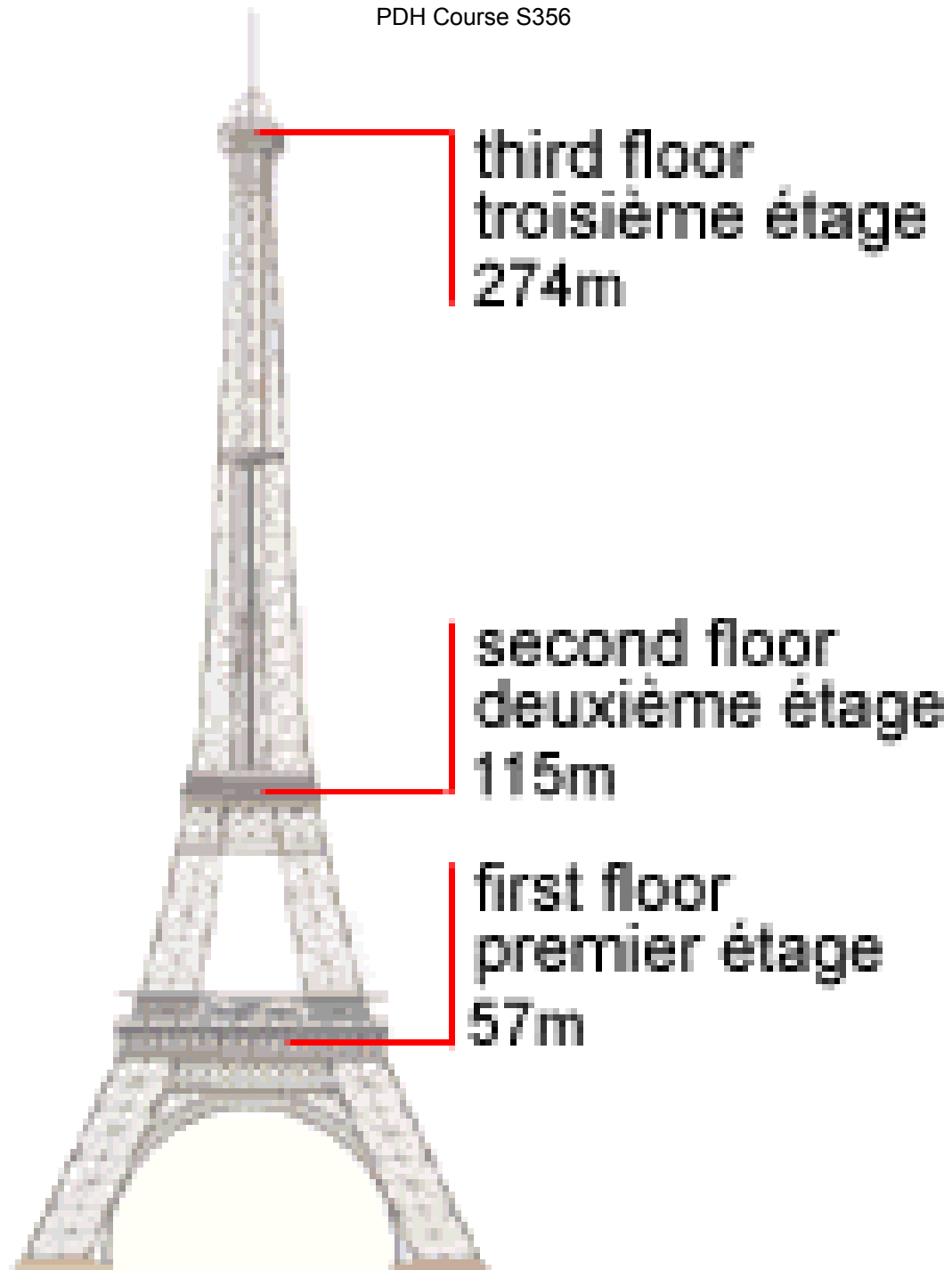








***“Its 172 square foot platform was at a height of 906 feet. Above this was a campanile incorporating a scientific laboratory, with a spiral staircase leading to an upper gallery twenty feet in diameter surrounding a 22 foot-high lantern with a powerful central lamp and a series of lenses in the national colors of France; under this light were installed two powerful projectors on tracks. The final height of the tower was 986 feet. Later, a spire and communications antennae were added, bringing the total height to 1,053 feet.”***

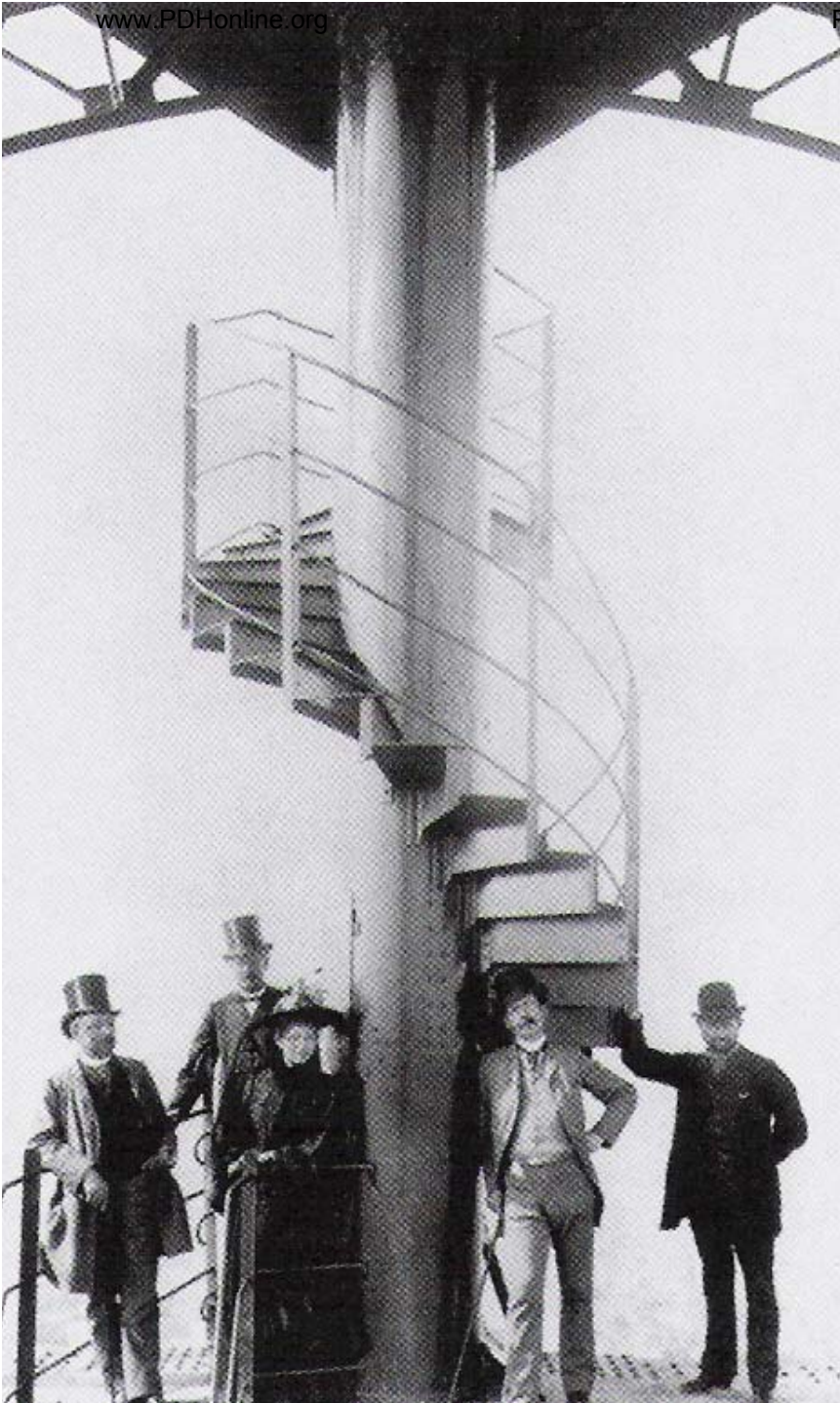


third floor  
troisième étage  
274m

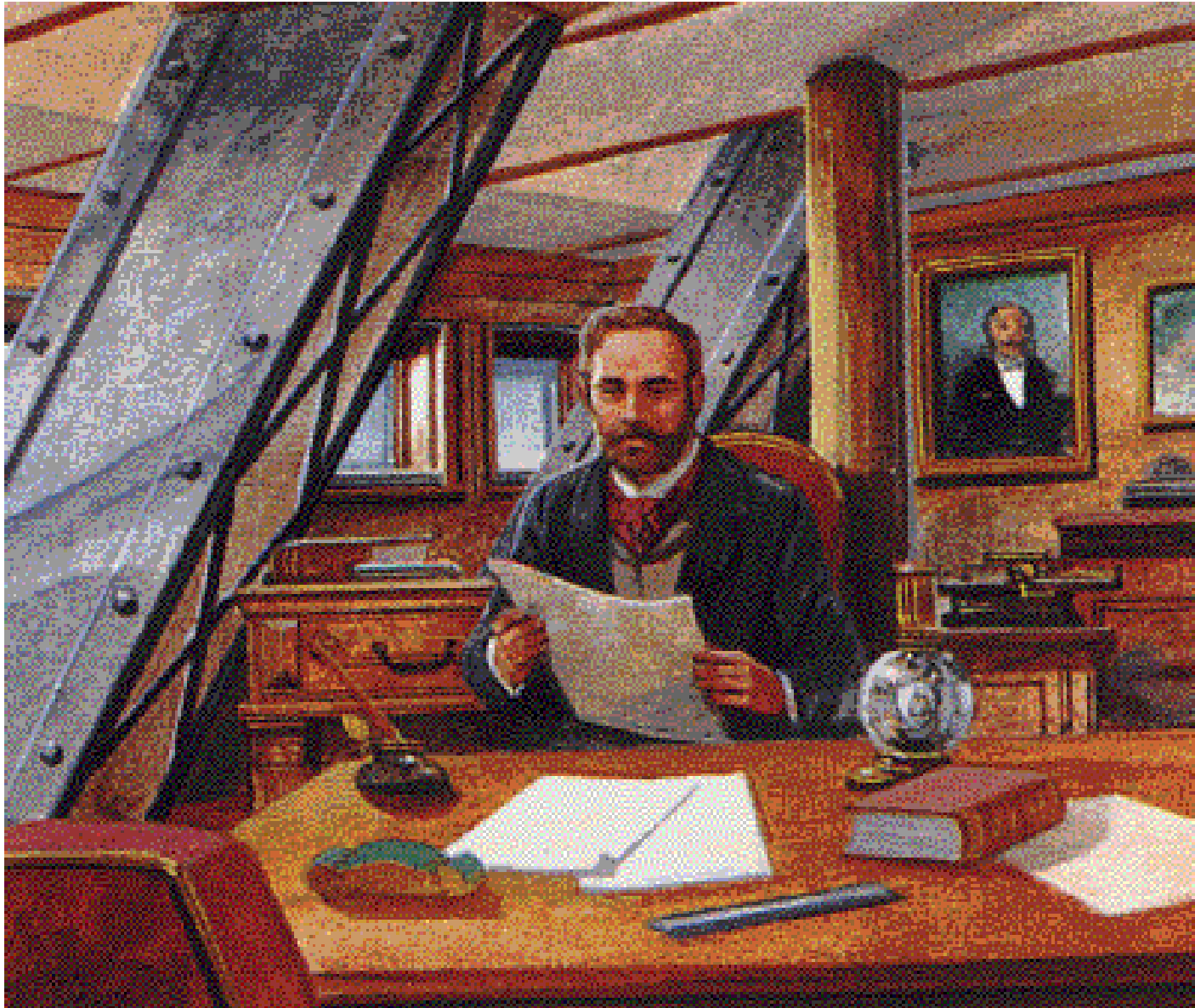
second floor  
deuxième étage  
115m

first floor  
premier étage  
57m



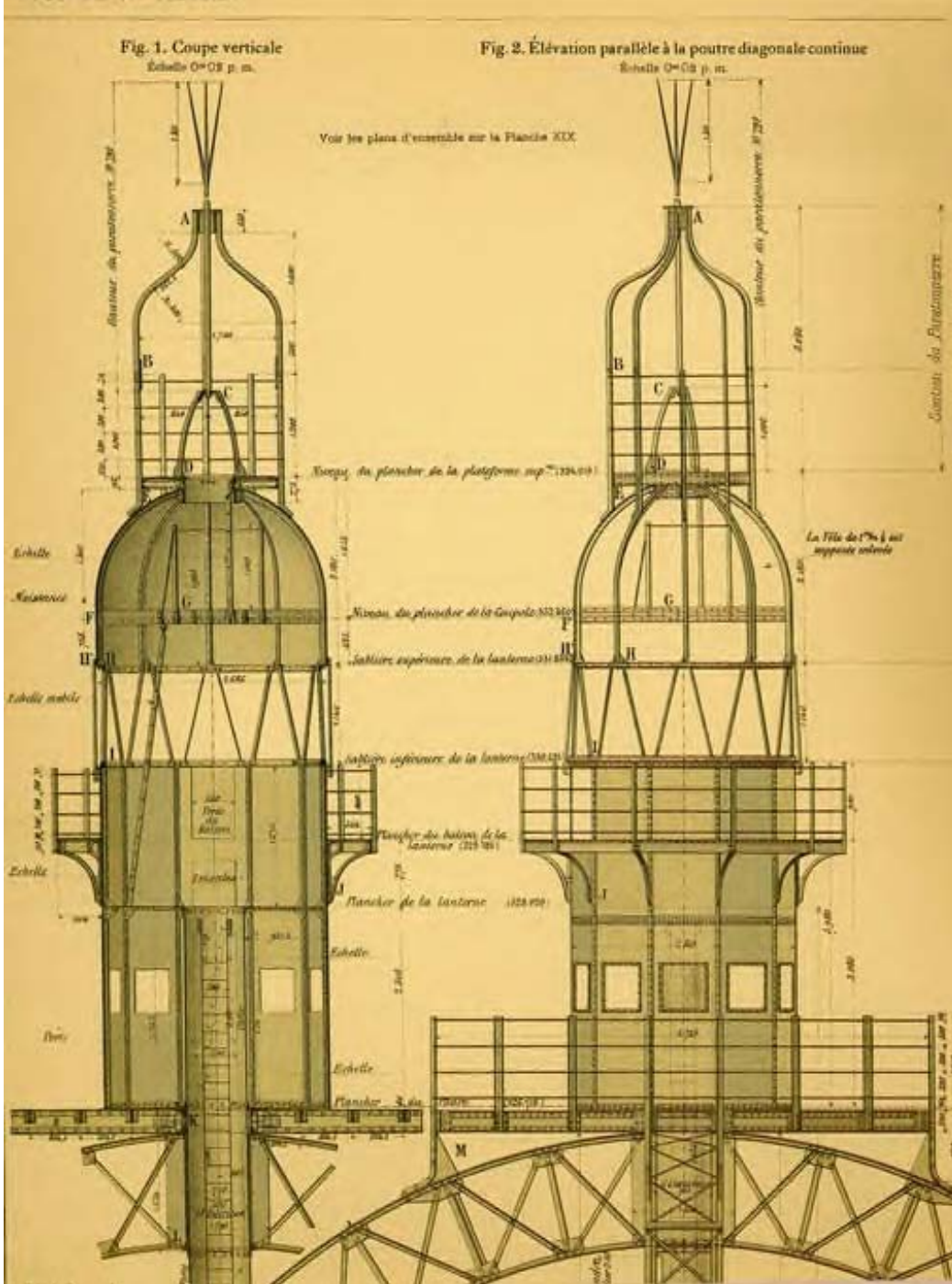


***“The small octagonal third platform at a height of 906 feet was entirely enclosed behind glass panels and provided the highest point to which the public was normally admitted. However, guests who were permitted to climb the short spiral staircase would reach another level, just below the campanile, which contained three small laboratories for the study of astronomy, physics, meteorology and biology, as well as a small furnished apartment reserved for Eiffel himself, intended for guests rather than a living accommodation.”***



**Eiffel's Private Apartment  
(Below the Campinile)**





***“The tower’s topmost features (atop the Campinile) were eight lightning rods which were connected to three-inch thick conductors leading deep into the foundations.”***



***“He had decorated the four sides of the first platform with a frieze on which he painted, in two foot-high gilded lettering, the names of 72 French scientists who had distinguished the nation in the previous century.”***



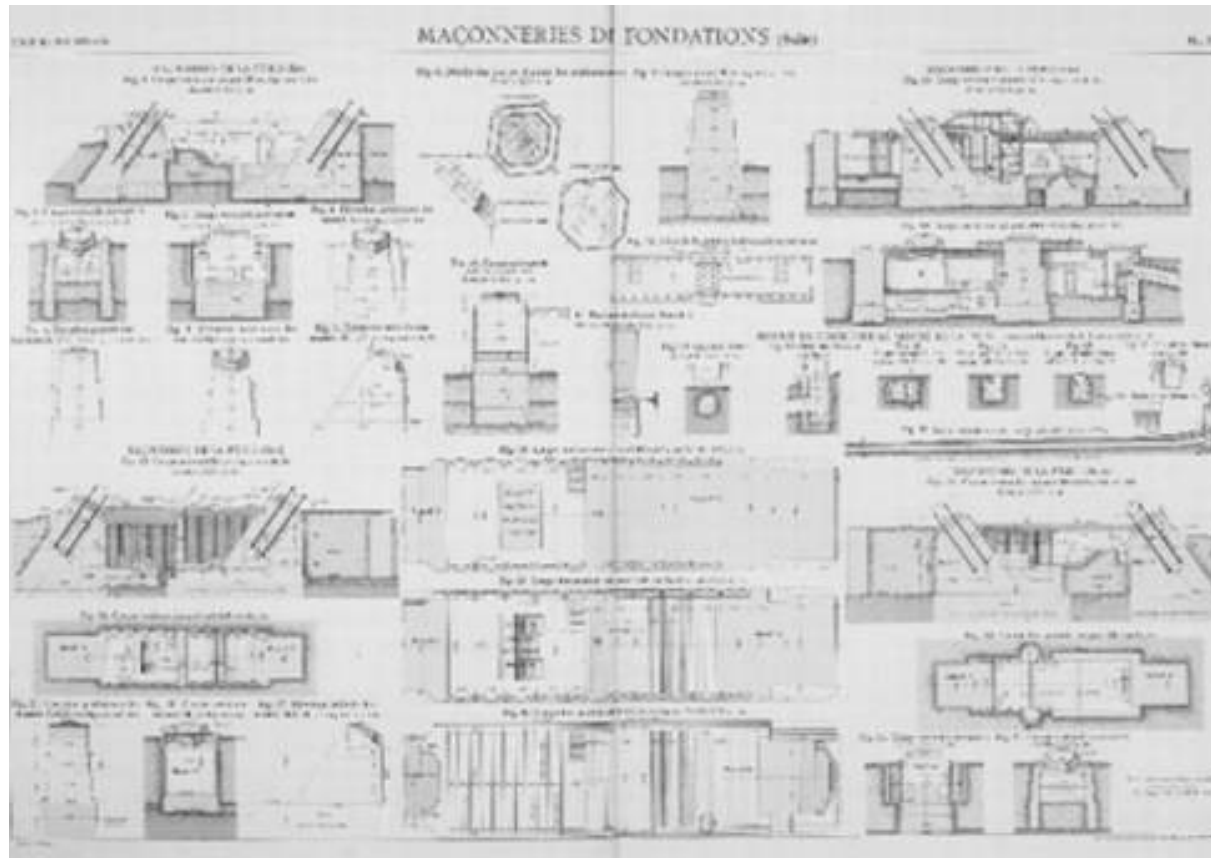
# FOUNDATIONS



***“What are the advantages of metal? Primarily its elasticity...for equal area, iron is 10x more elastic than wood and 20x more elastic than stone...At the same time, the relative lightness of steel constructions makes it possible to decrease the importance of supports and foundations...I have astonished more than one person who worried about the load on the foundations by saying that it would be no greater than that of a Paris house”***

**Gustav Eiffel**





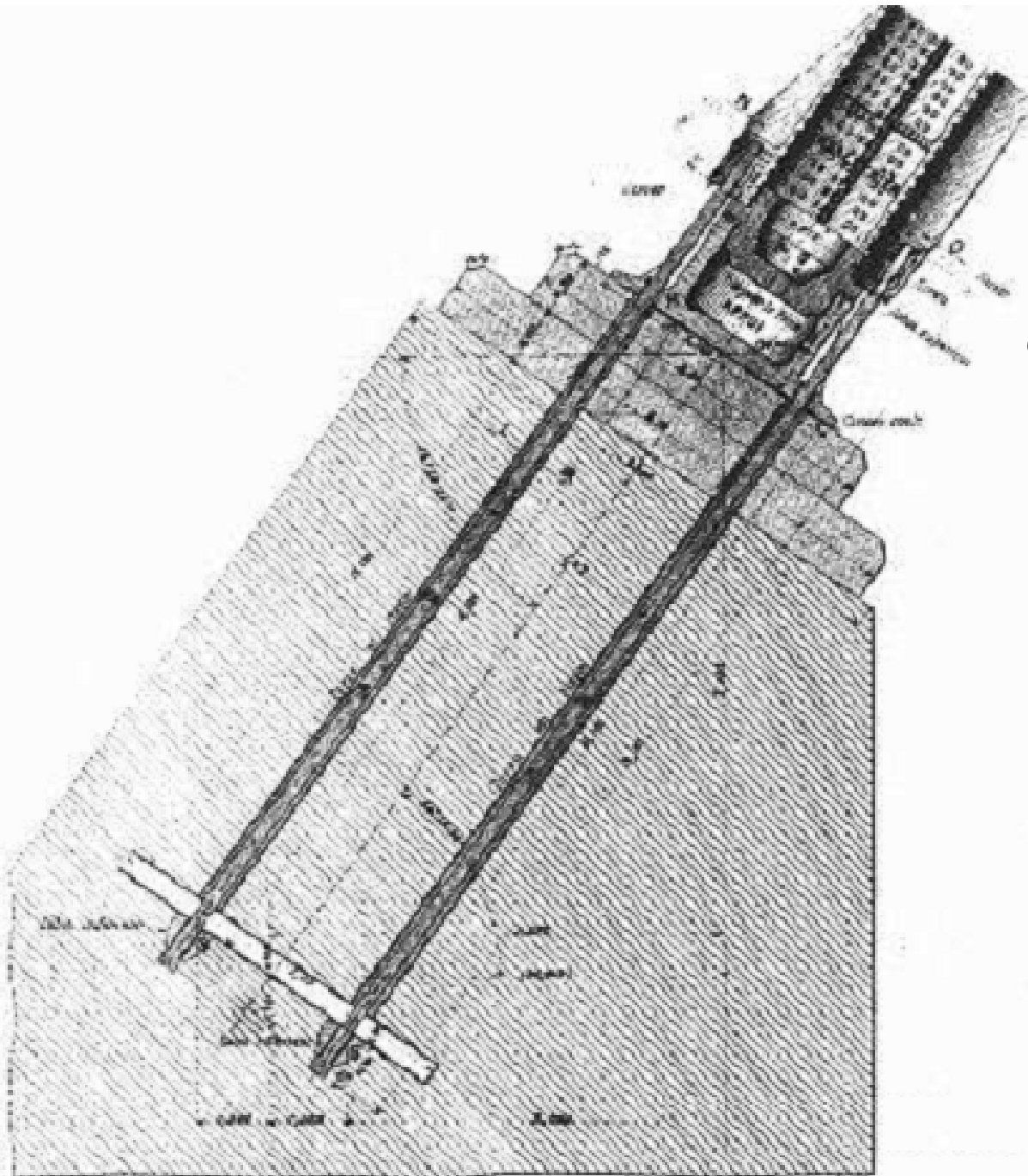
***“Eiffel built sixteen massive caissons, four for each pier, each weighing 34-tons, to be sunk to a depth of 70 feet (five-feet below water level). Each caisson was 50 feet in length by 20 feet wide, and 10 feet in depth.”***





***“Eiffel sank caissons to a depth of 53-feet before feeling confident that he had reached a sufficiently solid bed of firm clay; the foundation blocks farthest from the river could be cast in concrete in the open air, complete with the huge anchoring bolts and pistons with which to adjust angles once the piers were fitted; on the side nearest the river, foundations would have to be constructed inside the caissons.”***





**Into each pier were inserted anchor bolts 26' long by 4" in diameter. Attached to each bolt was a cylindrical iron column which Eiffel designed as a hydraulic piston capable of acting with a force of 800-tons. This allowed the main iron ribs to be precisely adjusted so that at each stage in the construction, accurate horizontal alignment could be guaranteed.** <sup>198</sup>







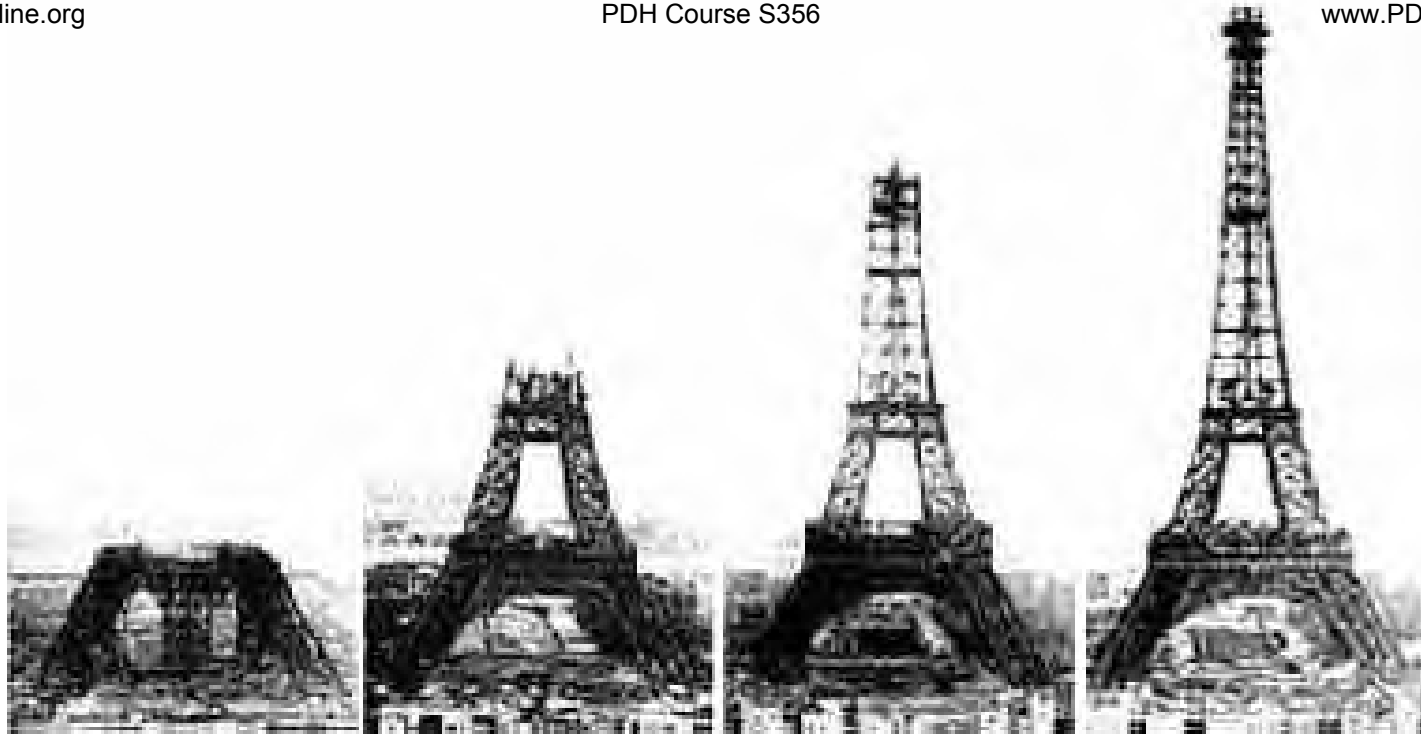
# **TOWER CONSTRUCTION**



***“One saw a masterpiece whose progressive steps first of all seemed to spring randomly into space, then settled into their relative proportions, shrinking themselves to some extent in force and power to leave the eyes of the spectator filled with wonder”***

**Max Nansouty – Civil Engineer, 1889**

**RE: witness to the rising Eiffel Tower**

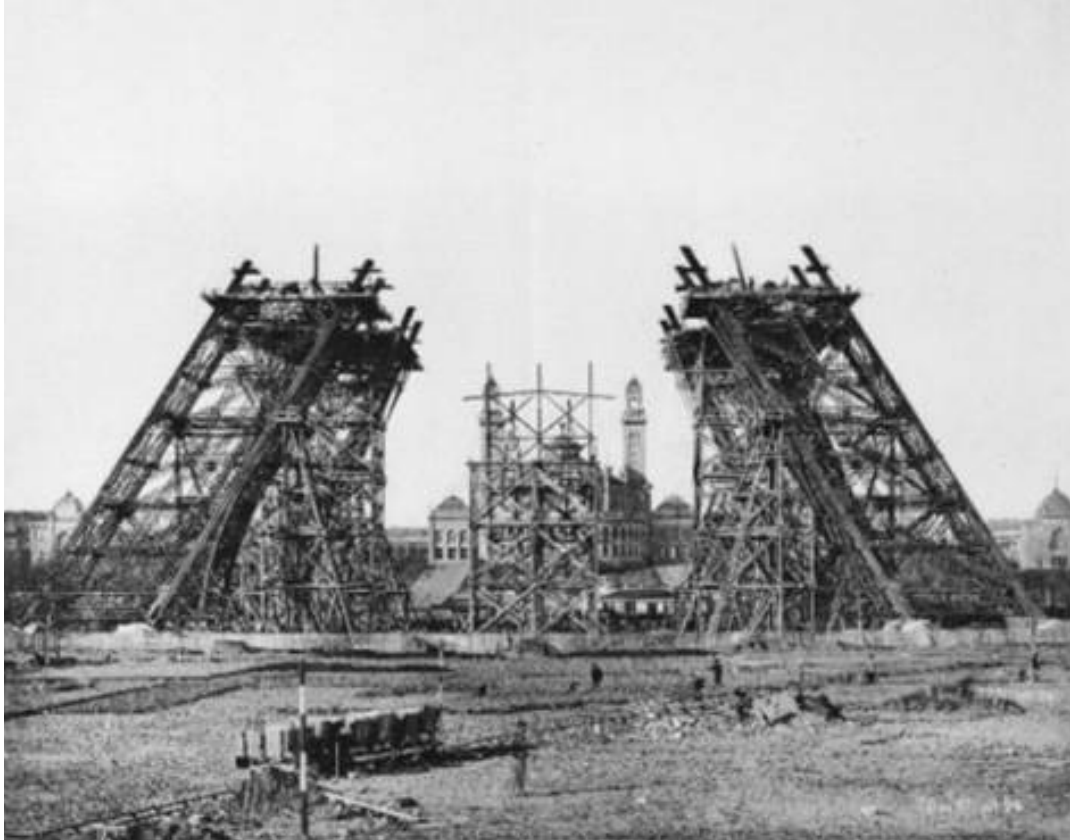
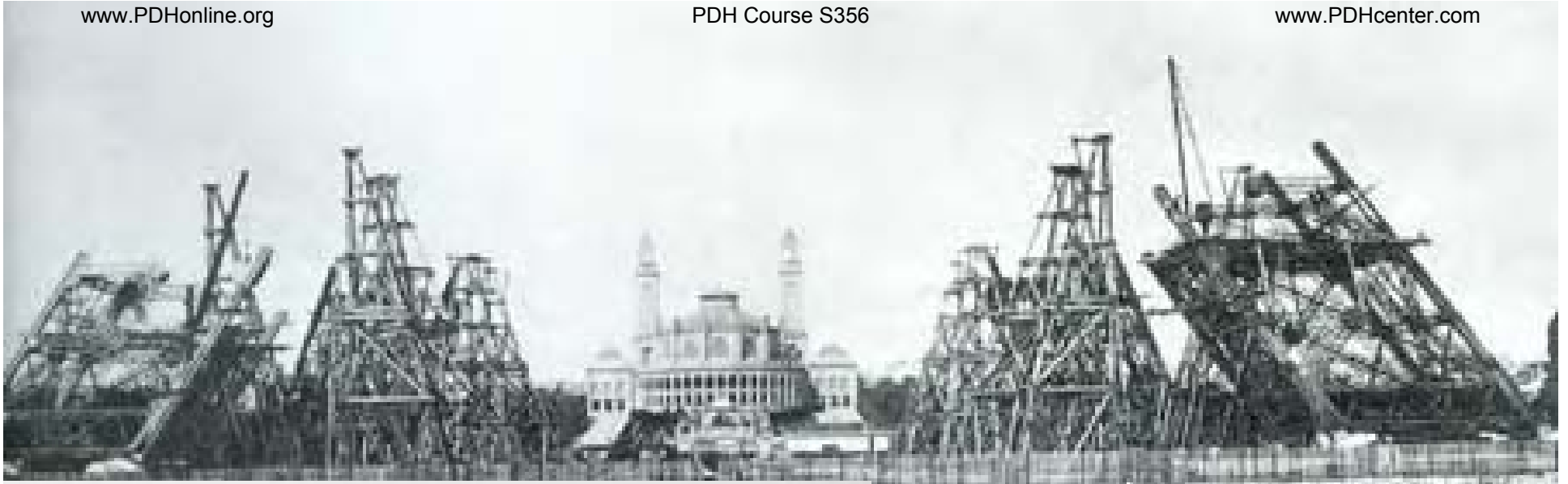


Mar. 15, 1888 Sept. 15, 1888 Dec. 26, 1888 Mar. 12, 1889

***“The pictures of the tower as it will be when complete, however, bear a strong resemblance to the electric light tower at Hell Gate or the elevator tower at Coney Island. In a framework of iron twice as high as the Washington Monument, of thick iron beams, and with its four corners flaring outward near the ground you have the Eiffel Tower.”***

**RE: New York Times reporter’s critique of the Eiffel Tower while still under construction**

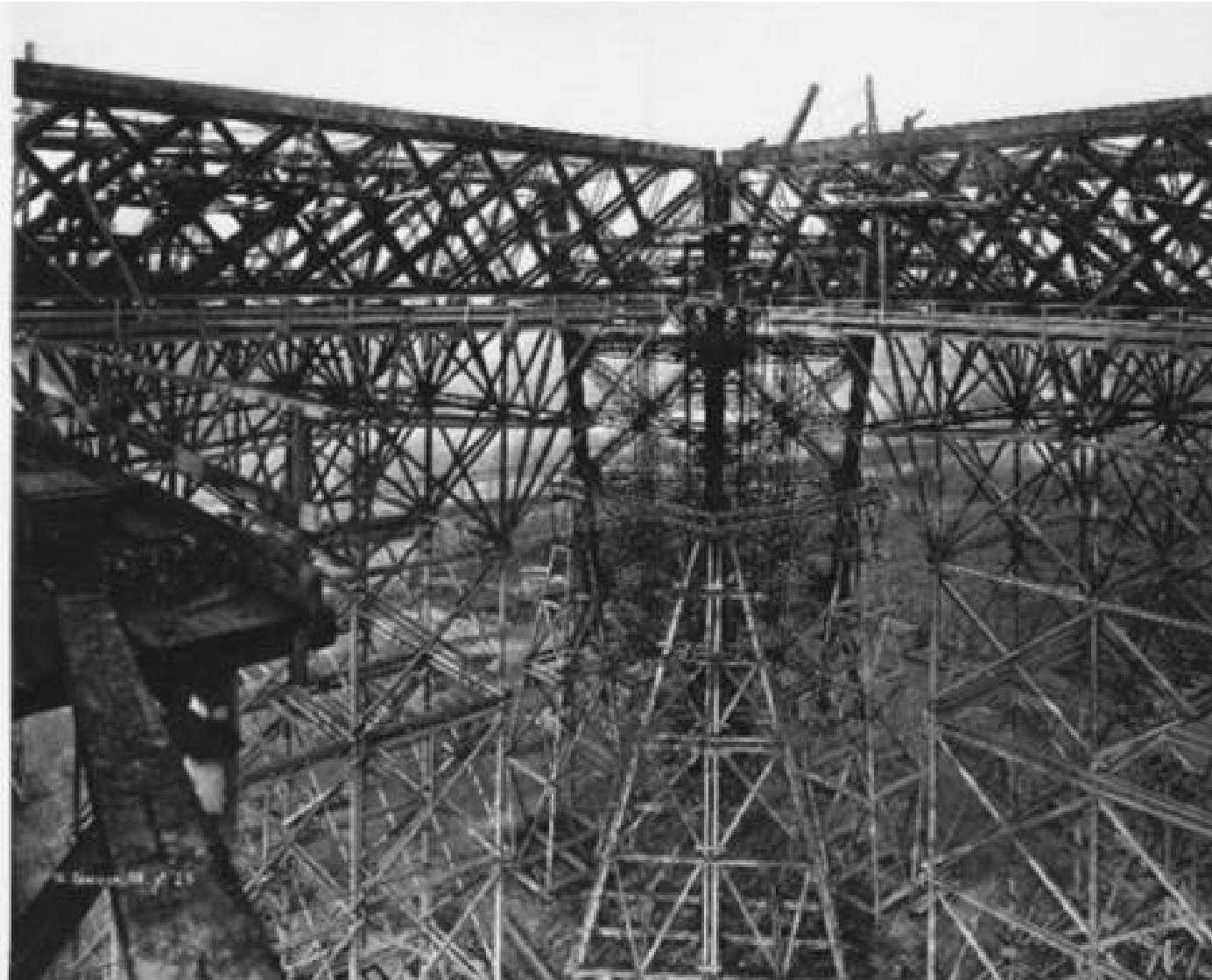




## Pier “Legs” under construction

***Eiffel Suicide!...Gustav Eiffel has gone mad; he has been locked up in an asylum...The Eiffel Tower will never pass 26 meters!***

**RE: newspaper headlines when work stopped for a week and Eiffel and his staff went unseen. In reality, they were finalizing the design of twelve 90' high temporary wooden scaffolds to be fitted with jacks and cylinders to support, raise and/or lower the iron structure inclined at 54 degrees which, otherwise, would have collapsed inwards before being tied together at the first level**



***“Each rib of each pier would be slightly nearer to the vertical than required so that each would require a slight lowering to meet its final position (by releasing sand from the appropriate box); the alternative of having to lift the ribs would have been considerably more troublesome.”***

**RE: critical joining of pier-ribs at 180 feet (first platform level). The first platform acted as the base for the remaining 800 feet of tower above.**



**When the four piers reached 180-foot (first platform level), they were tied together with four, 70-ton horizontal wrought-iron trusses, each 25-foot in depth**



***“Joined by the belt of girders, the piers formed a solid table with a wide base. The sight of it alone was enough to brush aside any fear of it overturning”***

**Gustav Eiffel**

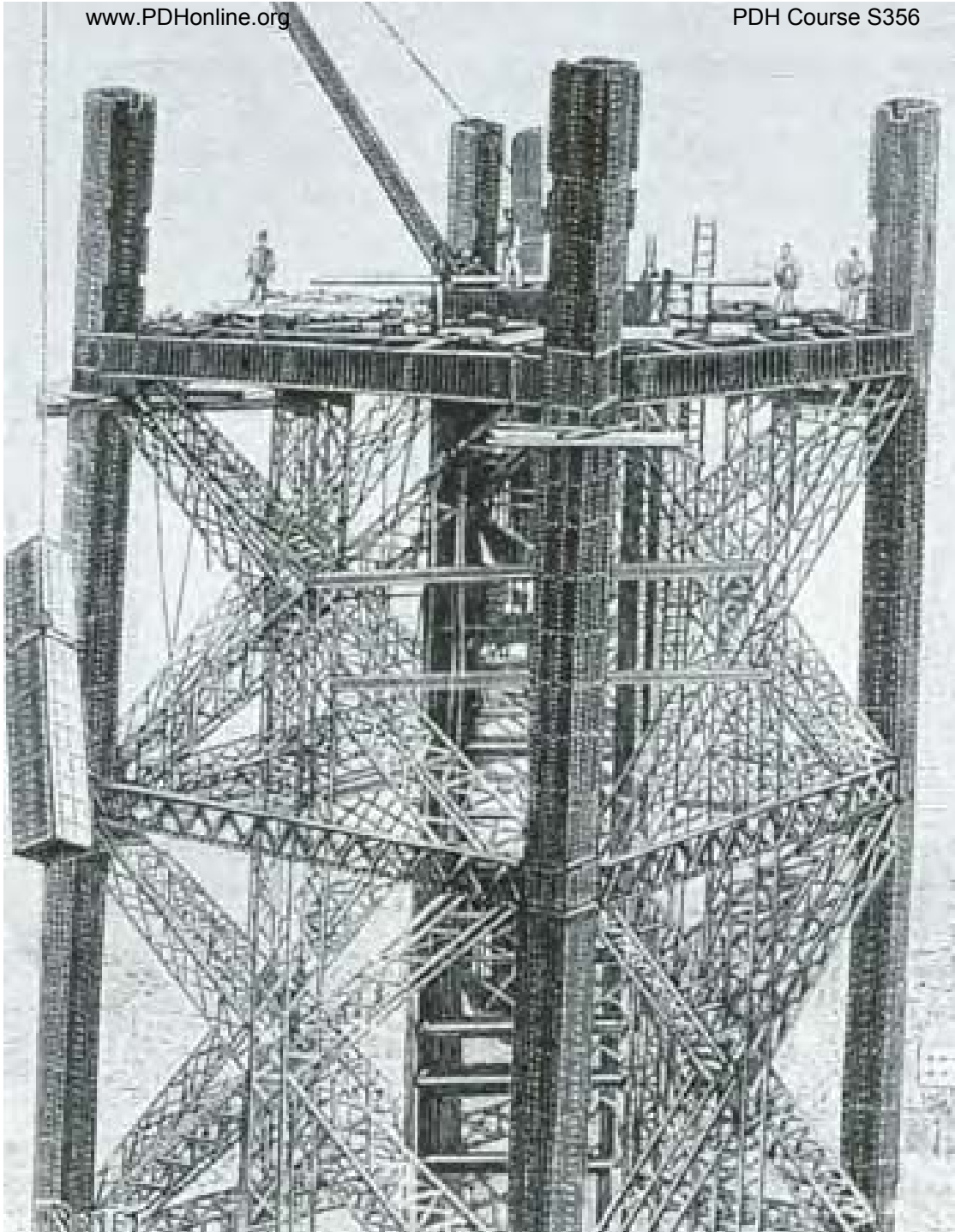
**RE: completion of the first platform level in perfect alignment,  
March 1888**



***“Isn’t it marvelous to see our constructors thereby adjusting in space, from heights of 80 meters, the position of such enormous weights of iron with as much ease as a careful land-surveyor delicately adjusts the supports of his precision instruments by hand”***

**Max Nansouty, Leading French Civil Engineer**

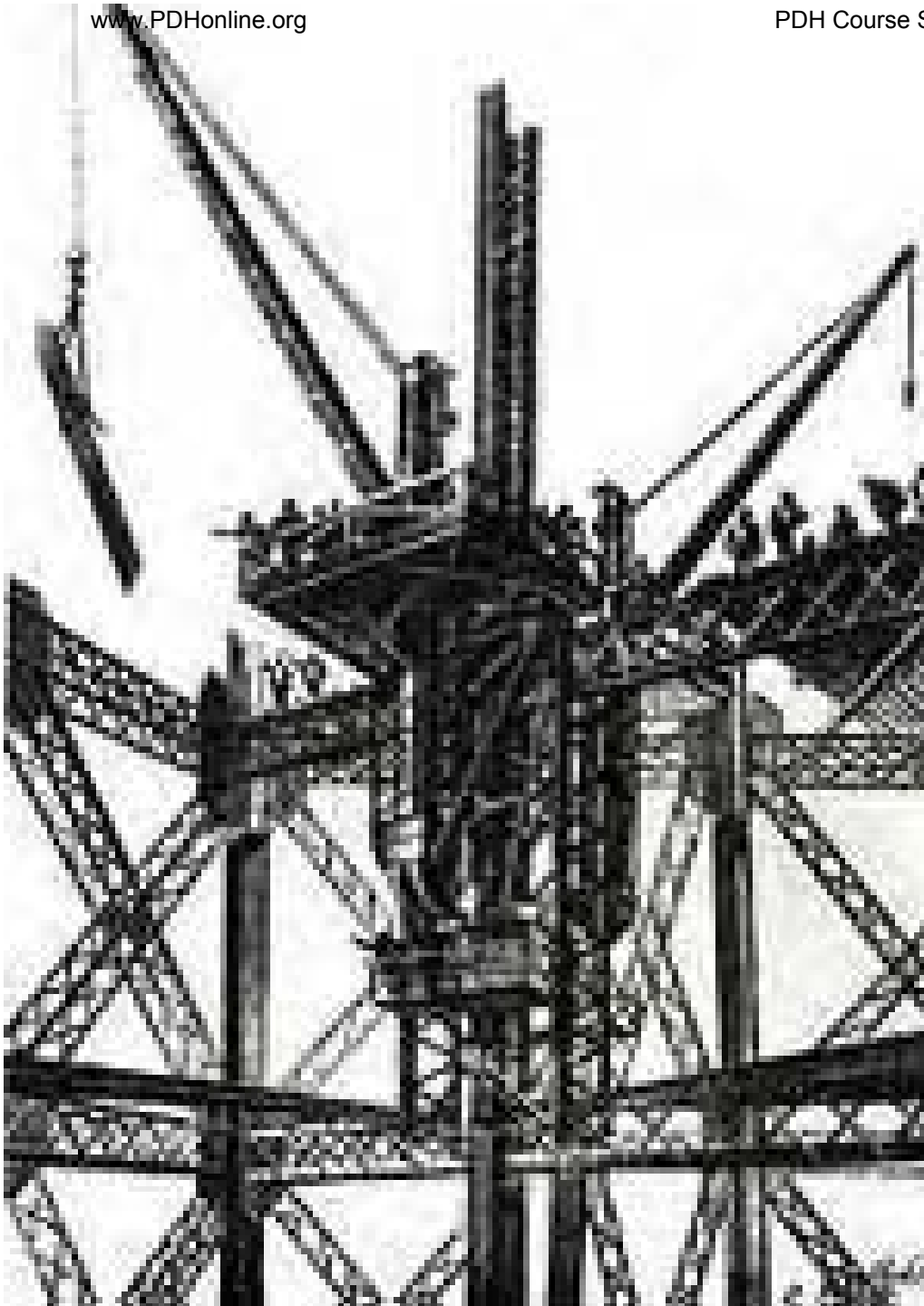
**RE: adjustment by Eiffel’s hydraulic columns – most critical at 189 feet (first platform level)**



***“One has to recall that staircase in Jacob’s dream, upon which the angels were ascending between heaven and earth. By no other work of men have heaven and earth been so closely connected.”***

**RE: impression of an *Atlantic Monthly* reporter upon witnessing workers climbing the tower’s stairs during construction**





***“Small, highly versatile 12-ton “creeper” cranes were innovatively designed to operate inside the piers themselves. Each was capable of lifting four tons, and was designed to climb the structure using rails which would later become part of the tower’s system of elevators.”***



***“In spite of the importance of the assembly work, we did not see on the building site as many teams as one might expect to find there; the number of the workmen does not exceed 250; not only the human workforce has been kept to a minimum, but also the number of operations ready to begin. The parts arrive from the Levallois-Perret workshops prepared to an extreme degree impossible at the Champs de Mars; there were no holes left to bore, no fitting to be done; the majority of the rivets were positioned; the structural components fitted one to another, without any final improvement.”***

**RE: excerpt from building official in his *Rapport General*. The “English Method” of construction relied on field cutting and drilling of parts with machinery. The Eiffel Tower was, in effect, a giant *Meccano Set*.**





***“Eiffel segregated issues to solve detail problems. Eiffel’s ‘kit-of-parts’ approach to construction influenced and simplified steel bridge and high-rise construction. It was even adopted by Meccano, an open-ended British engineering construction toy for boys in 1904. Meccano embedded the concept of open-ended standardized assembly kits in the minds of future engineers and manufacturers. The toy both mirrored and reinforced the cultural implications of the open system.”***

***“This additional expenditure, funded by the works, was compensated for by the reduction in the waste of time due to the workmen’s descent and ascent, and by that in the resulting tiredness...This canteen was reinstalled on the second floor when that platform was completed...”***

**Gustav Eiffel**

**RE: upon completing the first platform, Eiffel constructed a canteen for the workmen offering a 20% discount on prices. This “benevolent” gesture was for efficiency – not benevolence. General Contractor *Starrett Bros. & Eken* employed the same concept fifty years later with the construction of the *Empire State Building***



**The Eiffel Tower Under Construction, March 1888**  
Construction started on January 26, 1887. By January 1888, the tower had reached the first stage and the second stage by June 1888. The first stage was modernized for the 1937 Paris Exposition





***“Eiffel transferred strike leaders from the higher levels and restricted them to working on the construction of the buildings for the first platform, thus exposing them to the ridicule of their peers. His tactic for breaking strikers who demanded more money for various reasons worked. He promised all workers a bonus when the tri-color flew from atop the tower.”***



***“...four pavilions rising inside the structure hid the views of Paris. These were the foundations of a Flemish brasserie, A Russian restaurant, an Anglo-American bar and a Louis XIV cabaret. They were building a nightclub – 190 feet up in space! At meal times this vast terrace would hold 4,200 people...”***

**Hugues Le Roux – Journalist, February 24, 1889**

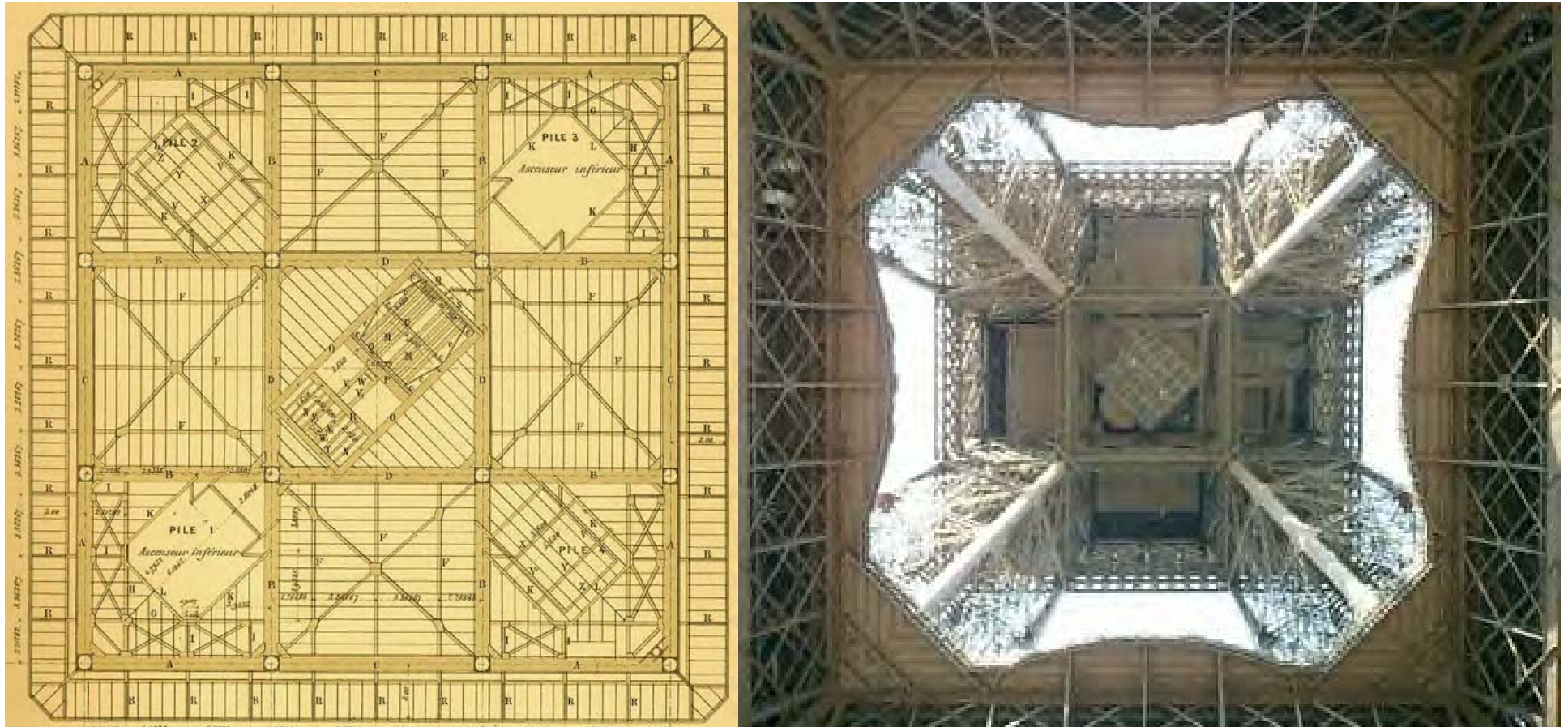


**April 1888**



***“The second platform level was reached in July 1888, and on Bastille Day, the 14<sup>th</sup>, a fireworks display was arranged at the new height of 380 feet”***





**Second Stage (Platform Level)  
Plan (at left) / view from below (at right)**



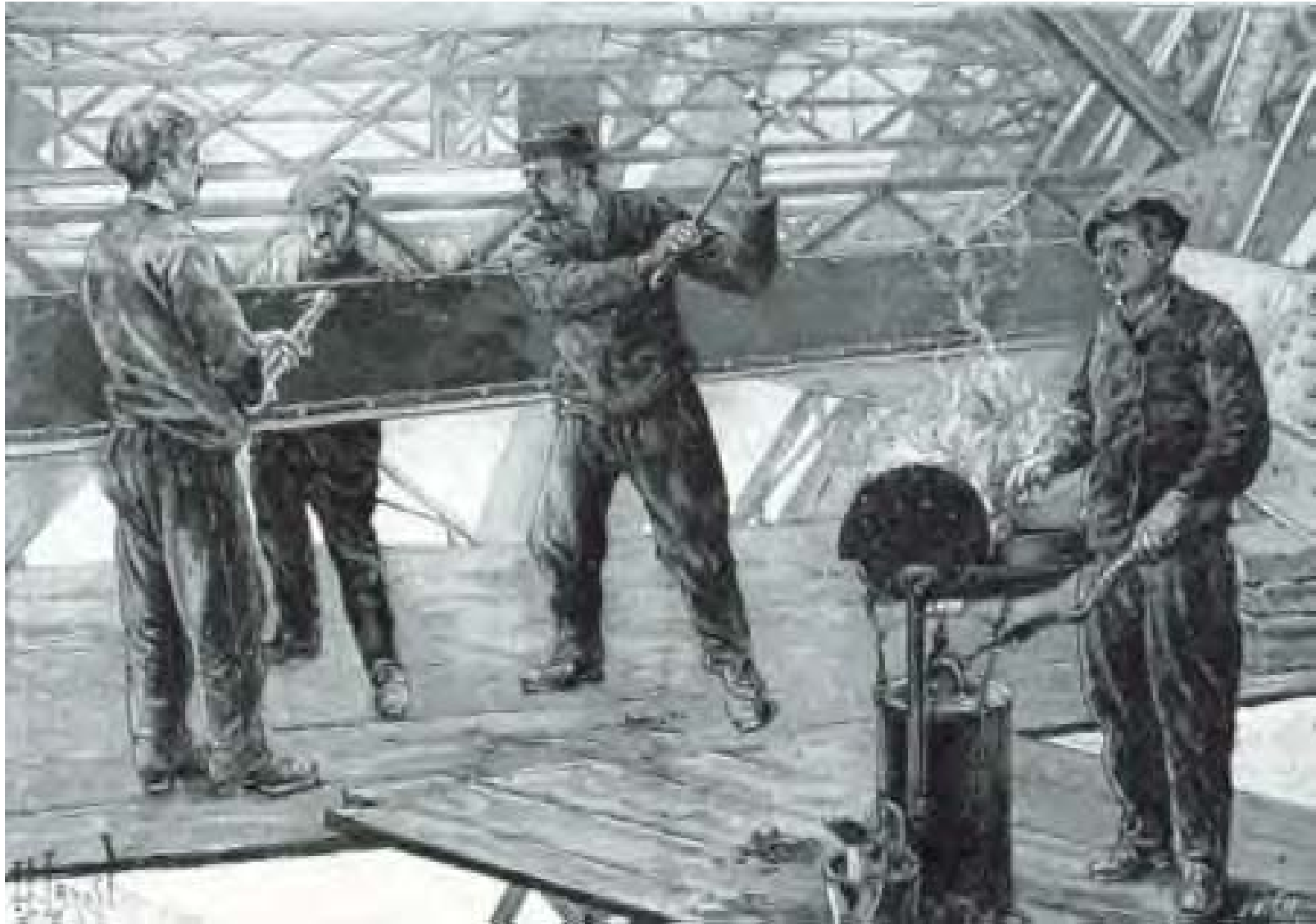


**Tower and exposition under construction, July 1888**  
**At left (dome) *Palace of Liberal Arts* under construction**



***“I was standing at a height of 200 feet, among a maze of ironwork painted with red lead, drilled with holes and arranged in criss-cross fashion...250 workmen came and went in a perfectly orderly way...climbing up and down through the latticed ironwork with surprising agility. The rapid hammer-blows of the riveters could be heard...The four cranes - one for each pillar – which brought up the pieces for this vast metallic framework one by one, stood out against the sky with their great arms at the four corners of this lofty site...the twenty rivet forges casting a sinister glow...”***

**RE: reporter’s account upon visiting the Eiffel Tower construction site**





***“Evidently people are uneasy because we are going to work at 820 or 986 feet from the ground, but when they know we shall be on a floor 49 feet wide, they will easily see that the men have never worked in greater safety”  
Gustav Eiffel***

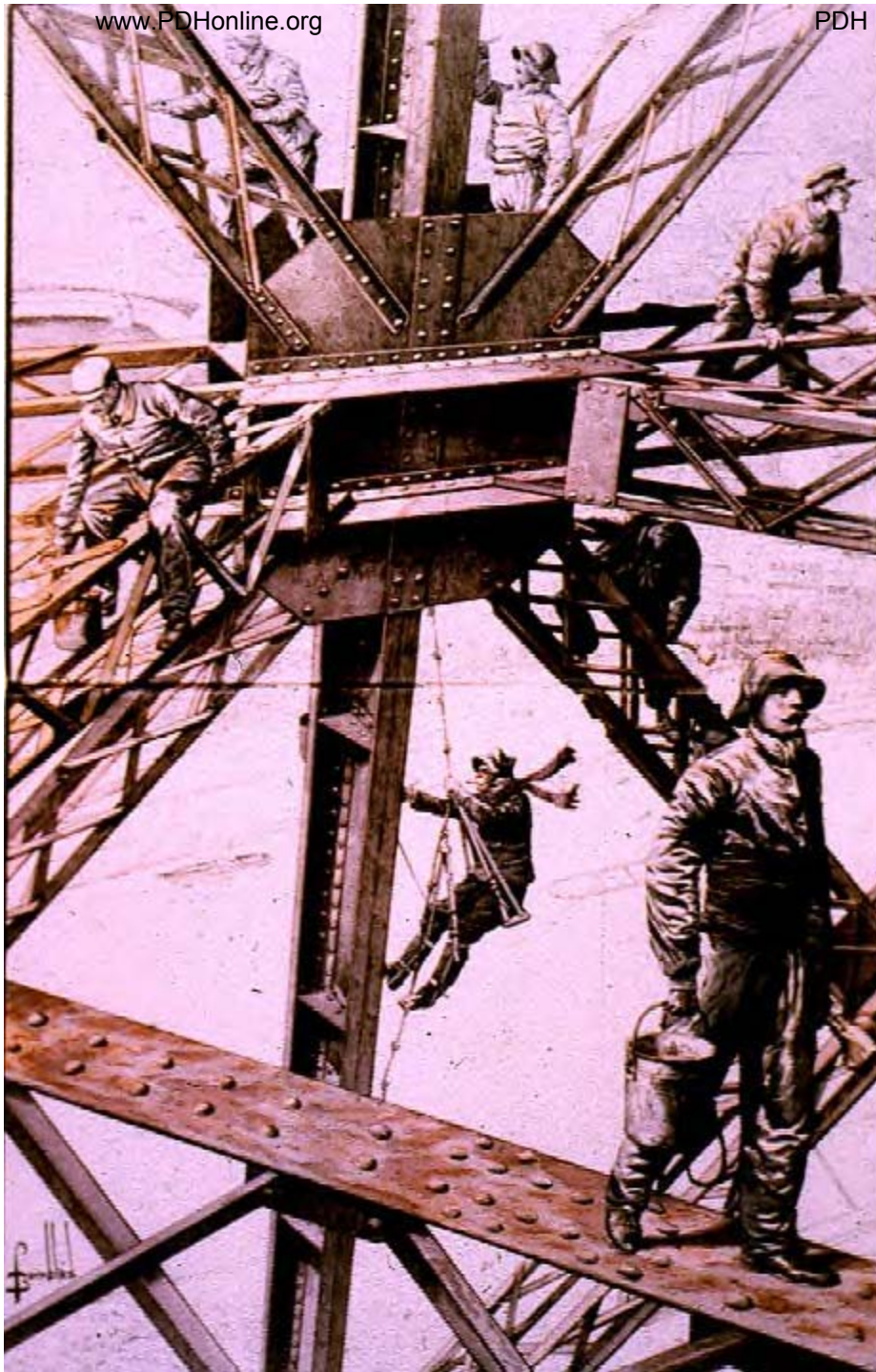




***“Not one death occurred during the entire construction of the tower, with the exception of one worker who entered the closed site at night after work and fatally attempted to show off to his girlfriend by climbing dangerously. This was a safety record which is remarkable when compared, for example, to the deaths of 57 workers on the Forth Bridge (1890) in Scotland.”***

***“A thick cloud of tar and coal smoke seized the throat, and we were deafened by the din of metal screaming beneath the hammer. Over there they were still working on the bolts: workmen with their iron bludgeons, perched on a ledge just a few centimeters wide, took turns at striking the bolts (rivets). One could have taken them for blacksmiths contentedly beating out a rhythm on an anvil in some village forge, except that these smiths were not striking up and down vertically, but horizontally, and as with each blow came a shower of sparks, these black figures, appearing larger than life against the background of the open sky, looked as if they were reaping lightning bolts in the clouds.”***

**RE: reporter's impressions upon visiting the tower while under construction**



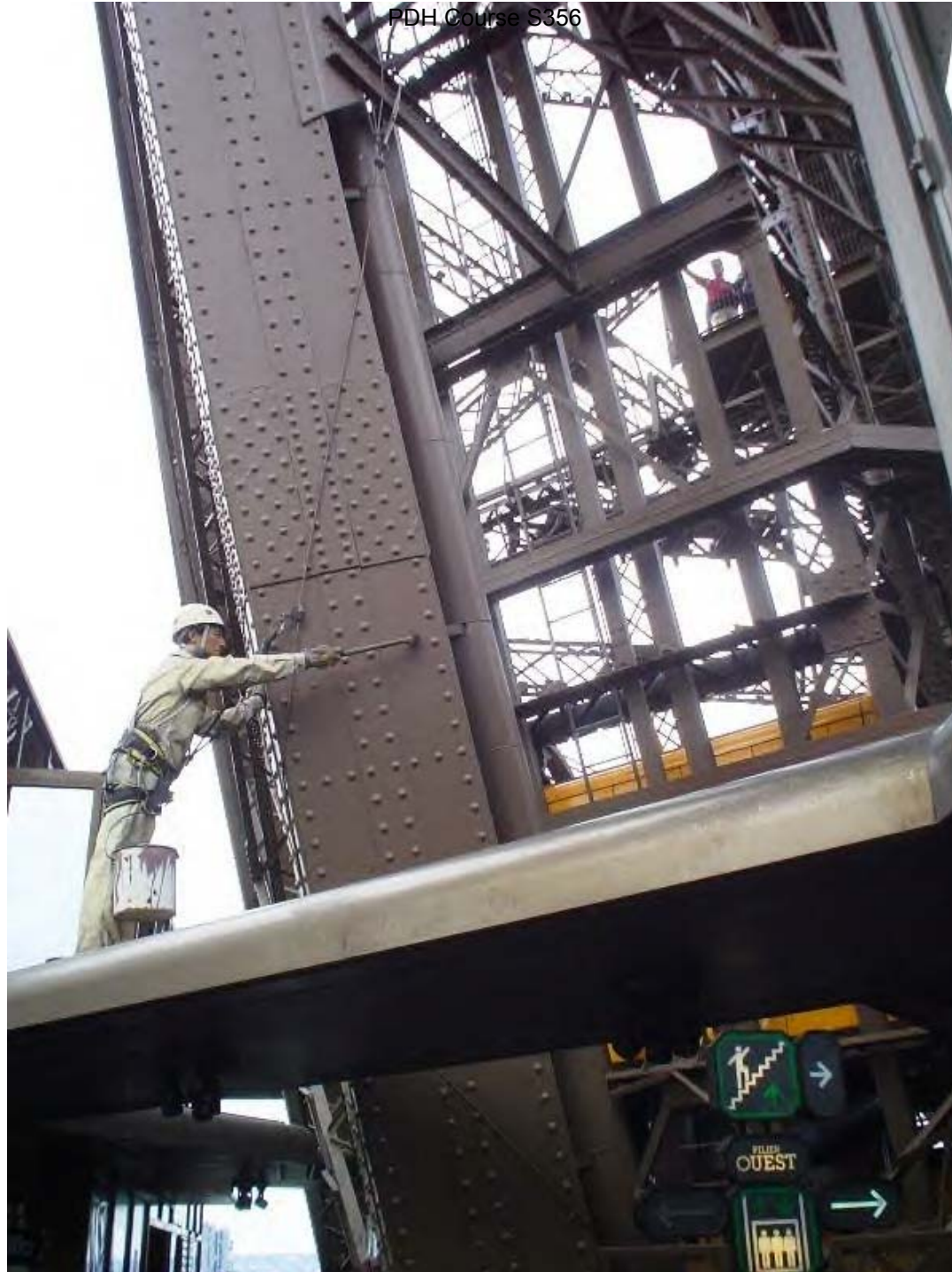
***“Painters began the first of the continuing efforts to paint the tower (using a reddish-brown iridescent concoction called “Barbados Bronze”) applied saturated at the bottom, becoming progressively lighter near the top to enhance the impression of height.”***





***“We will most likely never realize the full importance of painting the tower, that it is the essential element in the conservation of metal works and the more meticulous the paint job, the longer the tower will endure”***

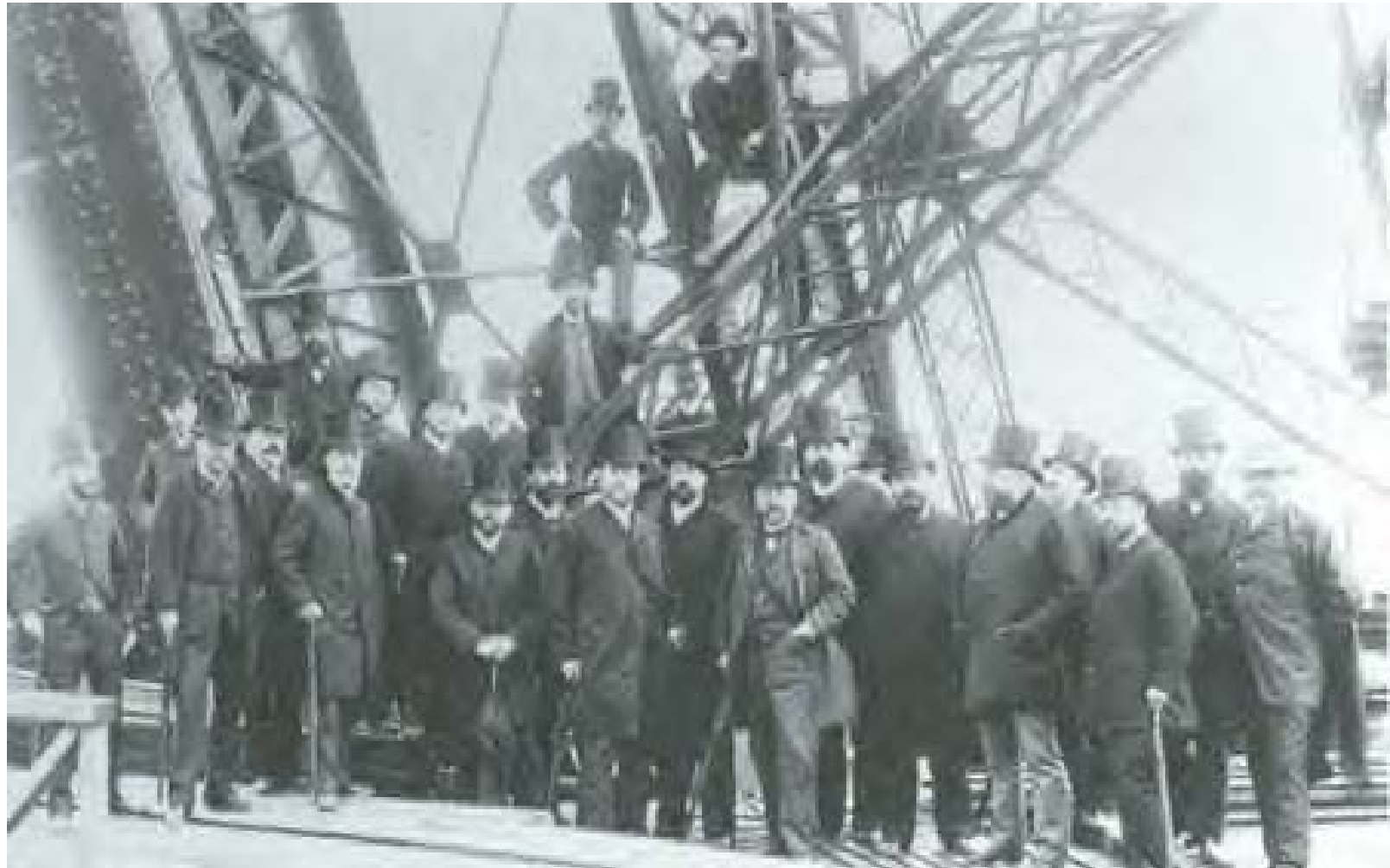
**Gustav Eiffel**







***“I come in the name of my comrades and friends, the workmen of the 986 foot tower, to express to you all the sympathy and respect that we owe you for completing the great work... We can repeat to the children of our grandchildren that we have worked on the most imposing monument in the world!... Long live engineer Eiffel! Long live France! Long live the Republic!”<sup>234</sup>***





***“The Eiffel Tower, weighing 7,300 tons, was completed on March 31, 1889, having been built in two years, two months and five days, at a total cost of 7,799,401.33 francs.”***

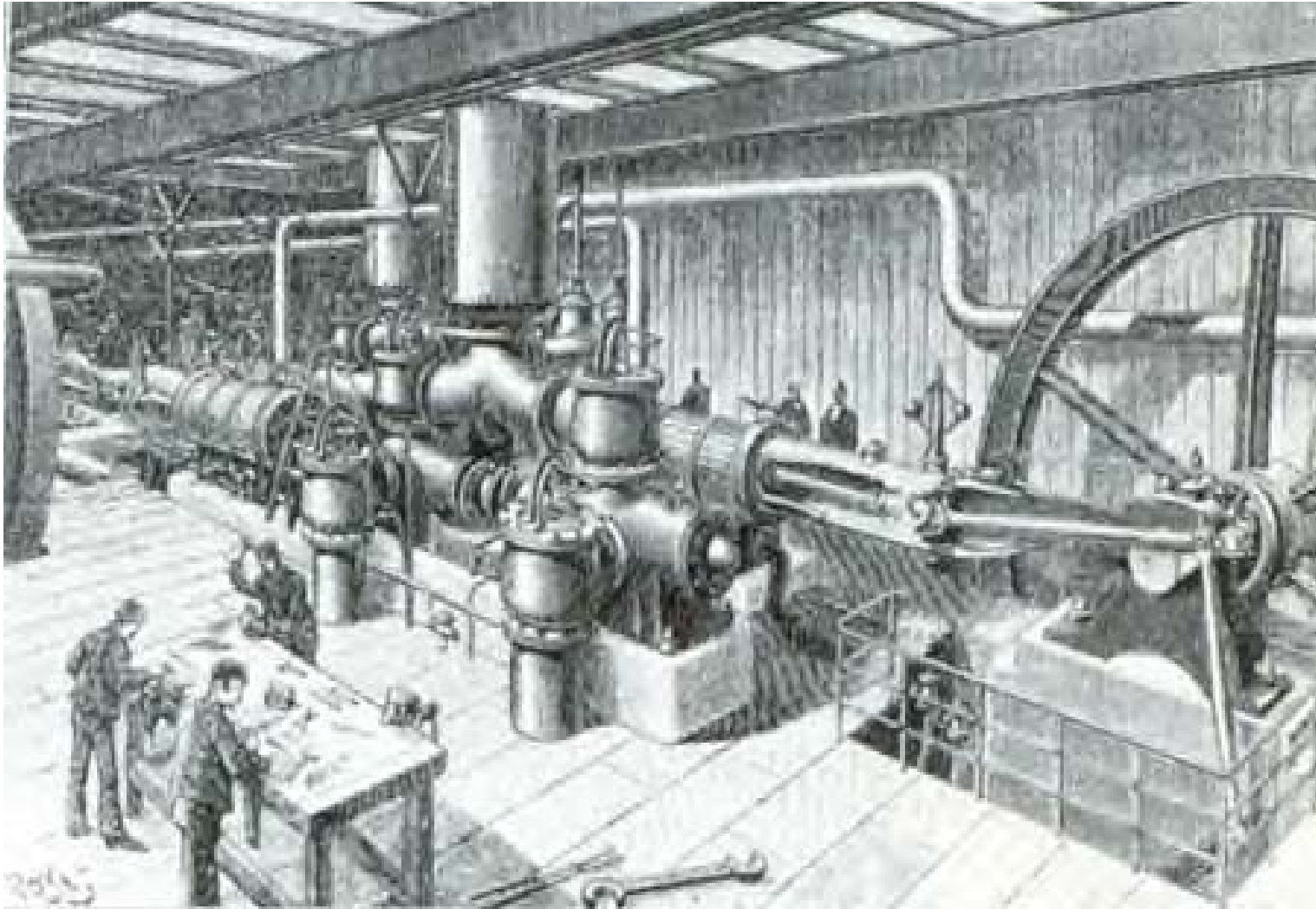
# ELEVATORS

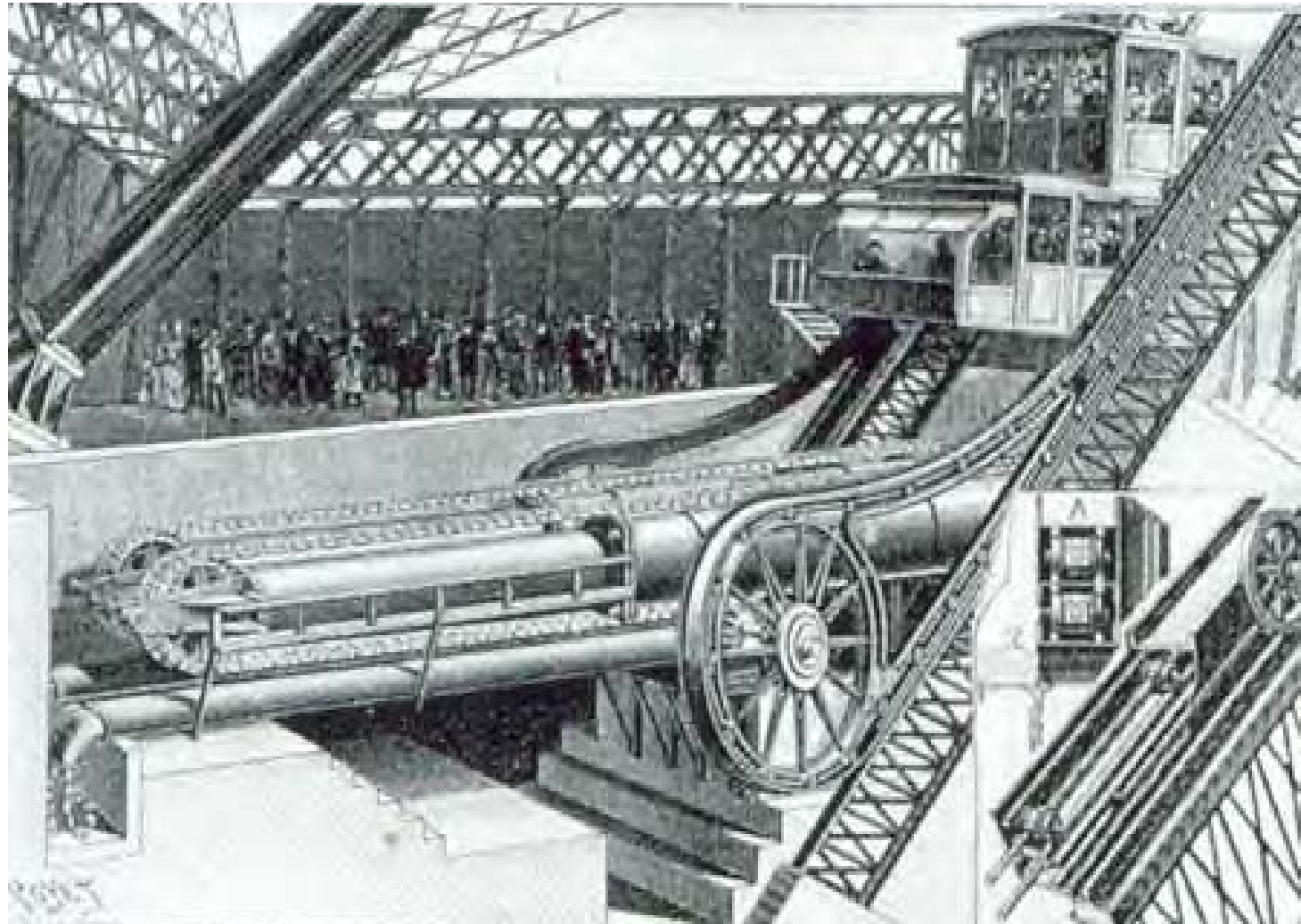
***“There were buildings to be fitted out and prepared on both platforms, staircases to be provided and, most problematic of all, a series of elevators which had been in the process of installation for some time but were still a long way from being satisfactory. The exhibition was due to open in two months time and both it and the tower had to be ready.”***

**RE: completion of the tower’s superstructure in March 1889. The exposition was to open in May 1889. Two-thousand people per hour needed to be lifted to the first platform and 455 people per hour to the top in seven minutes by the elevators.**

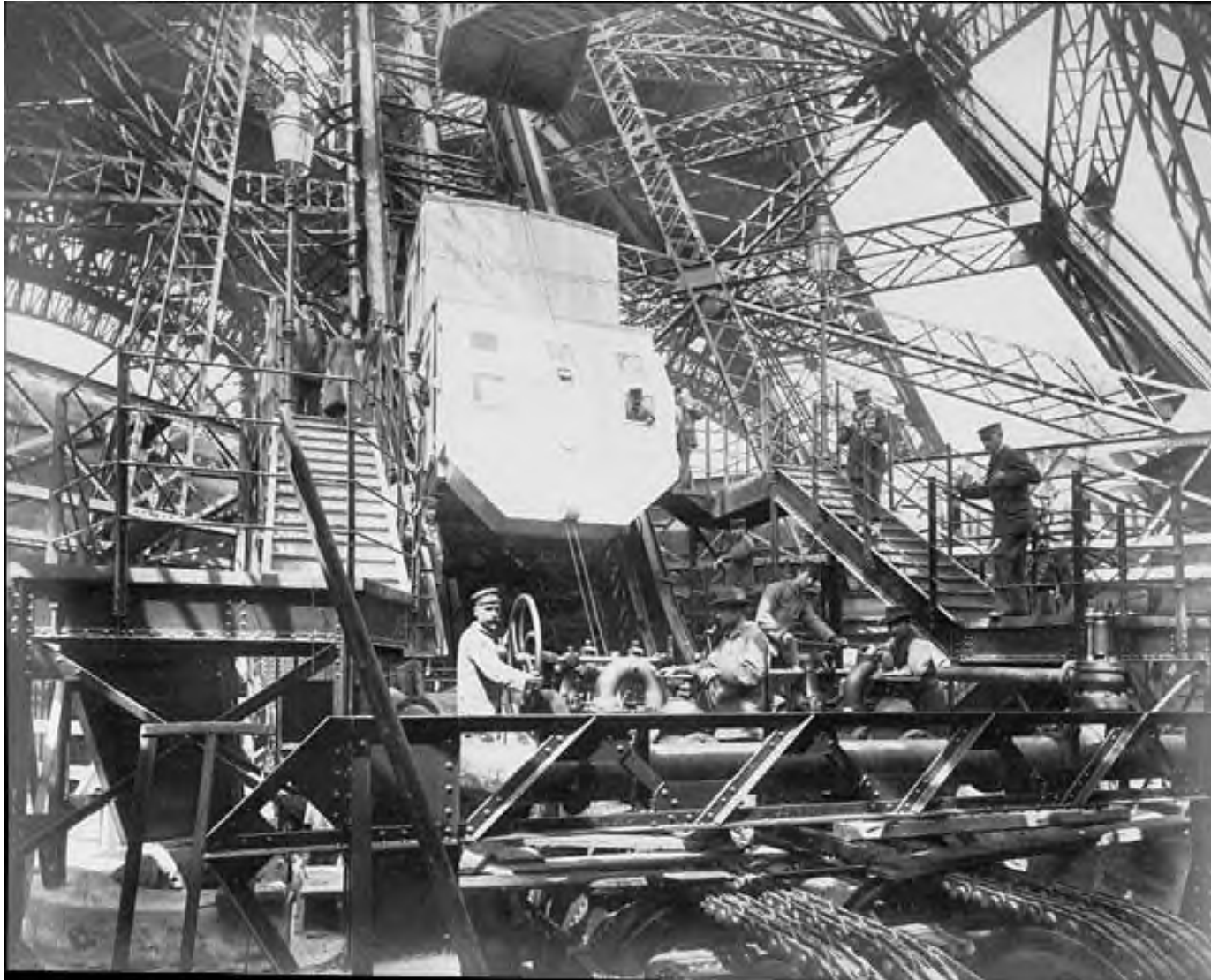


***“The Otis system was seen as the simplest; it used a 36 foot long cylinder with a 38 inch piston inclined parallel to the double-decked cabin’s initial running angle. As water pushed the piston, the cabin, suspended from twelve pulleys by six steel cables, was pulled along rails that curved at the level of the first platform to accommodate the dynamics of the tower, before continuing to the second platform. The Otis elevators carried 50 passengers 400 feet per minute. The elevators were modernized in 1912 by the use of electric power and were again modernized in 1995.”***





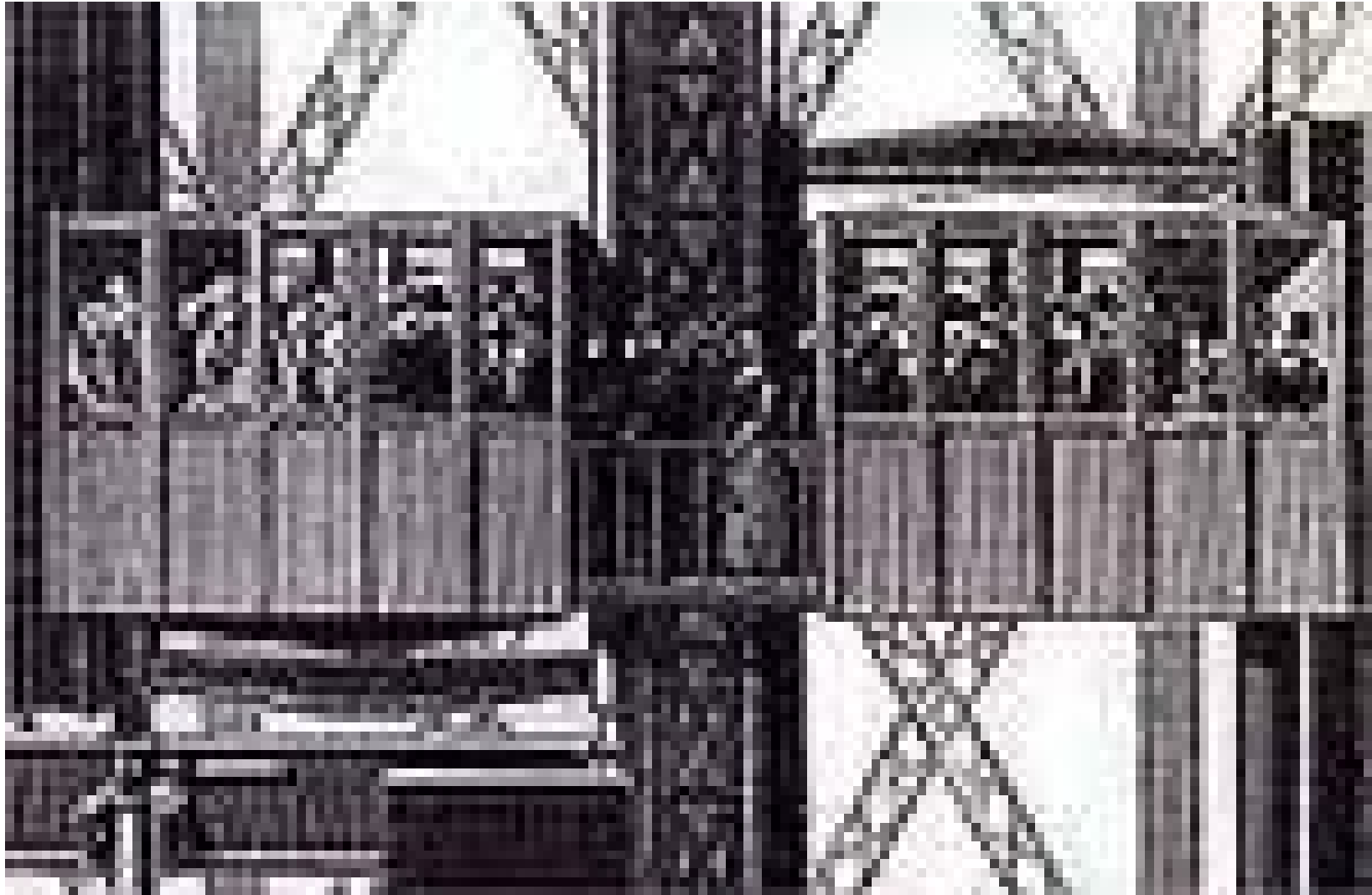






***“An intermediate stage constructed midway between the second story and the upper platform is the starting point of the Edoux elevator. One cage is placed at the top of the pair of pistons, and travels from the intermediate stage to the upper platform, a distance of 262 feet; the cage is connected by cables to a second cabin which acts as a counterweight and carried passengers from the second story to the interior stage, also a distance of 262 feet; the arrangement is such that when the elevator is at work the cages are traveling in opposite directions; at the intermediate stage the passengers change from one cage into the other, and in this way the whole journey is accomplished by one system.”***

**RE: “Split-Shift” elevator system**



## **“Split-Shift” Elevators**

***“After all else we have borne and suffered and achieved in your behalf, we regard this as a trifle too much; and we do not hesitate to declare, in the strongest terms possible to the English language, that we will not put up with it”***

**RE: response of Otis Elevator Company to Eiffel’s threat to withhold payment if the January 1, 1889 date of completion for the elevator contract was not met. Otis fulfilled their contractual obligations but, ultimately, lost money on the contract (but gained much positive publicity for the company).**







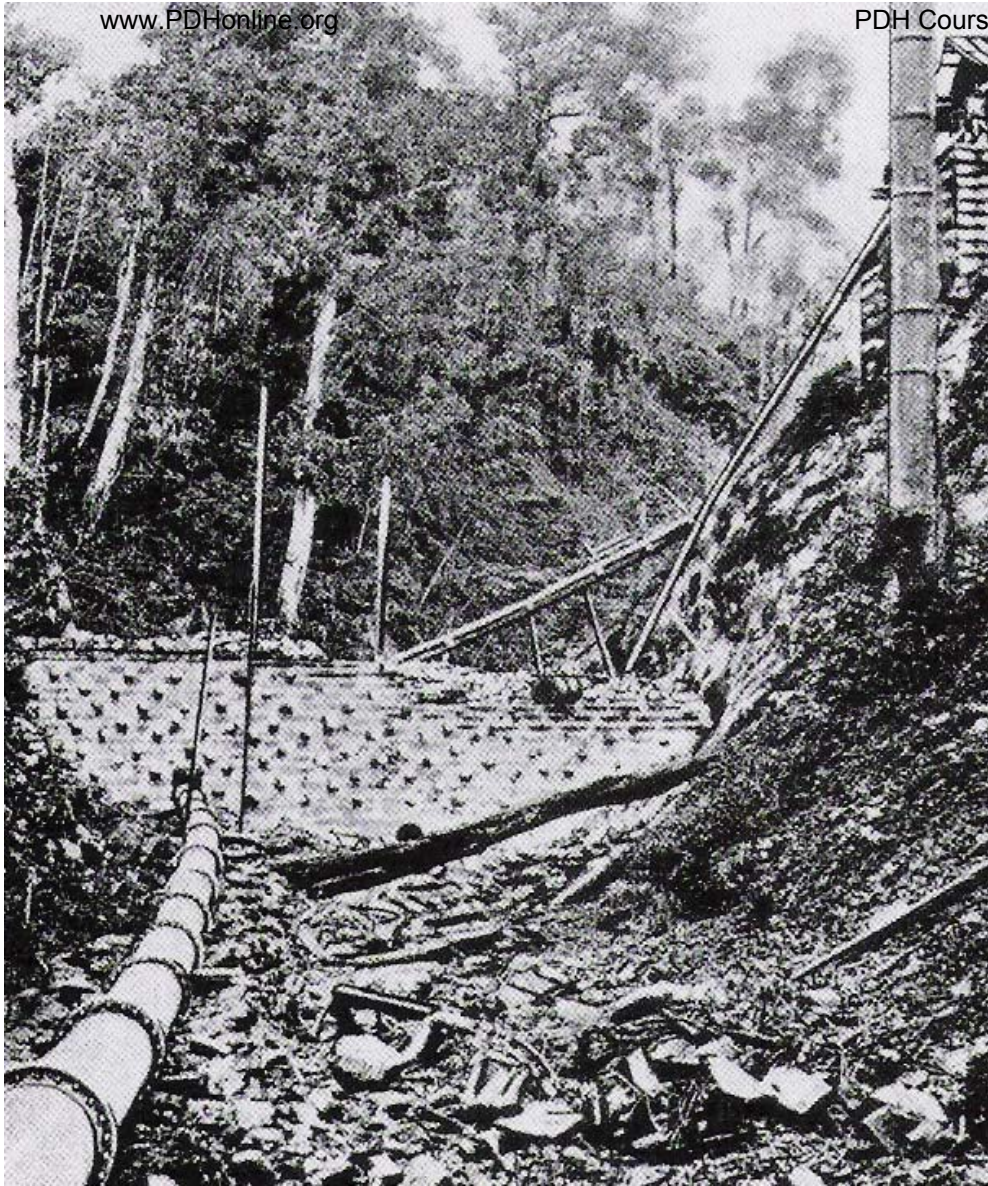
## **Part 5**

# **WONDER OF THE WORLD**

# **The Seven Wonders of the World (1931)**

- **The Great Pyramids (Egypt)**
- **Hagia Sophia (Turkey)**
- **Leaning Tower of Pisa (Italy)**
- **Washington Monument (USA)**
- **Eiffel Tower (France)**
- **Taj Mahal (India)**
- **Empire State Building (USA)**

# PANAMA PLUNDER



***“The Europeans who have lately arrived in connection with the canal scheme are apprehensive of the danger from the disease, and several of them are leaving the place”***

**RE: *Compagnie Universelle du Canal* - French company headed by Ferdinand de Lesseps (builder of the Suez Canal), attempting to build the Panama Canal**

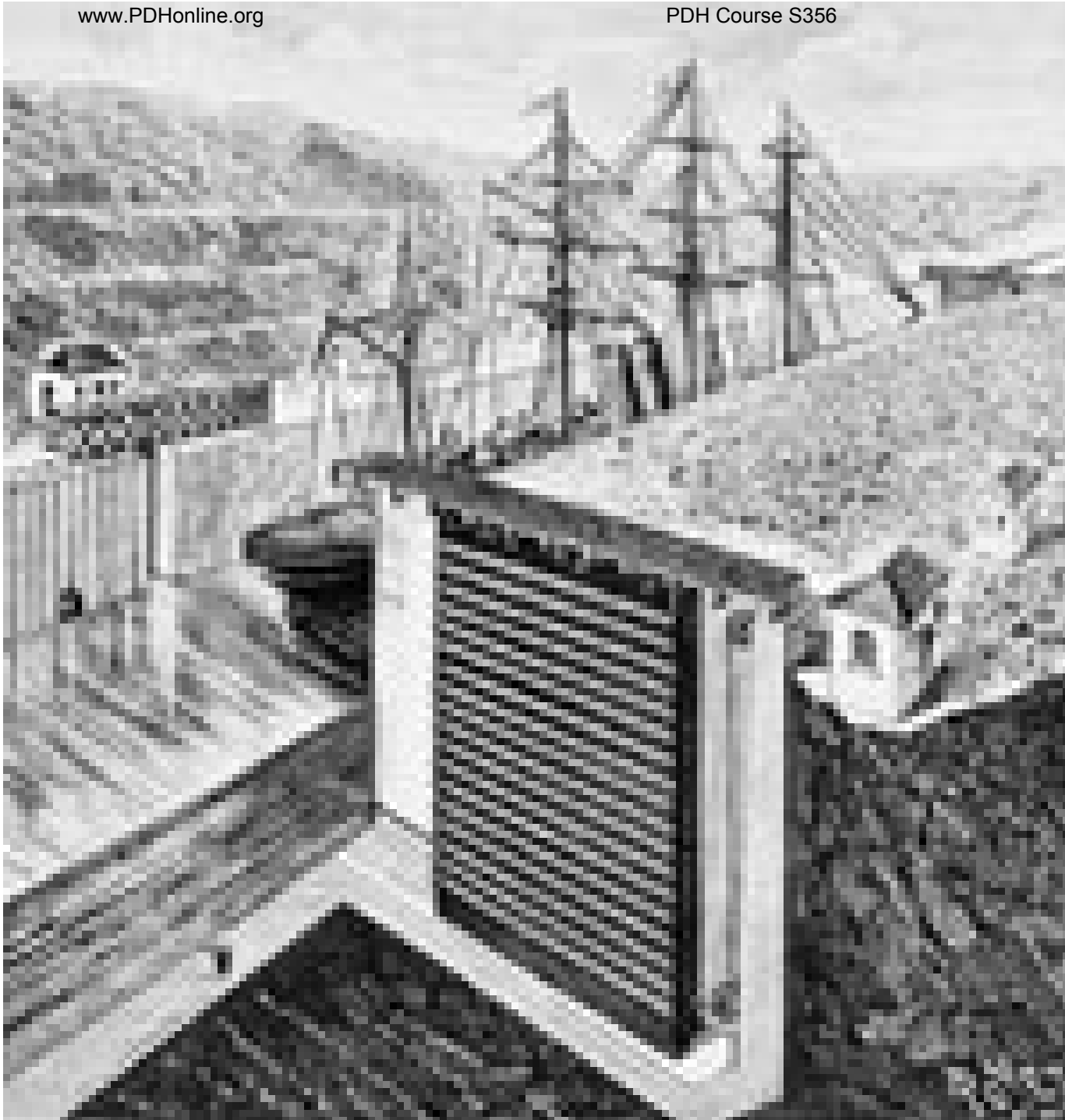
**Rio Grande Dam, Panama  
August 1888**





## Ferdinand de Lesseps





# **Panama Canal Locks Designed by Gustav Eiffel**

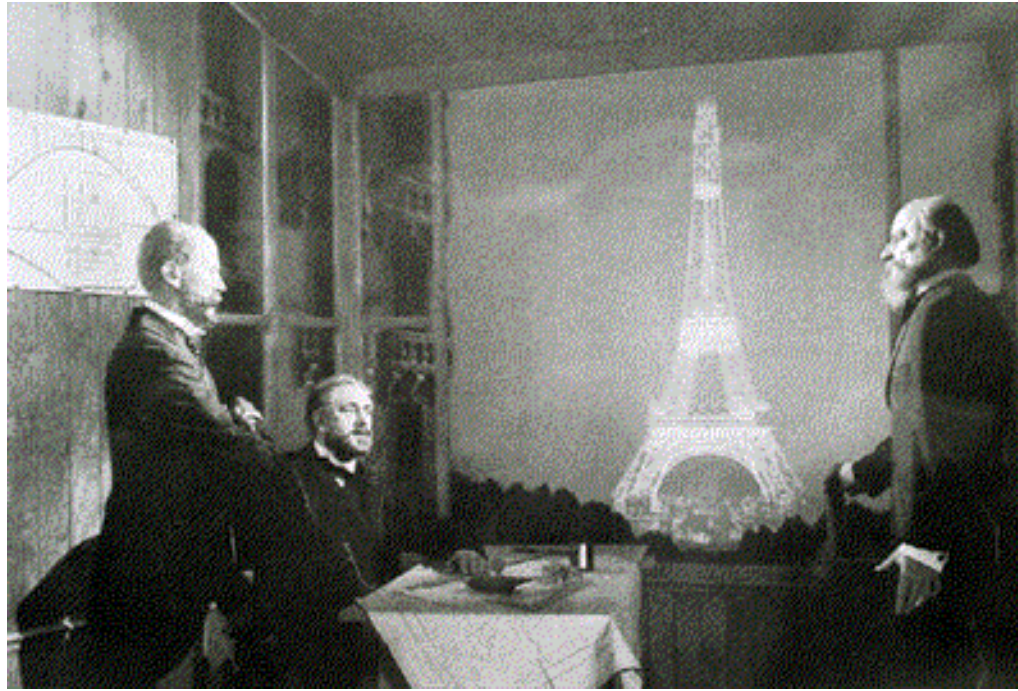
***“M. Eiffel, the contractor who forgot to supply the goods he charged for, was exonerated from the charge of swindling, but sentenced to two years imprisonment for breach of trust”***

**RE: verdict in the “Panama Plunder” case. Eiffel was also fined 20K francs and the verdict suspended pending appeal. The decision was reversed upon appeal due to a technical issue (statute of limitations expiration); not based on his innocence of the charges.**

# **MAN OF SCIENCE**

***“Europe’s foremost engineer devoted his restless genius to a new life as a pioneering practical scientist. This would be no wealthy, retired amateur indulging himself in his declining years; his prodigious mathematical abilities were to be redirected in two particular directions. The surprising scientific instrument in his new future would be the most spectacular and enduring product of his now rejected previous life; the Eiffel Tower.”***

**RE: Eiffel’s abandonment of construction engineering in the aftermath of the “Panama Plunder”**



***“Advantage is being taken of the Eiffel Tower to obtain high pressure through a manometric tube (the height of the tower) containing mercury. M. Cailletet proposes to utilize the enormous pressure – about 400 atmospheres – for his researches on the liquification of gases, and interesting results may be looked for.”***

258

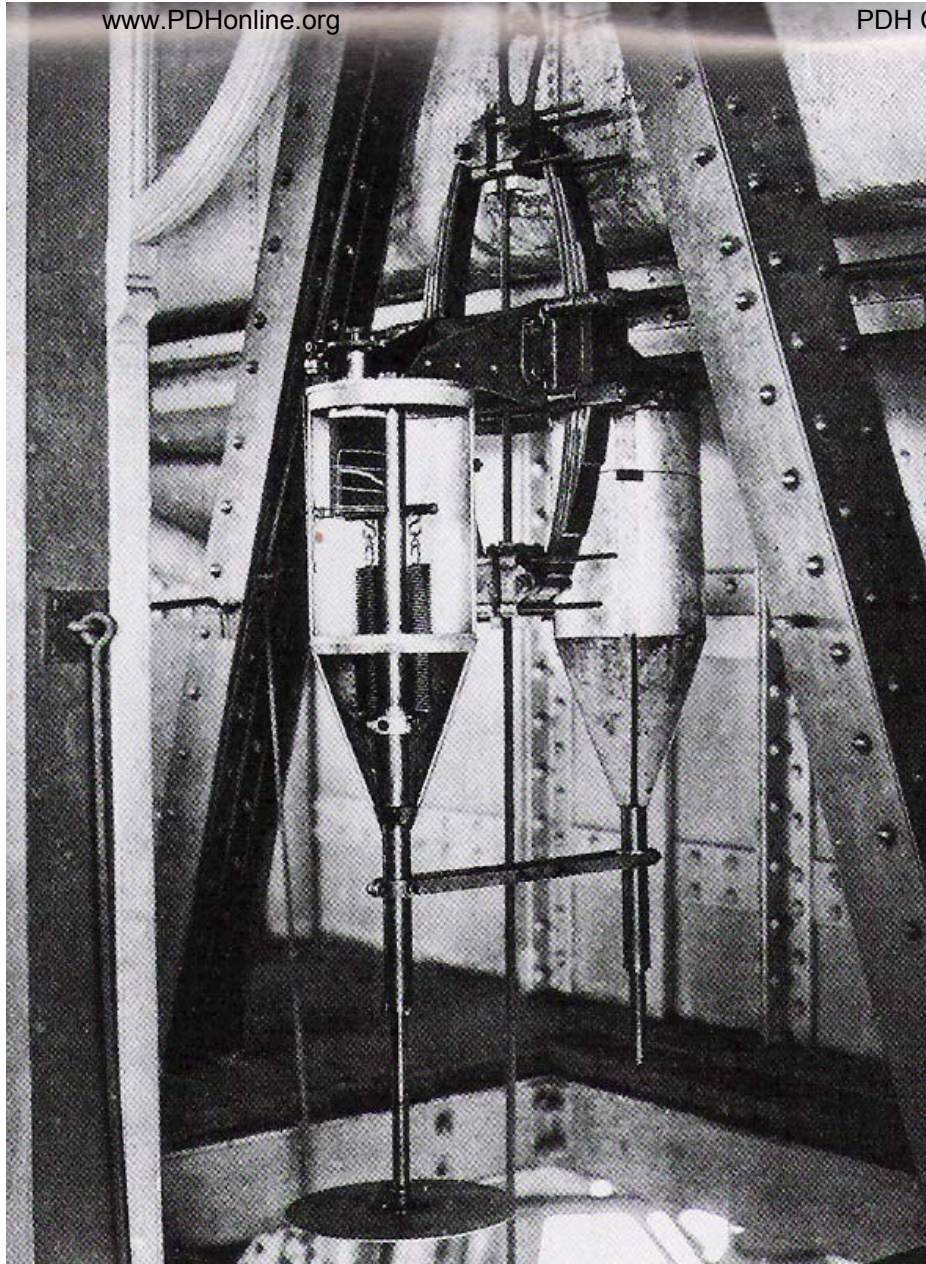
**RE: scientific experiments at the Eiffel Tower, August 1890**





***“Right from the start of construction, in 1889, an extremely important meteorology service was carefully installed...The measuring instruments are on the small five foot diameter platform which terminates the tower 986 feet from the ground; using a cable, they electrically transmit their readings to recorders located on the ground floor of the central weather bureau, which is nearby...All observations are taken every hour; wind speed and direction, temperature, atmospheric pressure, the hygrometrical state etc.”***<sup>259</sup>

***“He installed an array of thermometers, hygrometers, barometers, anemometers, rain-gauges and recording equipment to enable detailed readings to be retained. In 1904 he published detailed results of these experiments, and like all his published scientific work, it was comprehensive.”***



***“Eiffel’s work in meteorology soon extended into the practical study of air resistance, and, in 1903, he set up a small laboratory on the tower’s second platform in which he based his free-fall apparatus”***

***Appareil de Chute  
(free-fall apparatus)***





***“M. Eiffel was more than 70yo when he began his first experimental research at Champs de Mars, releasing a long vertical cable from the second platform of the tower. These first experiments continued for three years, and elucidated many obscure points. They fixed the essential laws of normal air resistance and established that this varied by the square of the airspeed.”*** 262

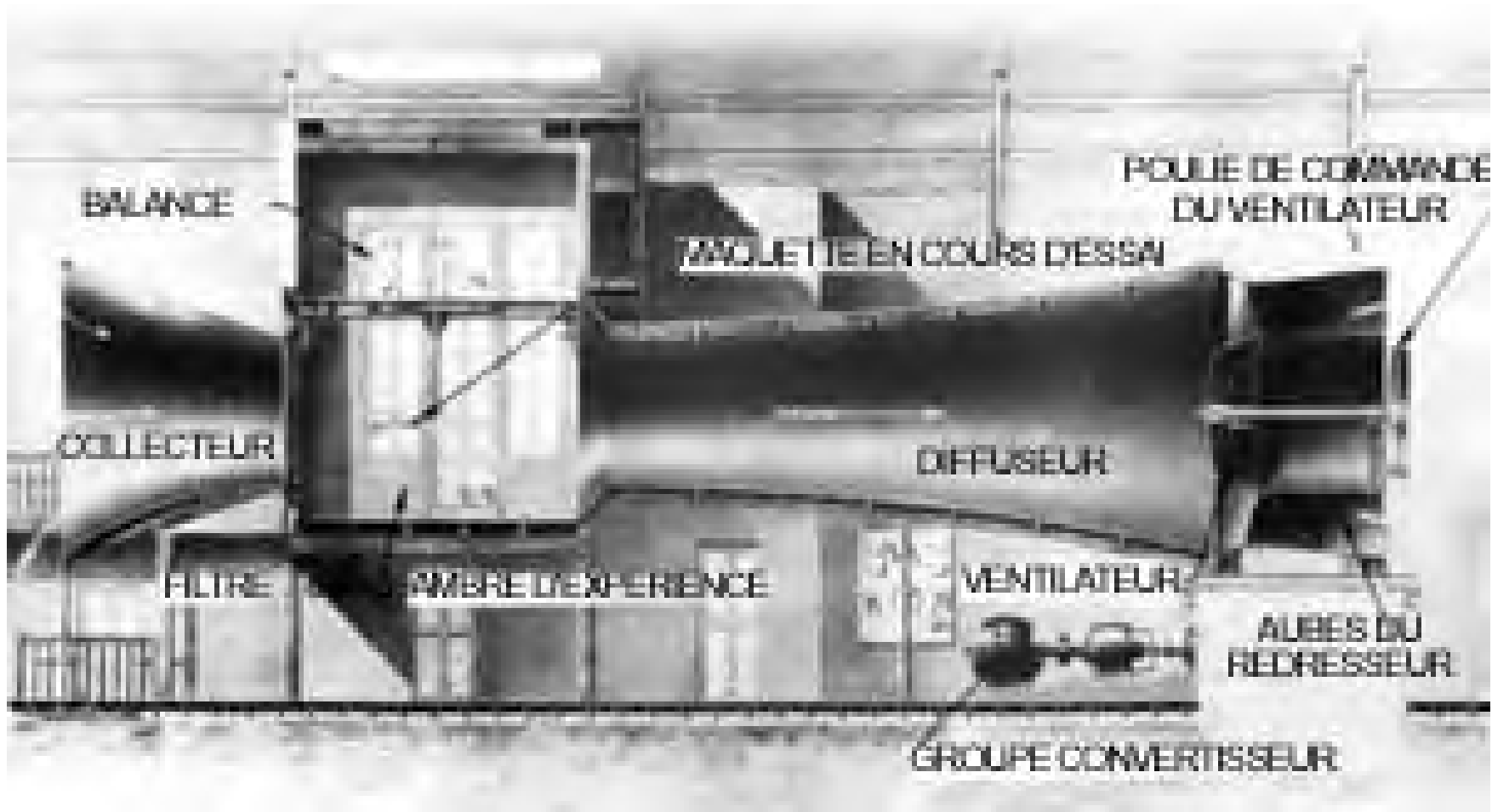
***“During the course of my career as an engineer and on account of the exceptional scale of construction works that filled it, wind was always an absorbing subject for me. It was an enemy against which I had to anticipate a constant battle, either during the building or afterwards.”***

**Gustav Eiffel**





**Eiffel's 40' x 66' Wind Tunnel Laboratory  
(established in 1909 at the *Champs de Mars*)**



## Eiffel's Wind Tunnel



***“Eiffel reached two important conclusions which had great significance for aircraft design. He showed that aircraft lift was largely achieved by airflow over the wing surface rather than under it. He also devised a new law governing propeller design.”***

***“This eminent engineer, the constructor of the Eiffel Tower, though more than 80 years of age, still continues his studies in his chosen field of labor with all the enthusiasm of youth, and his writings upon the subject of resistance of the air have already become classical. His researches, published in 1907 and 1911, on the resistance of the air in connection with aviation, are especially important and valuable. They have given engineers the data for designing and constructing flying machines upon sound, scientific principles.”***

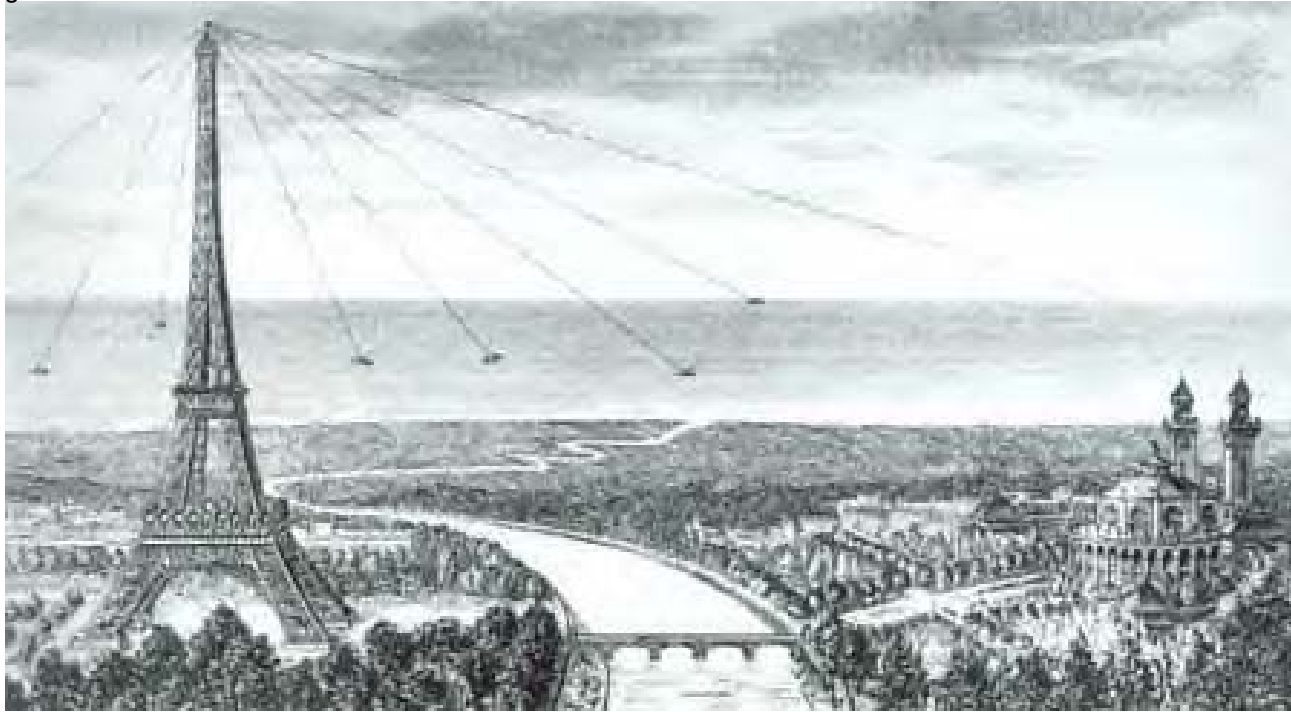
**Alexander Graham Bell**

**RE: presentation speech to the French Ambassador for the 1913 *Langley Gold Medal* from the Smithsonian Institution for Gustav Eiffel’s first translation into English in 1913 of his book: *The Resistance of the Air & Aviation***



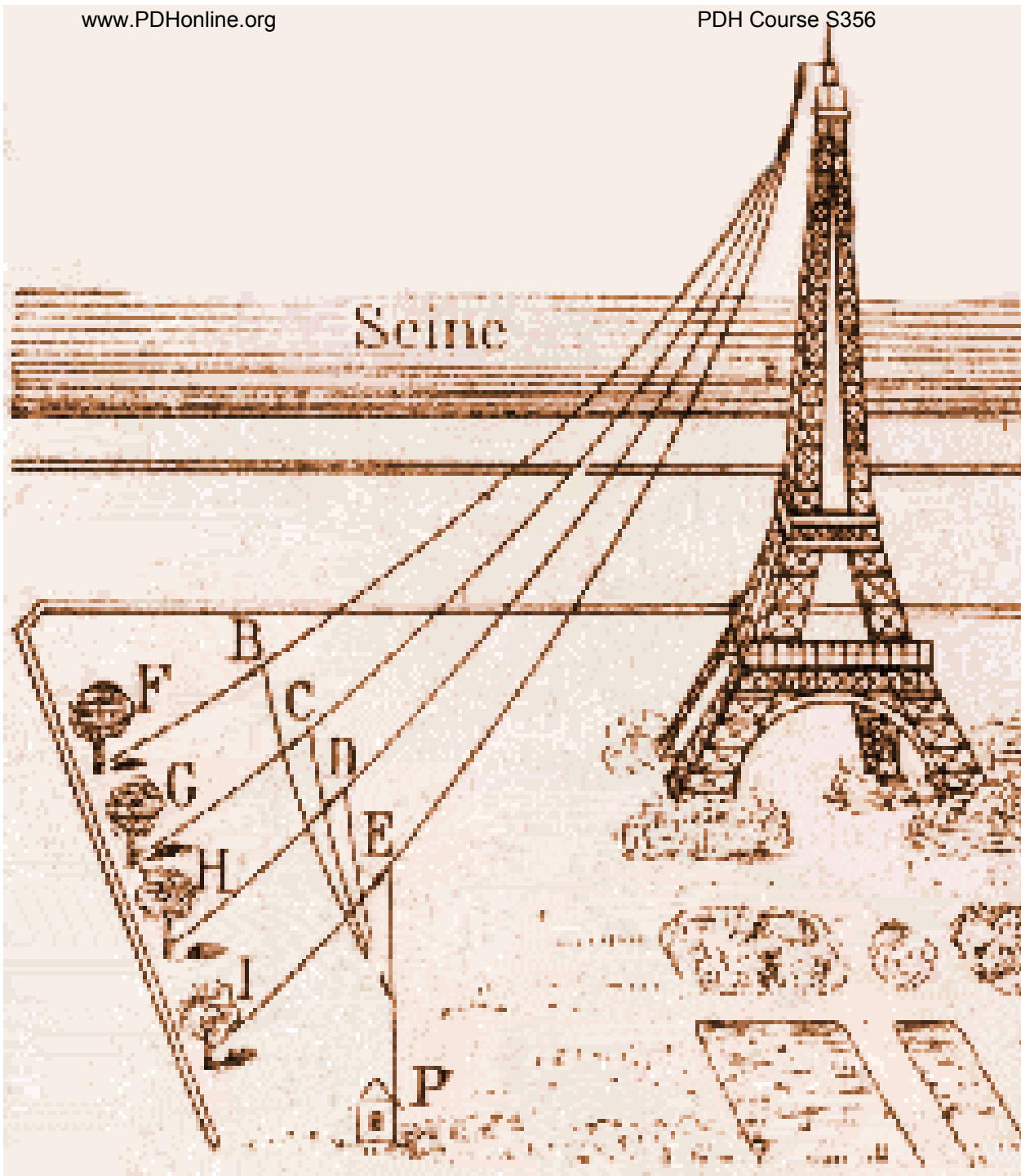
***“In 1898, Eiffel began actively to encourage yet another field of scientific research. “Radio” had not yet become the popular term for what was still known as “Wireless Telegraphy”. Eiffel recognized that his tower would have a significant role to play in future communication techniques.”***



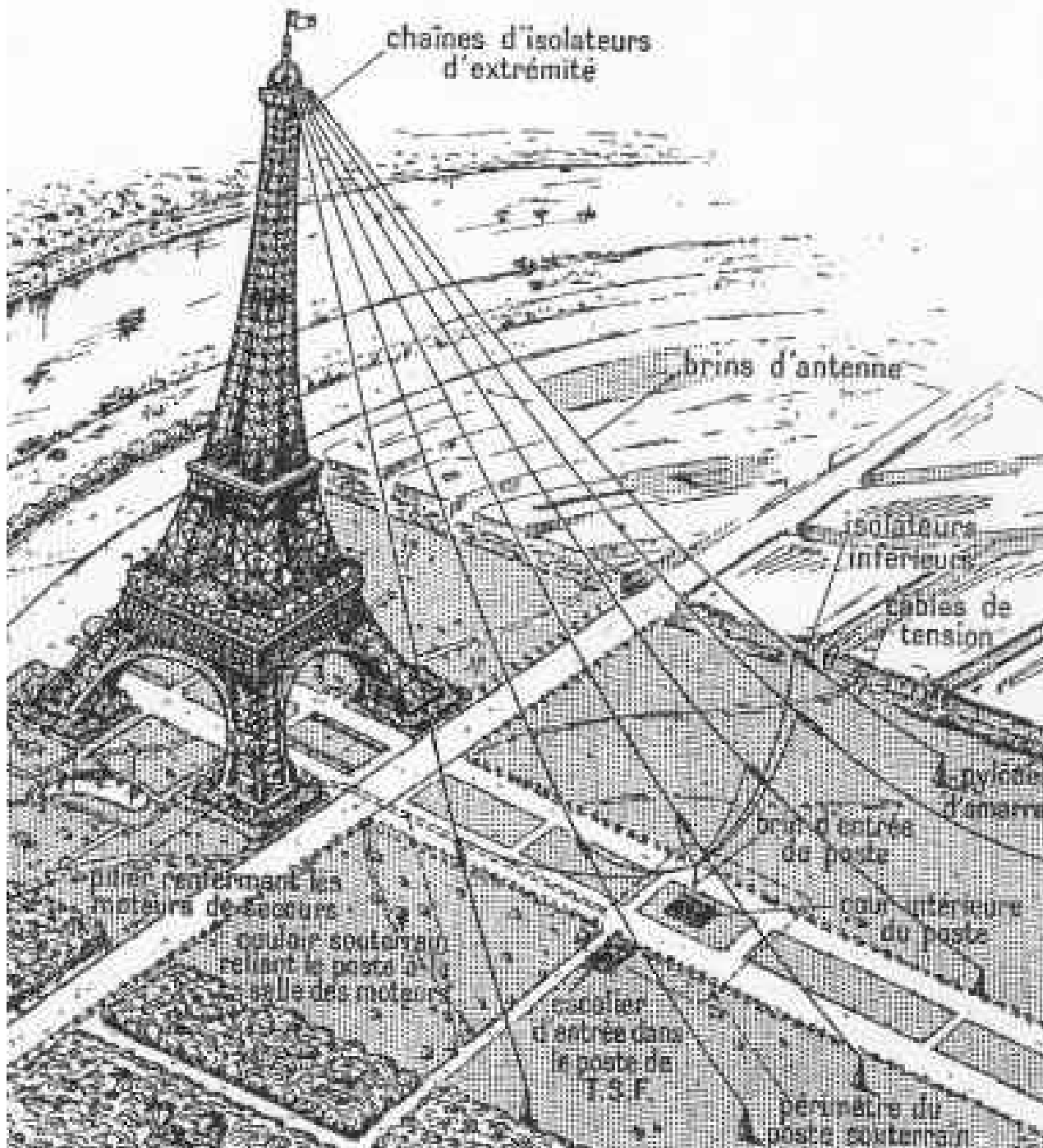


***“The transmission tests between the Eiffel Tower and the Pantheon, which I began on October 26<sup>th</sup> (1898), have continued since then. The distance covered is two and one-half miles and is filled with a large number of high constructions; the signals received in the pantheon were always very distinct, even in a rather thick fog; it is thus possible to affirm that with the same apparatus this distance could be appreciably increased.”***

**Gustav Eiffel**



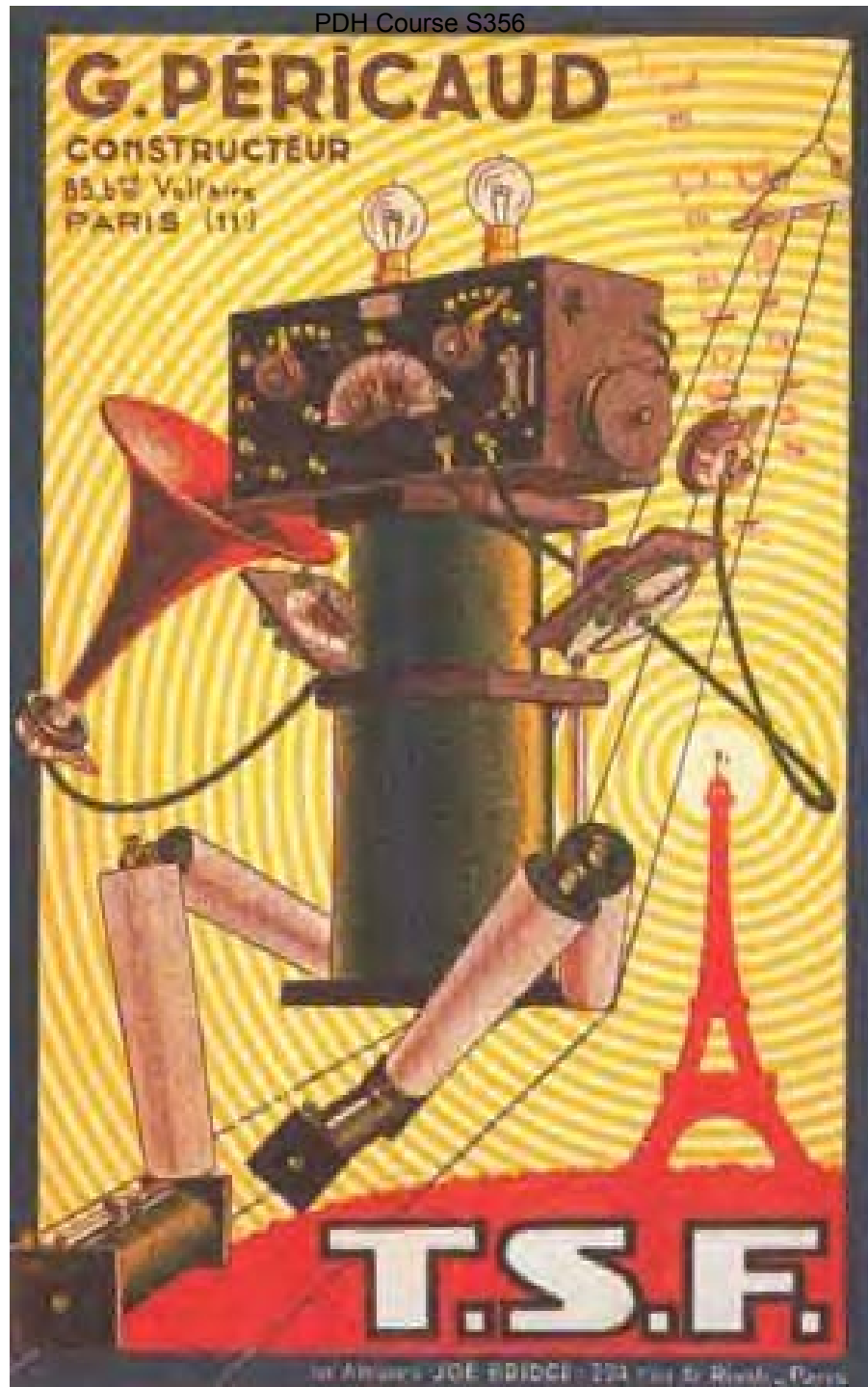
***“The first antenna, consisting of four cables from the top of the tower to the ground on the southwest side of the building was built in 1903, providing communications with military bases around Paris. Two years later, regular contact was established across France.”***



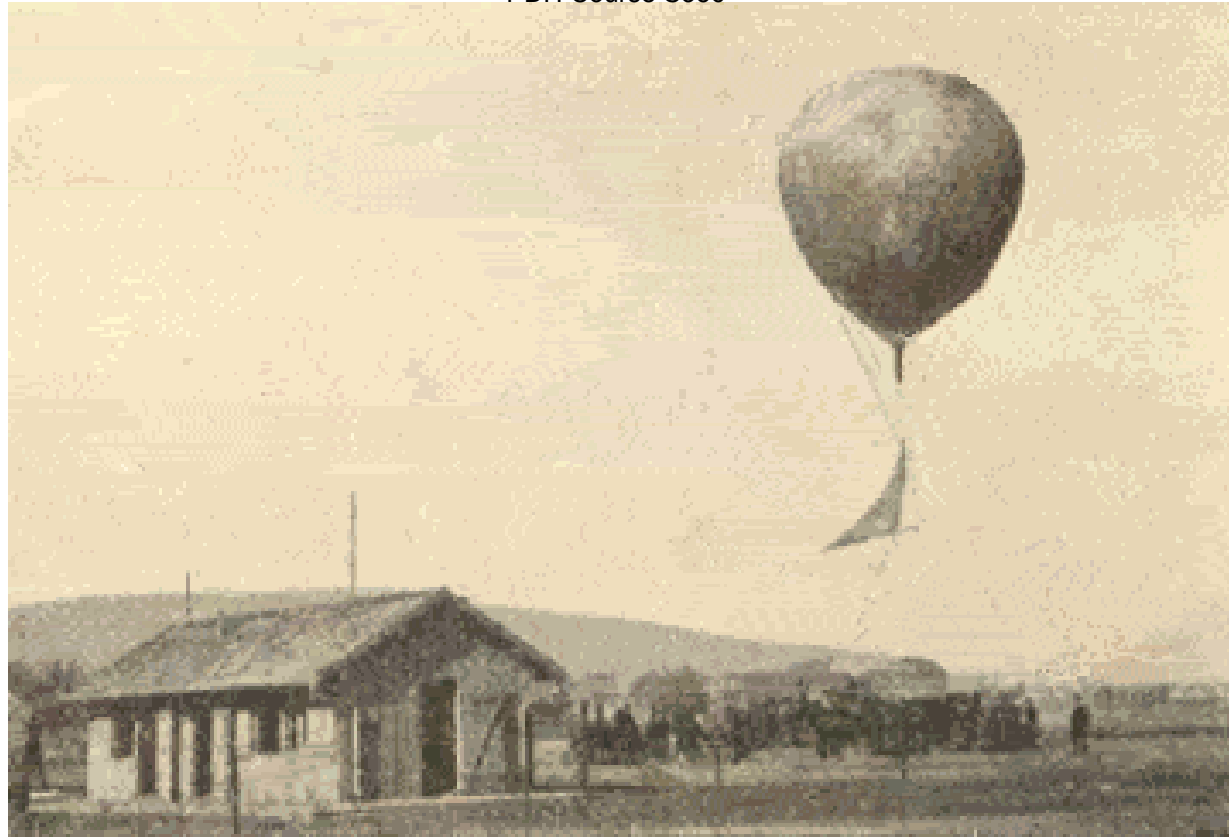
***“In 1908, an even larger antenna using six massive cables was constructed at right angles to the river, on the southeast side of the tower, with the transmission facilities buried under the Champs de Mars. This system enabled communication with Berlin, Algiers, Casablanca and North America.”***



***“Also in 1908, Lee de Forest set up a station at the foot of the Eiffel Tower. With his radio telephone (shown), he transmitted a musical program to New York featuring grammophone records. Scheduled for destruction in 1909, the tower escaped its fate because of its usefulness as an antenna which, at that time, was being used for radiotelegraphy – the forerunner of radio.”***







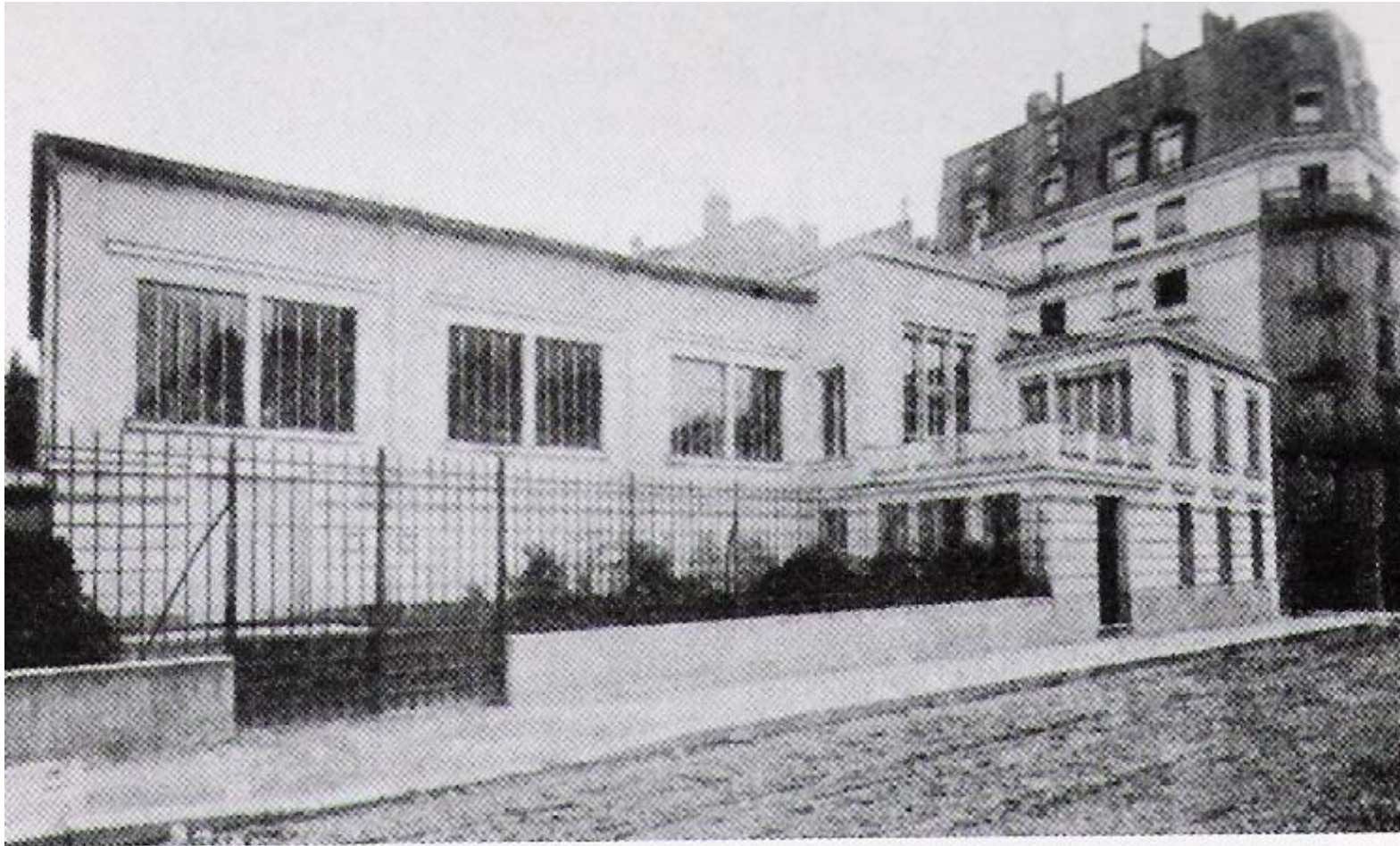
***“Eiffel had, for a long time, considered that the tower would have an important part to play in military communications and, aware that the French Corps of Engineers was conducting telegraphy experiments using tethered balloons, he contacted the military authorities to offer the use of the tower...the tower became the army’s principal wireless telegraphy laboratory, its activities subsidized by Eiffel.”<sup>274</sup>***



**“What outraged Parisians more than either the suicides or the official attempts to thwart them with ugly and intrusive barriers was the removal, in 1957, of the flagstaff carrying the tricolor. Despite the fact that it was replaced by an antenna.”**

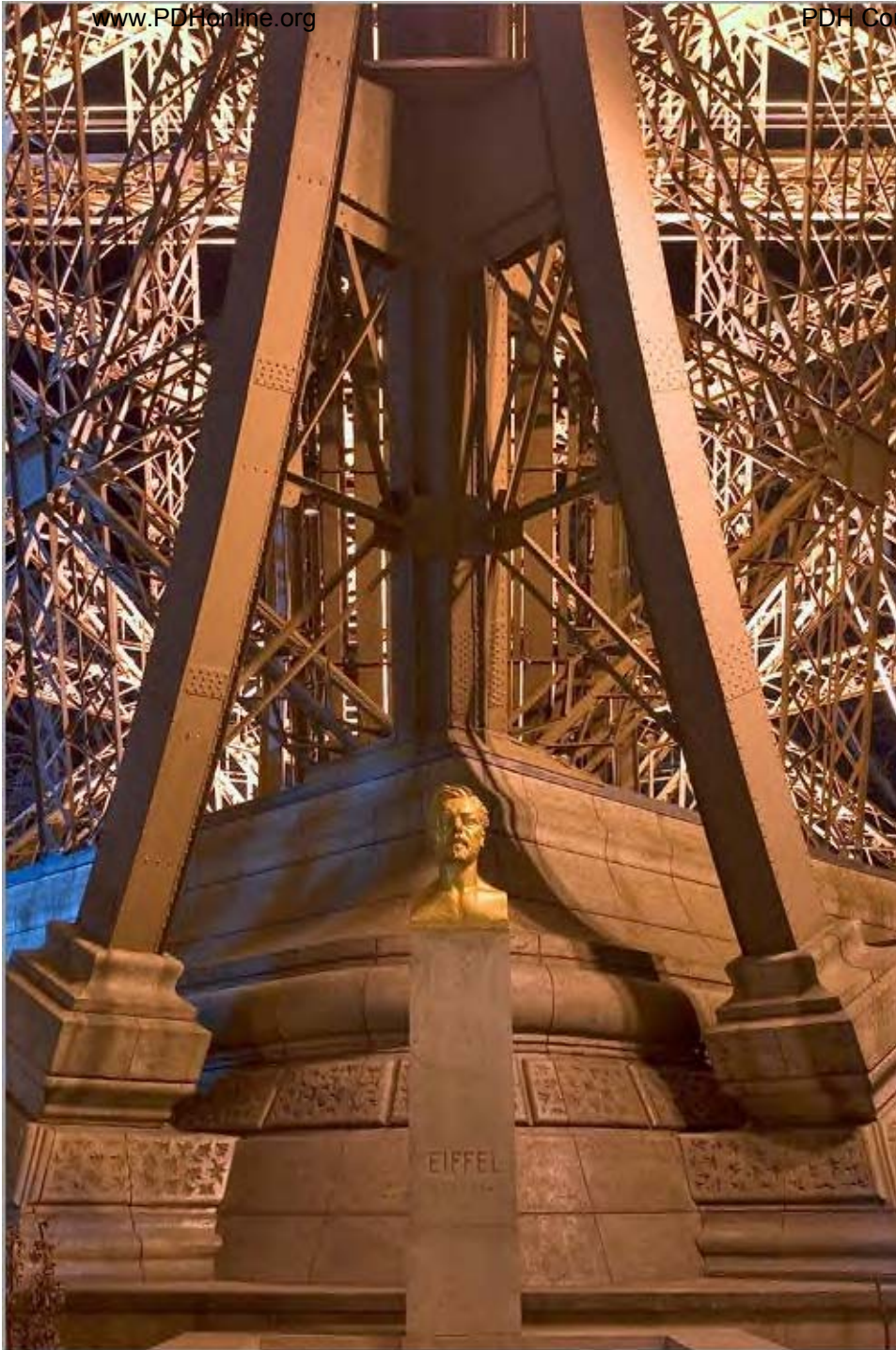




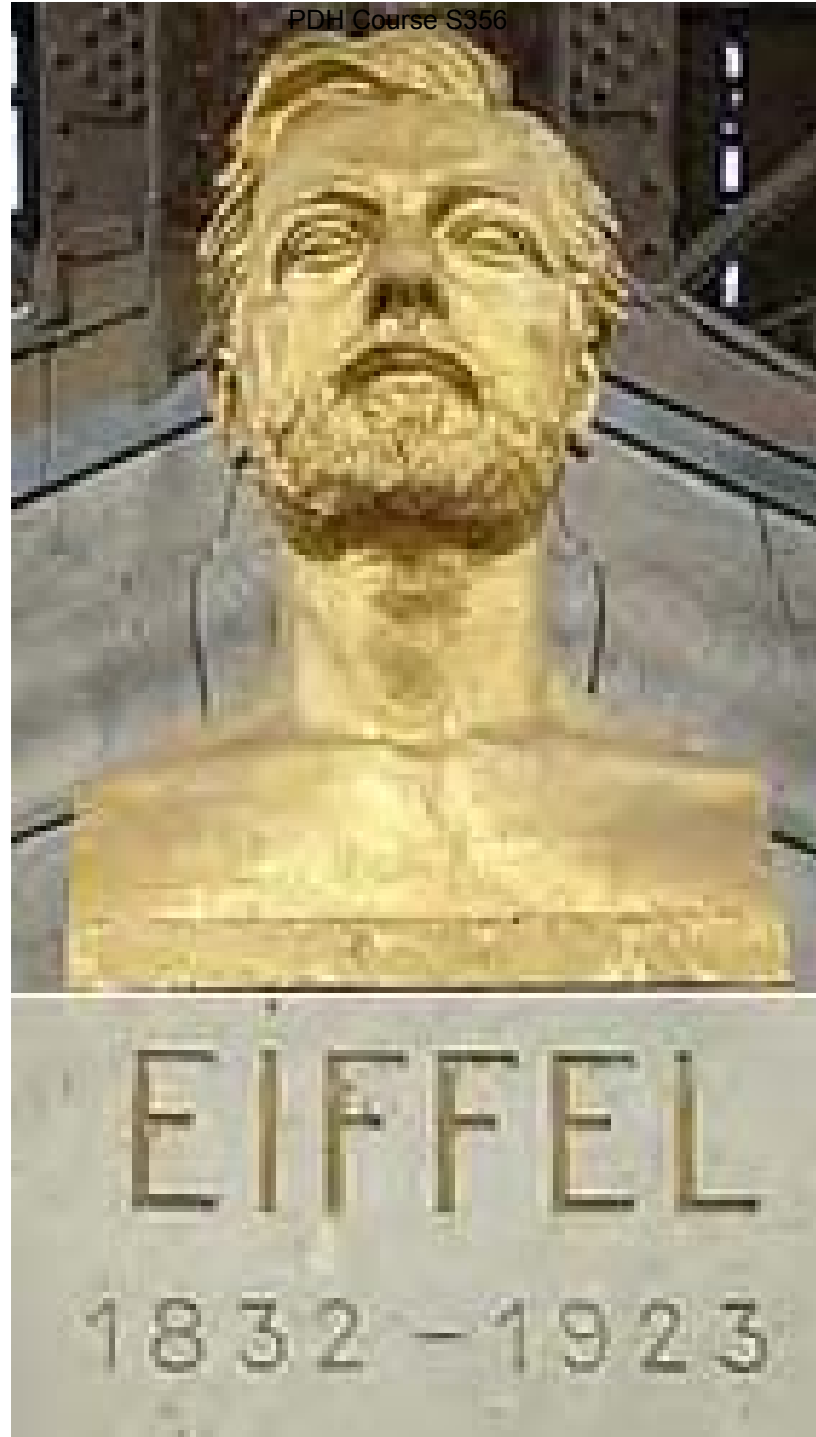


***“In 1920, at the age of 88, Eiffel finally decided to retire from his hugely productive, practical life, donating his laboratory at Auteuil to the state. It had been the first laboratory to establish the laws of aerodynamics and to give the new science of aviation its founding principles.”***





***“Le Magicien du Fer died peacefully at his mansion on the Rue Rabelais on December 27, 1923, at the age of 91. It was to be 26 years before even the simplest bust of Eiffel was unveiled at the foot of the tower.”***



# Part 6

# WAR & PEACE



**“WAR.”**

**RE: the one-word response by Wilbur Wright when asked in 1905; *what was the purpose of flying machines?***



LES VINGT-CINQ ANS DE LA TOUR EIFFEL.  
Son utilisation actuelle pour la télégraphie sans fil

***“In the summer of 1914, a message was intercepted at the (Eiffel) tower from the German cavalry commander advancing on Paris; the message informed his superiors that the advance would have to be halted as he had exhausted the foodstuff for his horses. The result was that an opportune French and British counter-attack was successfully mounted on the German forces at the River Marne.”***





***“Margarete Gertrude Zelle, the infamous sensuous dancer who had performed to rapturous crowds on the tower’s first level theater, was identified and convicted as the German spy Mata Hari, after a message was intercepted at the tower between Berlin and Spain arranging the payment of money to her from Germany at a Paris bank. When she attempted to obtain the cash, she was arrested, tried and shot as a spy.”***



**During the occupation of Paris during WWII, only Germans were allowed in the Eiffel Tower and there were fears that the symbol of French nationhood – the Eiffel Tower, might be destroyed by the Nazis. The Germans made good use of the tower, using it for military communications. In particular, with their U-Boat fleet in the Atlantic.**



**Adolph Hitler was a great admirer of French culture, art and architecture. He visited Paris after the city was captured but was unable to enjoy the view of the city from the top of the Eiffel Tower. The French resistance sabotaged the elevators, thus Hitler had to take in the view from the Trocadero Palace (left).**

25 AOUT 1944



- Mon grand !



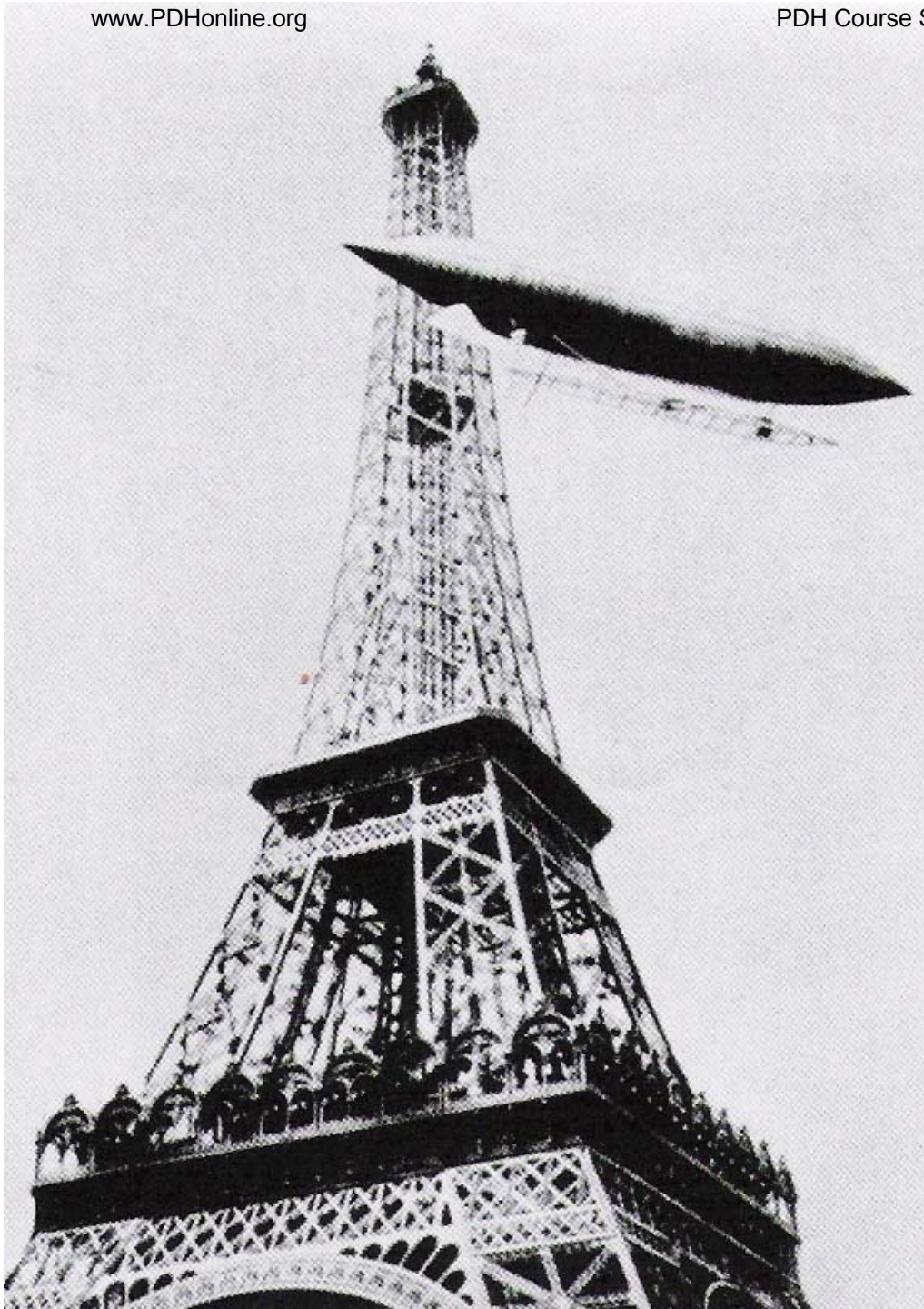
***“The occupation was over, as every Parisian knew who saw the tricolor snapping that afternoon atop their proud tower”***

**RE: On August 25, 1945, a band of French soldiers (the Free-French were allowed to enter Paris first) and climbed the 1,671 steps to return the French flag to its rightful place atop the Eiffel Tower** 288



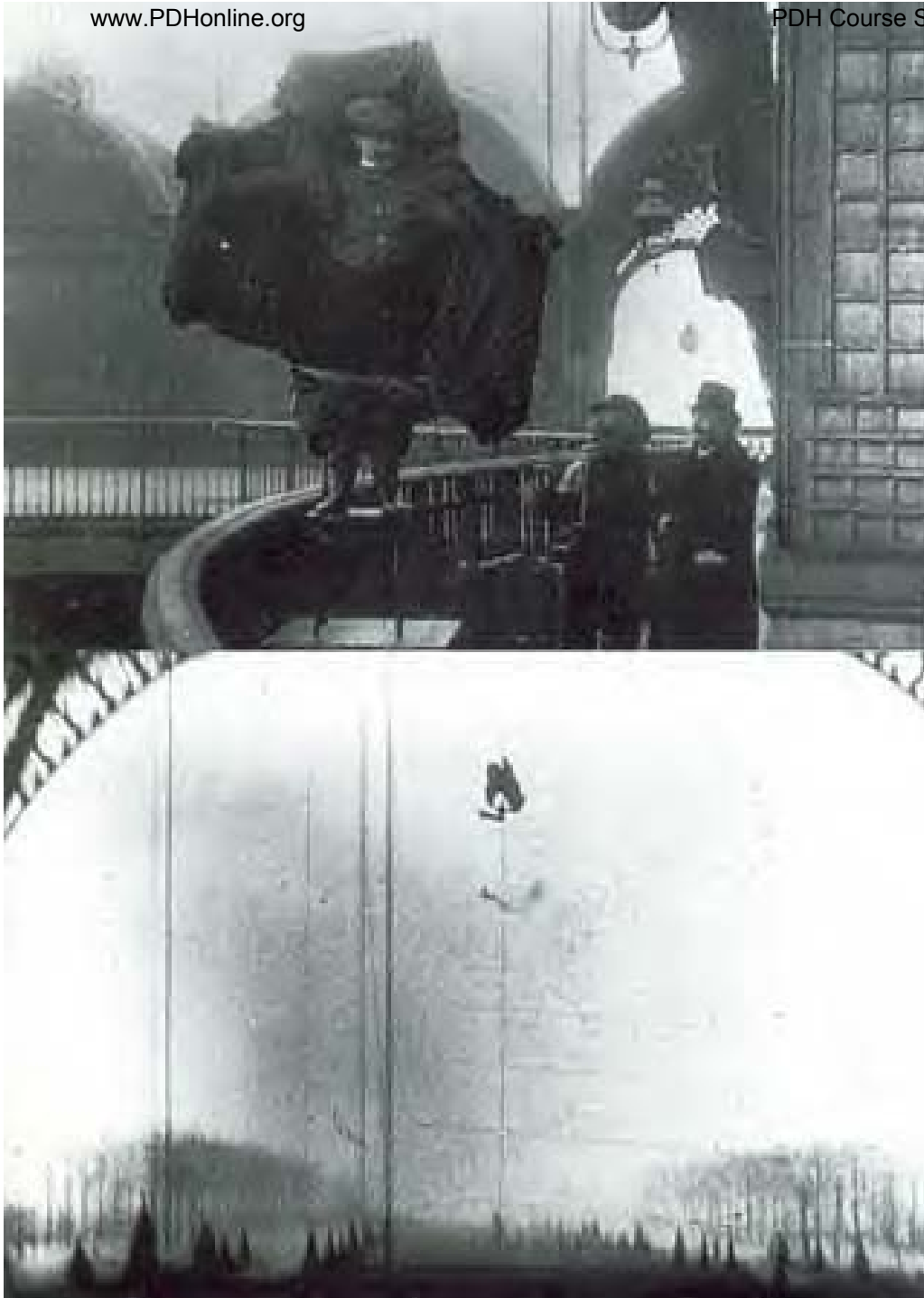


**PEACE**



***“Henri Deutsch de la Meurthe, President of the Aero Club of France, sponsored a balloon race. He offered a large cash prize for the first balloon to take off under its own power from Saint-Cloud, the hill park west of Paris, circle the Eiffel Tower three and one-half miles away, and return without landing within thirty minutes. The flight was to take place between May 1, 1900 and October 1, 1903.”***





***“In order to prove the viability of his own spring-loaded winged cape, in 1911 a Parisian tailor/inventor attempted to fly off the first platform of the Eiffel Tower. At the last minute, he lost his courage. Jeered by the merciless spectators, he stepped out into the ether with his mechanical contraption fluttering ineffectually about him. He died from heart failure before his body even hit the ground.”***





# THE TOWER BY NIGHT

***“I found that the tower was most imposing at night. Then the vulgarity inseparable from an indiscriminate crowd, the trivial details, the clap-trap, the pasteboard aspect of huge temporary structures, were lost in a vaster and more comprehensive impression, at once more real and more fantastic.”***

**RE: Exposition visitor’s impression**



## 1900 Exposition

***“As early as 1925 Andre Gustav Citroen – who had watched the Eiffel Tower being built as a child and decided then to be an engineer, managed to obtain a virtual monopoly on its use as a blatant advertising gimmick. The Italian lighting engineer Fernand Jacopozzi wanted to construct a gigantic lighting scheme featuring animated shooting stars, comets, zodiac imagery, fountains and water cascades. Citroen agreed to fund the cost in exchange for the Citroen name and logo in lights 98 feet high with 350,000 bulbs in six colors visible for 24 miles. When Citroen’s contract expired in 1936, nothing like it was ever allowed again. Not until 1964 was the tower designated a national monument immune from casual commercial alteration or interference.”***





## 1925 Paris Exposition des Arts Decoratifs



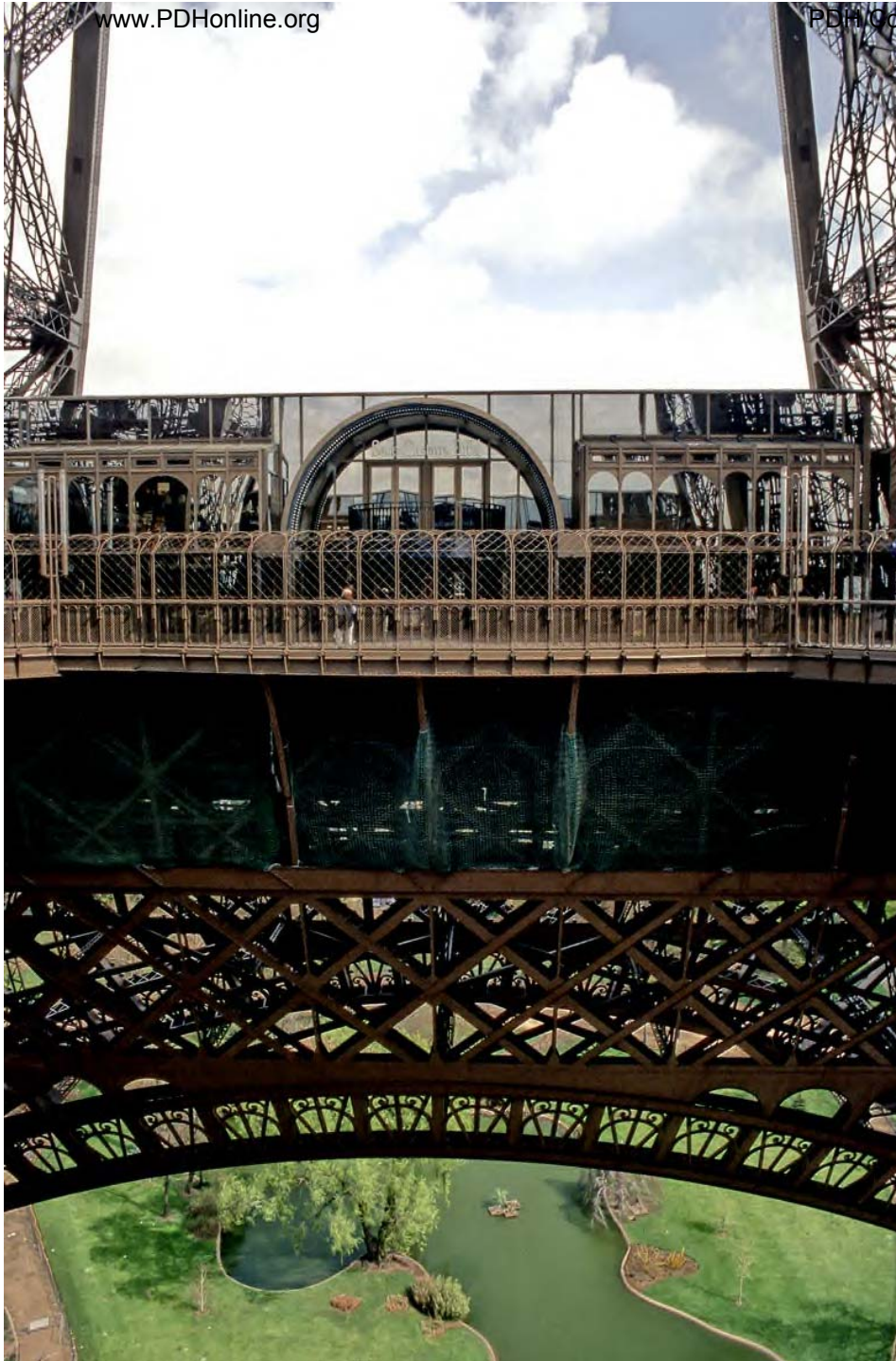
**The Eiffel Tower  
as a giant  
billboard for  
*Citroen* – a  
French  
automobile  
company**



## **Electricians at Work 1937**

# Part 7

# ICON



***“From its inception, the Eiffel Tower incorporated all features of a building, rather than a simple tower – rooms, offices, elevators, shops, cinema – and every day it still plays host to thousands of people both going about their business and visiting.”***













## **Wax Figures of Eiffel & Edison (Eiffel's Apartment)**



***“During its first 94 years it welcomed 100 million visitors, but only another 19 years passed before that number doubled, and in the winter of 2002 the anonymous 200-millionth visitor entered the massive iron maze as 1,200 VIP’s attended a celebratory dinner on the first platform.”***

# IMMITATORS



***“There is a long list of direct copies and imitators of the Eiffel Tower, from Shenzhen to Berlin to Las Vegas; none of the same size, but all offering an extraordinary homage to the original.”***



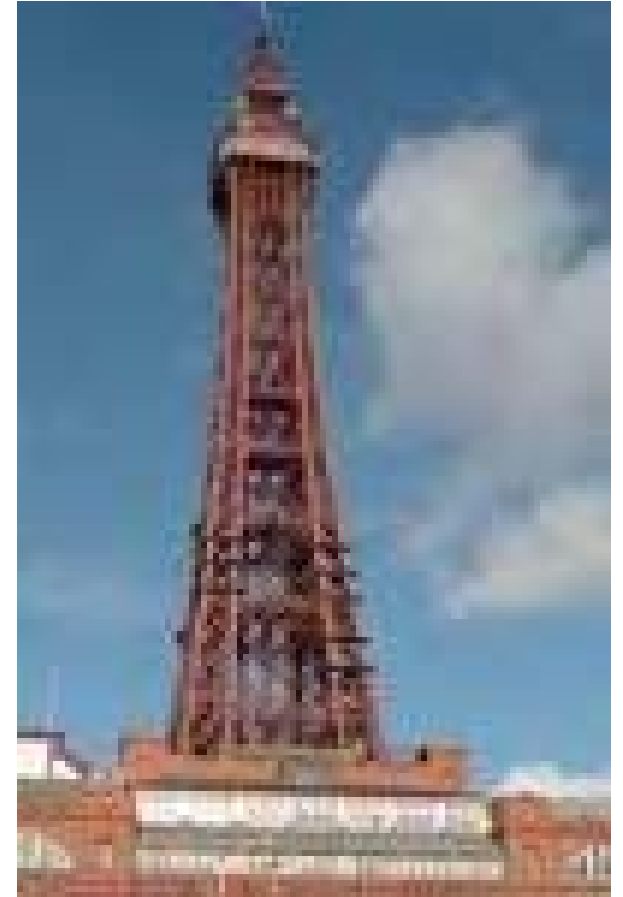
**Sedgwyck, England**  
**Near the site of the relocated Crystal Palace**



**A replica of the Eiffel Tower constructed of Bamboo. Erected in Indonesia in the late 1890's to celebrate the coronation of Queen Wilhelmina of Holland.**



**Prague, Czech Republic**  
**Situated atop a hill, the tower reaches the same height as the**  
**Eiffel Tower**



**Blackpool Tower  
Blackpool, England**



# America's Eiffel Tower with Sherwin-Williams

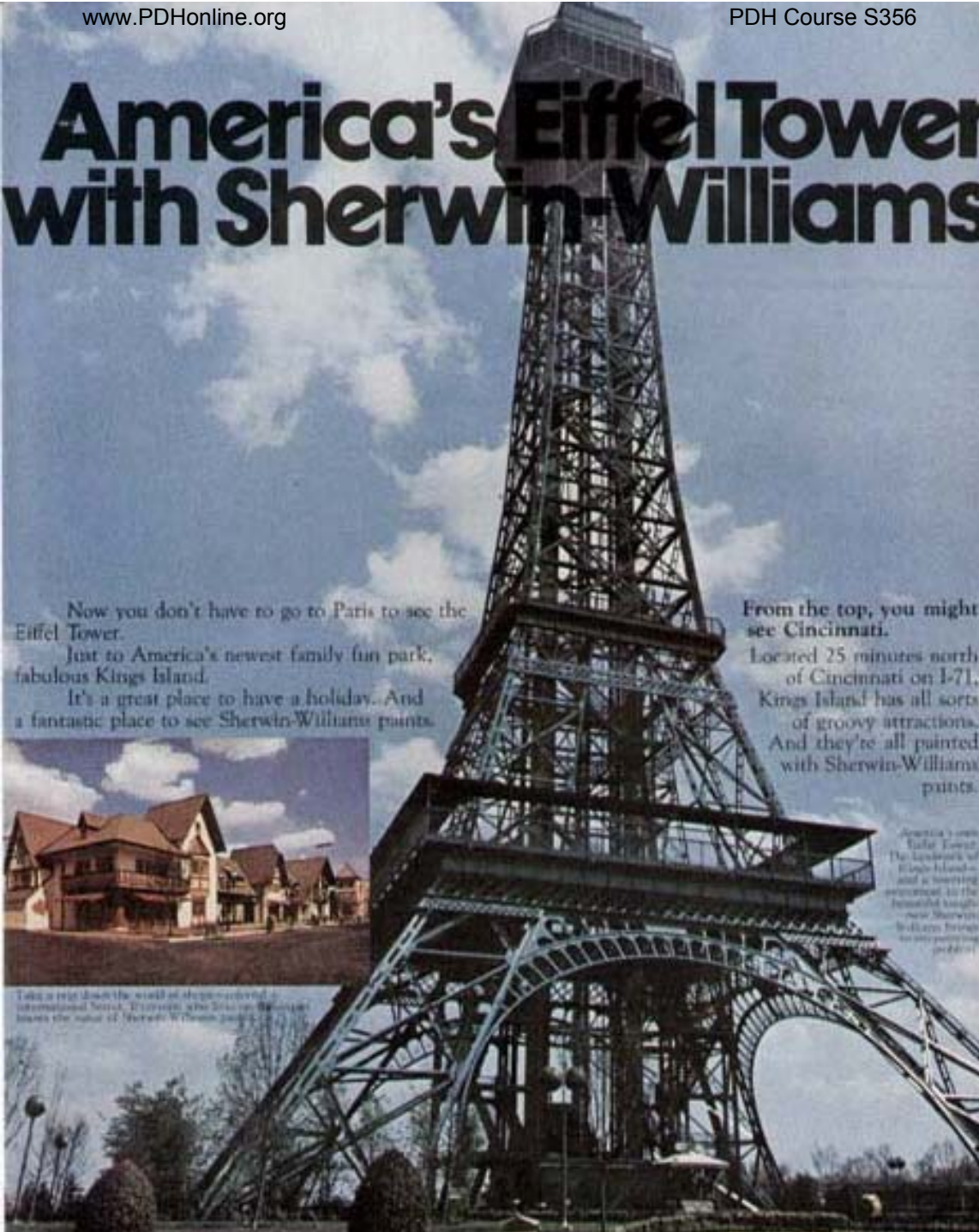
Now you don't have to go to Paris to see the Eiffel Tower. Just to America's newest family fun park, fabulous Kings Island. It's a great place to have a holiday. And a fantastic place to see Sherwin-Williams paints.

From the top, you might see Cincinnati. Located 25 minutes north of Cincinnati on I-71, Kings Island has all sorts of groovy attractions. And they're all painted with Sherwin-Williams paints.

America's own Eiffel Tower. The landmark at Kings Island is and is towering over much of the beautiful landscape. Sherwin-Williams paints bring an extra painting job to life!



Take a trip down the world of step-up comfort at International Hotel. It's right where you want to be. Sherwin-Williams paints the color of Sherwin-Williams paint.



## King's Dominion Eiffel Tower Richmond, Virginia



***“Inevitably, it was to be in the gambling center of Las Vegas, Nevada that a 540 foot half-scale replica of the Eiffel Tower would open in 1999, in front of the Paris Hotel and Casino. This is a welded steel structure inclusive of 300,000 simulated rivet heads. It is the centerpiece of an \$800 million resort known as Paris Las Vegas.”***

# ARTWORK







**Les Mariés de la tour Eiffel**

**(Marc Chagall)**







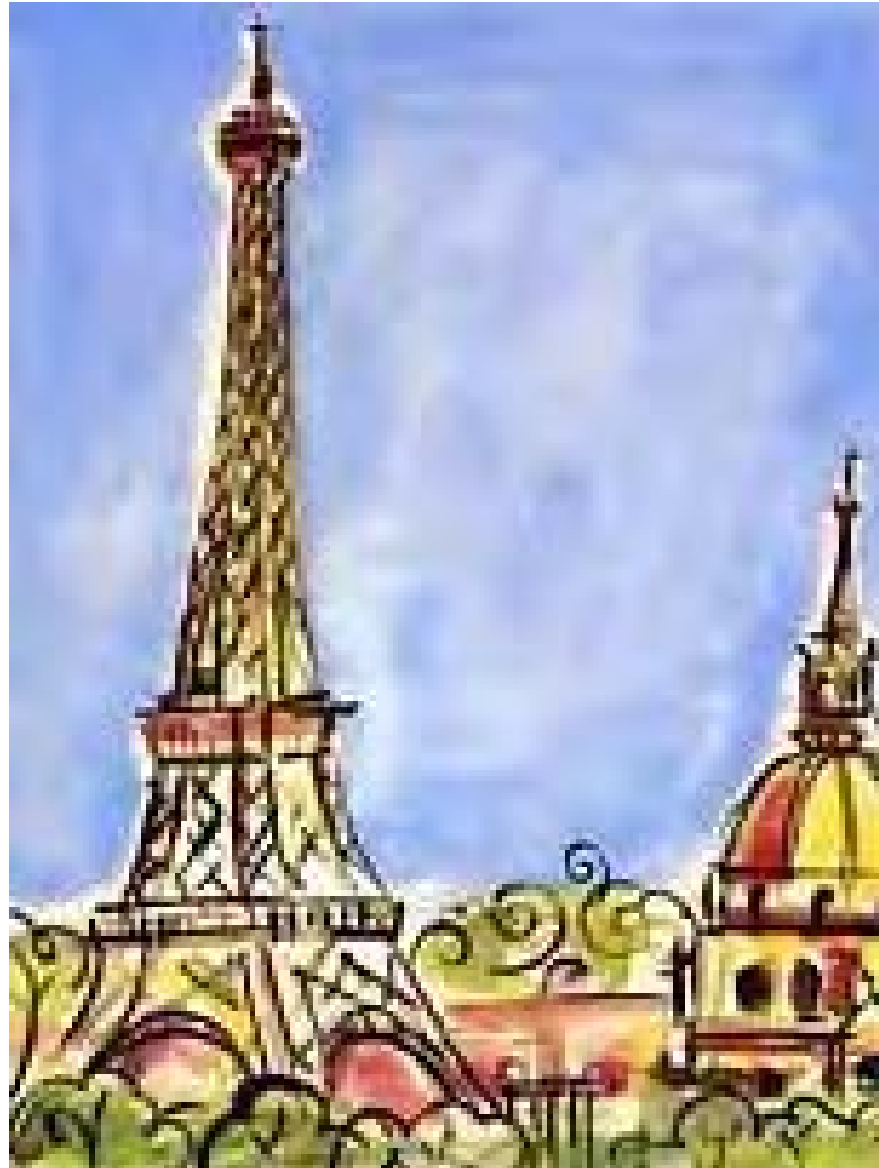


***“The artist most obsessed with the Eiffel Tower was Robert Delaunay. His first painting of the tower in 1909 displayed what had, until then, been the clear influence of Cezzanne. In 1911, Delaunay did 51 canvases of the Eiffel Tower before achieving the desired result.”***











# PHOTOGRAPHS









# CULTURE



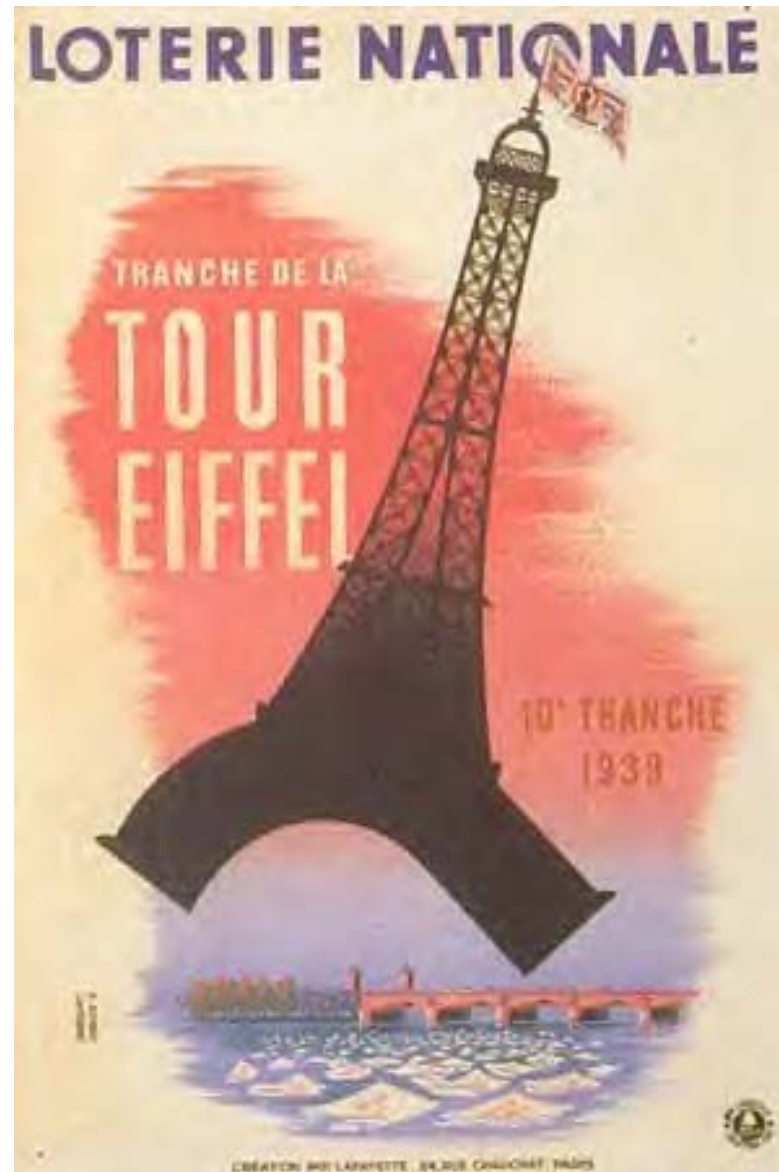
***“Notre-Dame is faith, the Pantheon is service to the nation, the Louvre is Art & History, the Arc de Triomphe the glory. The Eiffel Tower has affirmed the vitality of the technical culture which has maintained our position in the modern world.”***



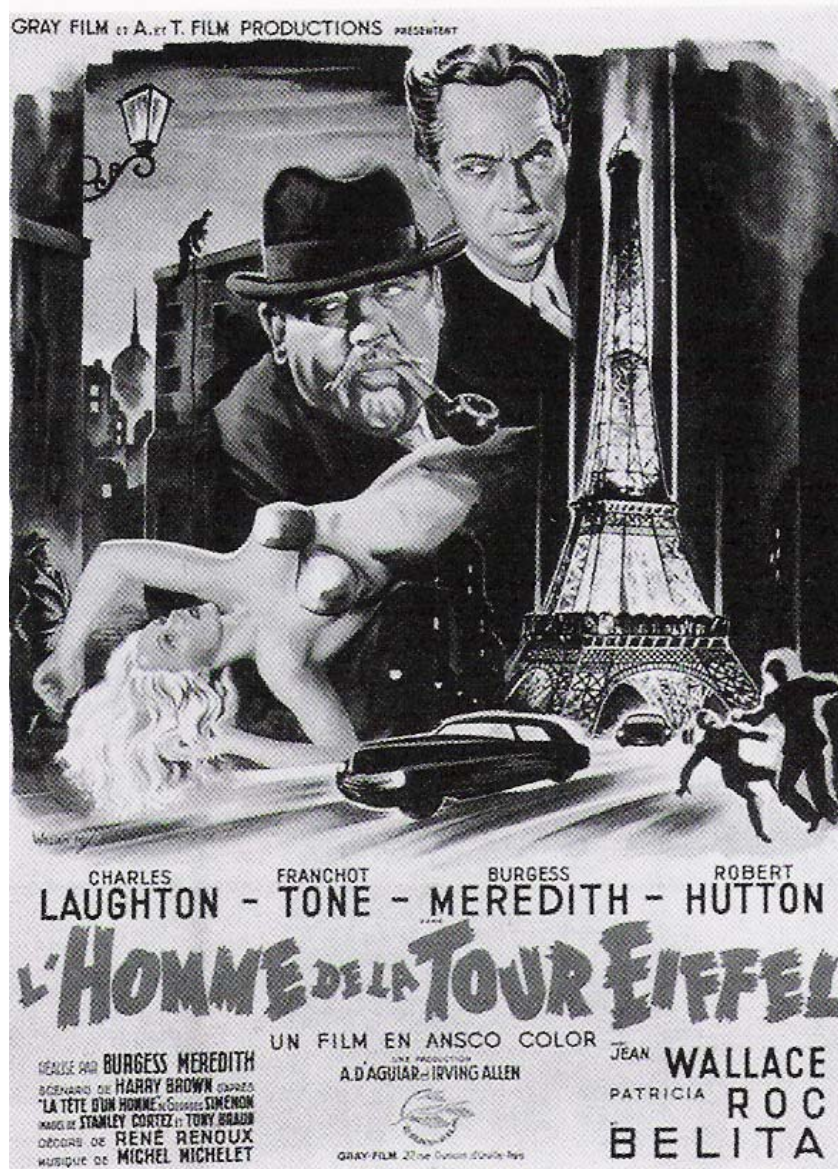




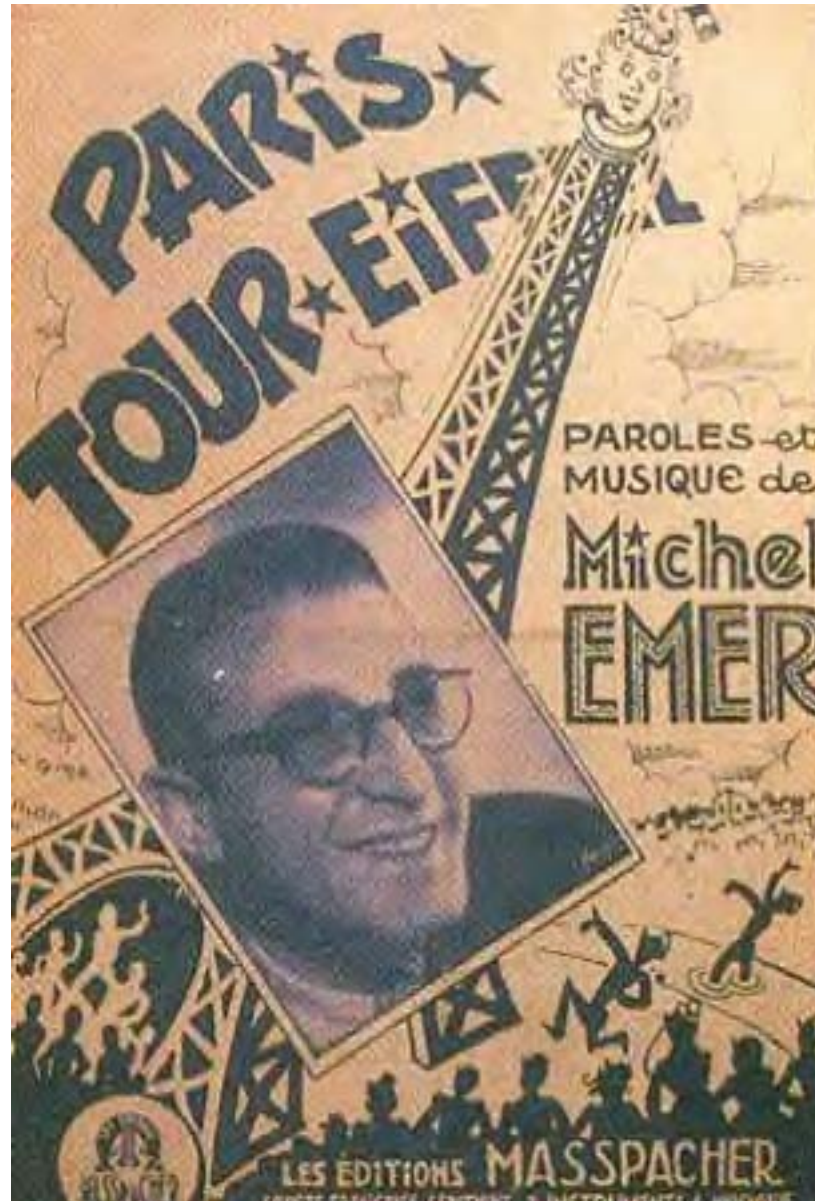














# ON A VOLE LA TOUR EIFFEL

Paroles de Paul WEIL      Musique de Edouard JOUVE

*Allegretto*

De chez moi je vois tout Paris,  
J'ha.bi.te là-haut sur la But.te, Or ce ma.tin je fus surpris De  
ne plus voir, de ma ca.hu.te La Tour Eif.fel, le Panthéon  
Ni l'O.pe.ra, ni Saint Sul.pi.ce, Ni mê.me le  
*REFRAIN*  
Palais Bourbon! Qu'a.on fait de ces é.di.fie.s? Qui a vo.  
lé la Tour Eif.fel? Elle a dis.pa.ru de mon ciel; Qui a pris

**The arrival of the engineers and workmen at the Champs de Mars (*lento*)**

**Beginning of the tower's foundation works (*moderato*)**

**Sounds of iron (*moderato & martellato*)**

**The ironsmiths (*allegro & cheerfully*)**

**Tumult and trouble among the workers (*allegro agitato*)**

**First Platform (*andante cantabile*)**

**Second stage, the tower mounts**

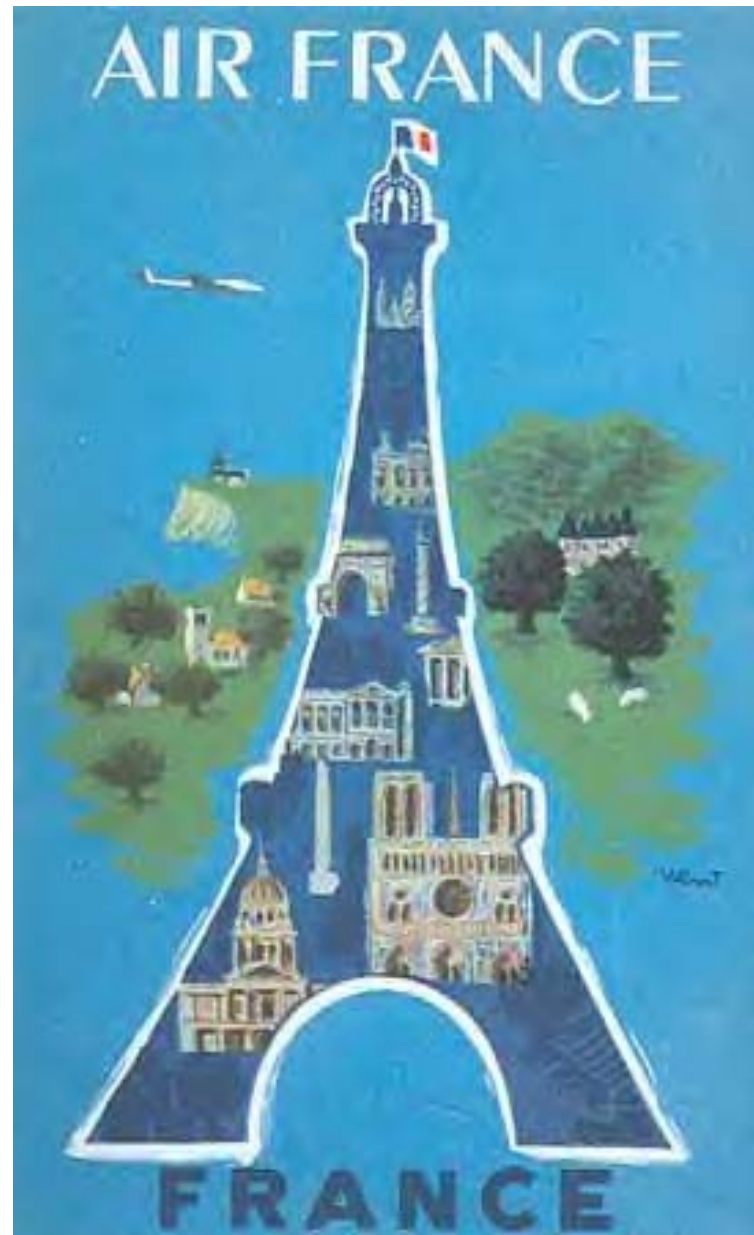
**Higher, the top (*andante cantabile*)**

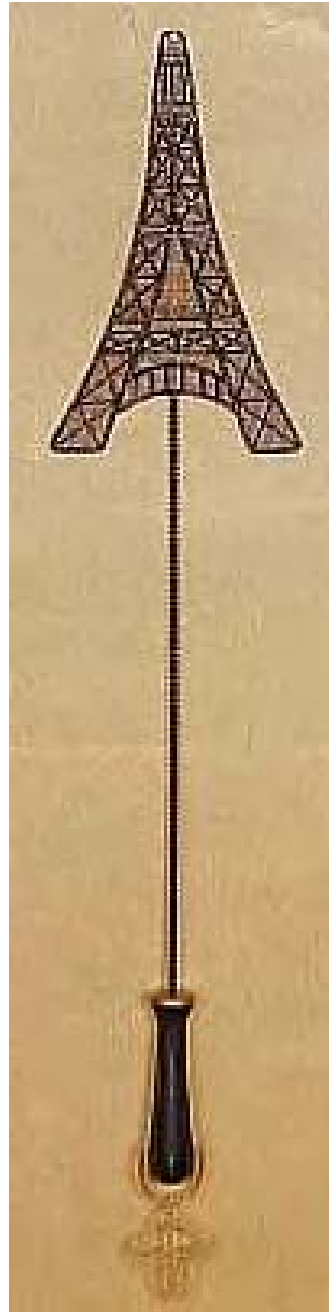
**The crowd climbs (*moderato accelerando e crescendo al fine*)**

**Hymn to the French flag (*lento e grandioso*)**

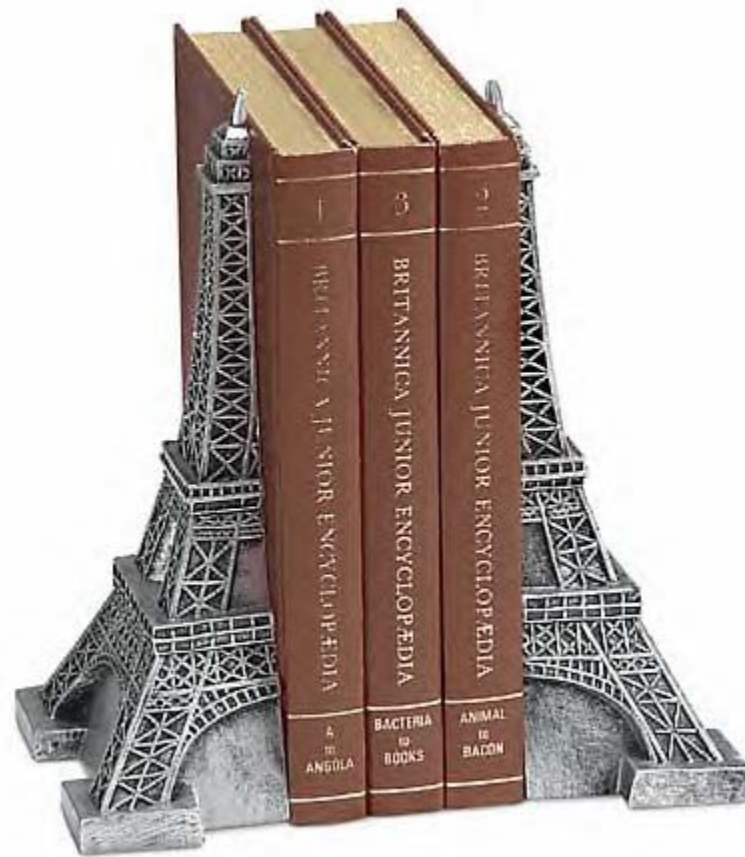
***Opus 63: The Eiffel Tower Symphony* by composer Adolphe David**











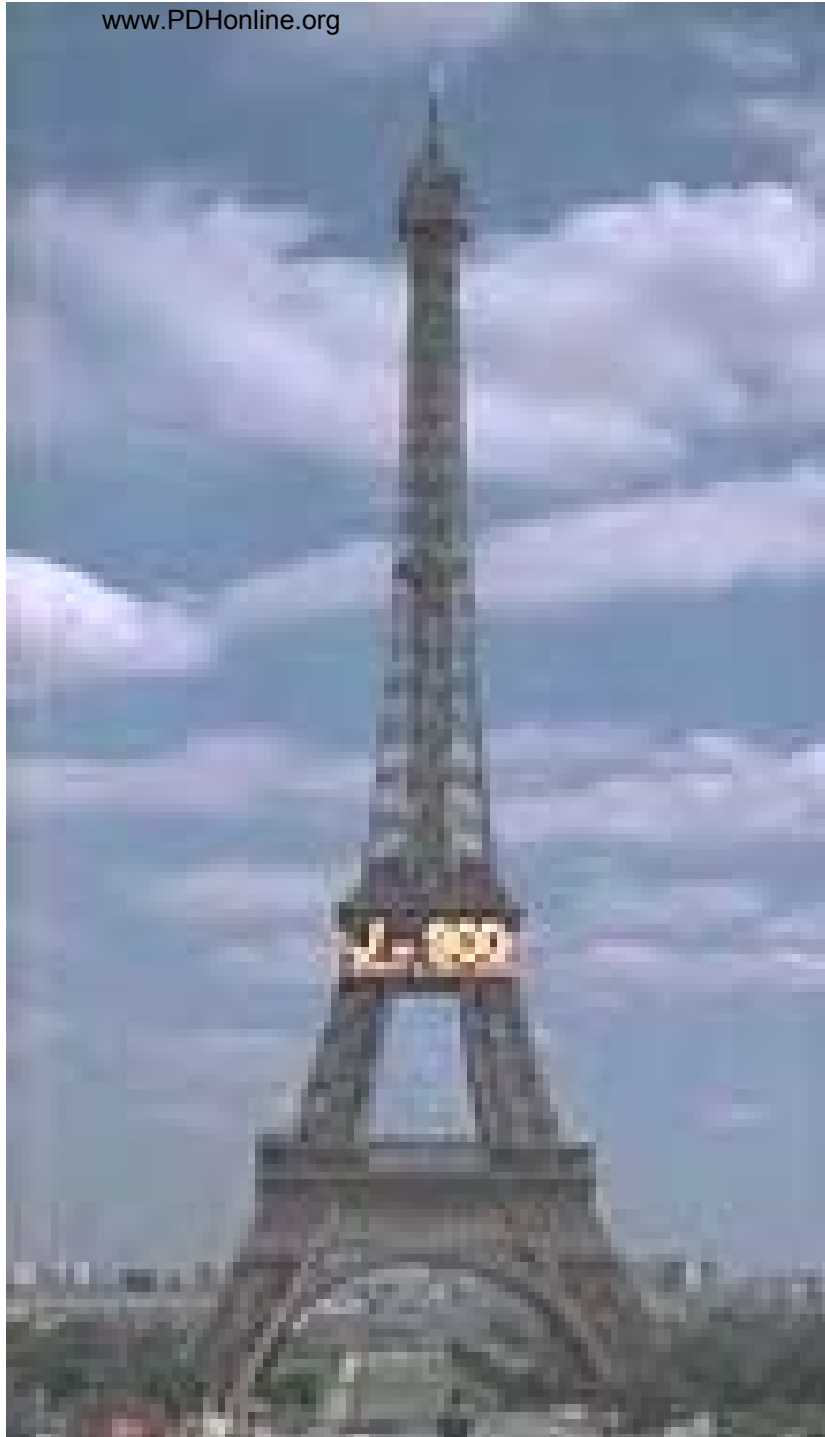






***“Count” Victor Lustig (one of 40 aliases) became aware of public concern about the physical condition of the Eiffel Tower. Posing as a government minister, he opened discussions on the contract for the demolition of the Eiffel Tower which, he insisted, would have to be discreet to avoid a public outcry. Andre Poisson had hoped for publicity for his company, but ended up defrauded of several million francs but he could not afford the embarrassment of making his situation public. Lustig returned to Paris and repeated the trick with another five companies but this time the victim contacted the police. Lustig escaped to the United States. In 1935, Lustig was incarcerated for a counterfeiting swindle and sentenced to twenty years in Alcatraz. He died there in 1947. His death certificate gave his occupation as “apprentice salesman.”***





**“J-900” indicates that there are 900 days until the millennium year 2000. This photograph was taken on Bastille Day; July 14, 1997**



**The Eiffel Tower retained its position as the world's tallest structure until May 1930, when, in the space of 90 minutes, a *Vertex* (a 180-foot tall stainless-steel spire weighing 28-tons) was lifted by crane to the top of New York's Chrysler Building, making it - at 1,046 feet, the tallest man-made structure in the world.**