

Shop Fabrication of Steel for the Empire State Building

Across the narrow flange of a beam a surefooted ironworker tread, high above a busy street or the swift current of a river. With a spud wrench or a rivet hammer in hand they sculpted the structural steel of buildings and bridges. Whether it's the Golden Gate Bridge in San Francisco or the Empire State Building in New York City, the skill of these 1930's craftsmen was on display for all to view. Rivets heated with a coal forge to the color of yellow, grasped with steel tongs and sent through the air to a catcher's can were promptly inserted in the hole of a connection plate and riveted in place with a pneumatic field rivet hammer. But for every field rivet driven by these skilled craftsmen on the construction site, hundreds of rivets were heated in a fabrication shop and compressed in place by giant shop pneumatic riveters suspended by a system of cranes and operated by a crew of four or five men. Assembling the massive steel columns for the Empire State Building in the fabrication shop required hard physical labor by craftsmen unseen by the general public and often unrecorded. When completed, these massive shop-riveted steel columns were shipped to the Empire State Building job site, lifted in place and field riveted with a pneumatic field rivet hammer weighing twelve to thirty pounds. Shop fabrication of the steel for the Empire State Building was done at the American Bridge Company and the McClintic-Marshall Company.

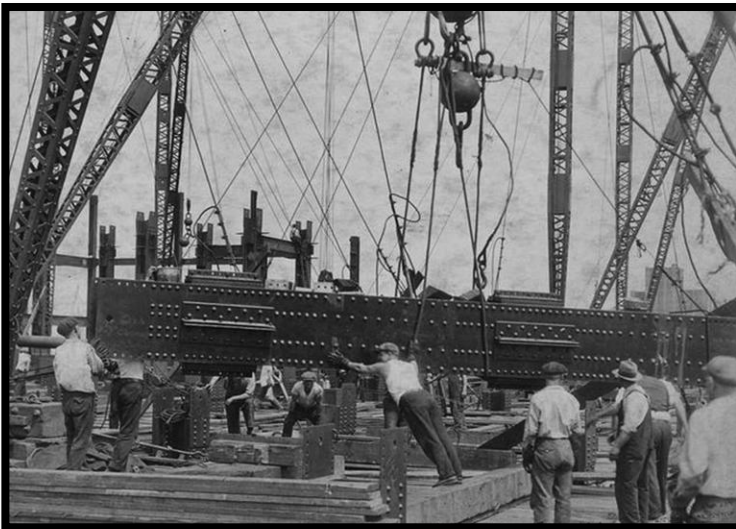
"Rather than awarding the steel fabricating contract to the low-bidder, Starrett Brothers and Eken signed the two lowest qualified bidders and divided the building into horizontal slices, with alternating sections supplied by the American Bridge Company and the McClintic-Marshall Company." (Building The Empire State, 1998, The Skyscraper Museum)
In 1931, Bethlehem Steel purchased McClintic-Marshall Company and in 1936 renamed it as Bethlehem Steel Fabricated Steel Construction Division.

Before the shop fabrication of the Empire State Building could begin, the steel had to be rolled. The Carnegie Steel Company rolling mills (a subsidiary of U.S. Steel Corporation) in Homestead, Pennsylvania, supplied the structural steel shapes that were shipped to American Bridge Company and the McClintic-Marshall Company storage yards for fabrication.

"Structural steel is detailed for fabrication by shop drawings, which are the fabricator's interpretation of the structural engineer's somewhat schematic drawings. Shop drawings are divided into two types: piece drawings that show the exact location of every rivet or bolt, and erection drawings that show where each piece goes along with any information required for proper sequencing." (Building The Empire State: A 1930s Notebook, 1998, The Skyscraper Museum)

Below is a series of pictures detailing the fabrication and shop riveting of an Empire State Building steel riveted column.

The film *Making A Skyscraper (Steel)-Empire State Bldg.* (from the Prelinger Archives) shows pneumatic shop riveters (in the first part the film). The film can be viewed at http://archive.org/details/making_a_skyscraper_empire_state_bldg



Empire State Building Photograph by Lewis Wickes Hine/NYPL Digital Gallery
"Hoisting a large beam (1931)"



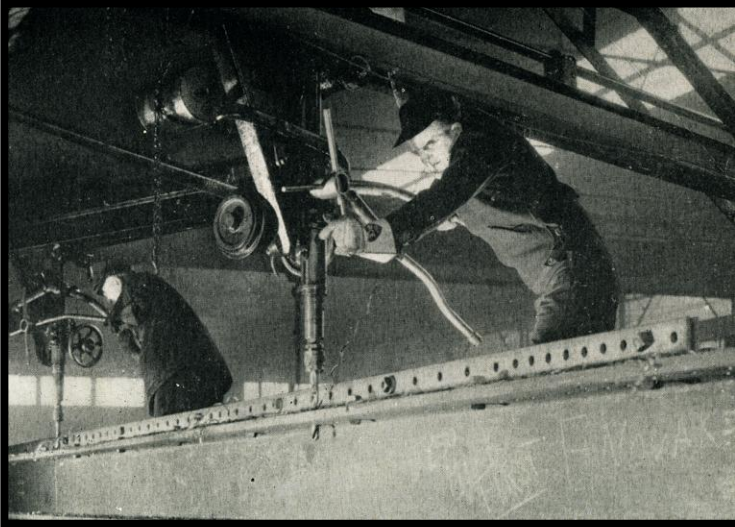
Steel for the Empire State Building was shipped from the Carnegie Steel Company rolling mills in Homestead, PA, and stored at the American Bridge Company and the McClintic-Marshall Company storage yards similar to the storage yard shown in the picture above. (Photo: AISC Textbook of Structural Shop Drafting, vol 1, 1953)



Template making is the first major shop operation. Templates are used to layout the location of the rivet holes, which are then drilled or punched. "Structural steel is detailed for fabrication by shop drawings (p 43, *Building The Empire State: A 1930s Notebook*). "The shop drawings providing full detail for fabrication were being delivered less than six weeks before the steel was due to be delivered, and the steel was delivered from the fabricator to the erector's yard one week before it was due for erection (p 45)."



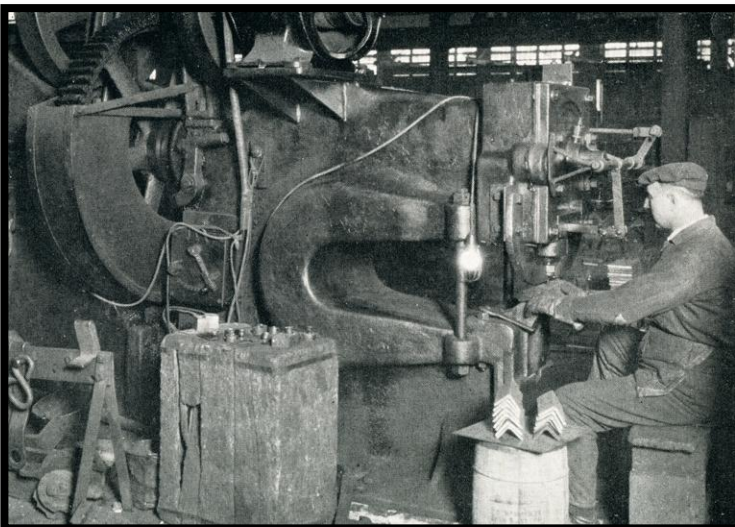
Shop fabricator uses template to mark with a steel punch the location for drilling holes for rivets or bolts. "Shop drawings are divided into two types: piece drawings that show the exact location of every rivet or bolt (p 43, *Building The Empire State, A 1930s Notebook*)."



Match drilling an angle to the flange of a wide flange beam in preparation for shop riveting. (Photo: *AISC Textbook of Structural Shop Drafting*, vol 1, 1953)



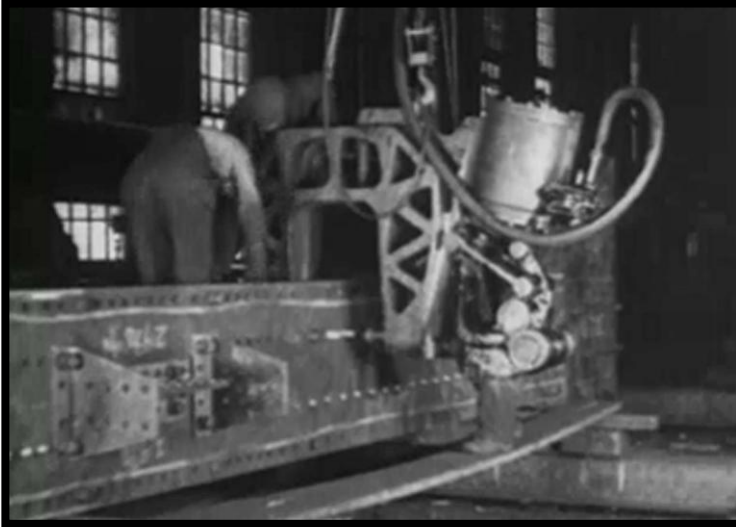
Drilling rivet holes in the Wing Plates for an Empire State Building fabricated steel column. (Photo: from the film *Making A Skyscraper (Steel)-Empire State Bldg.*, Prelinger Archives, San Francisco)



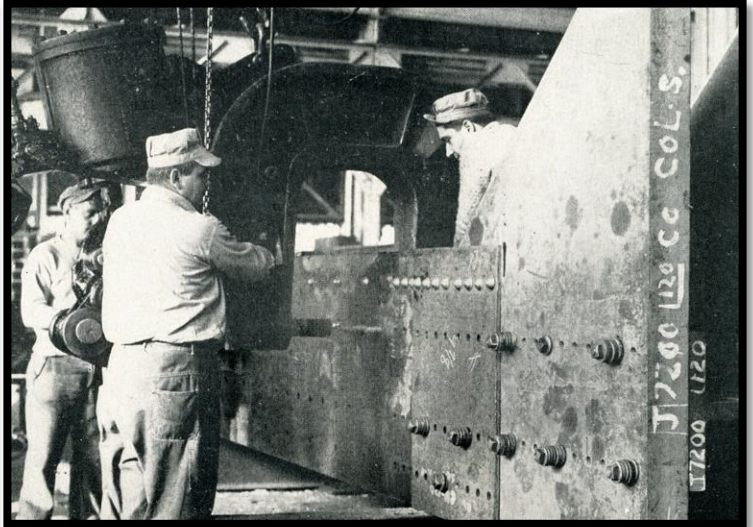
A punching machine used to prepare angle and plate detail for riveting. (Photo: *AISC Textbook of Structural Shop Drafting*, vol 1, 1953)



Portable shop riveter (Photo: from *Hanna Riveter Catalog*)



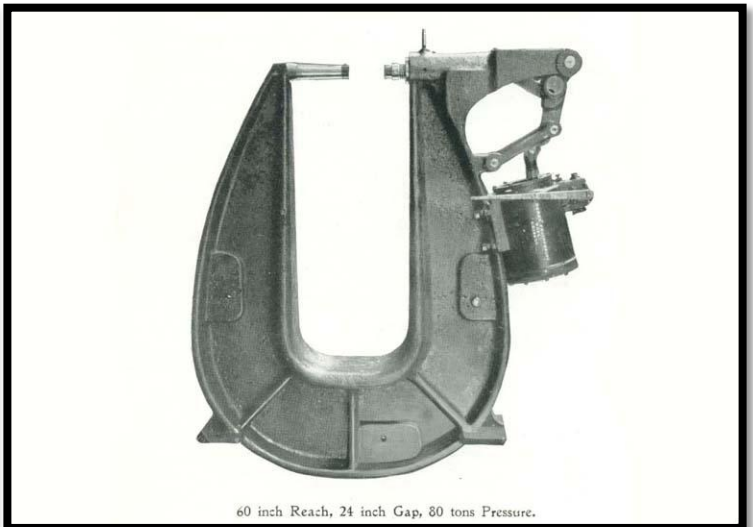
Shop riveting an Empire State Building fabricated steel column with a suspended pneumatic portable riveter (Photo: from the film *Making A Skyscraper (Steel)-Empire State Bldg.*, Prelinger Archives, San Francisco)



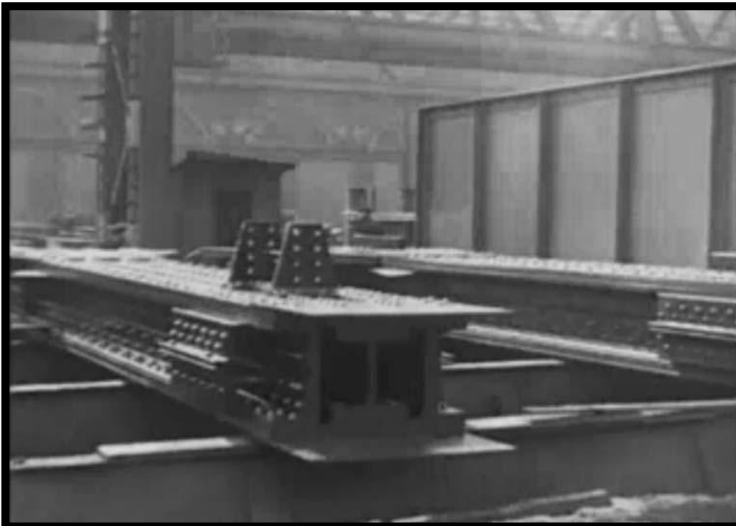
Shop riveting a cover plate to a fabricated steel column with a suspended pneumatic portable riveter. (Photo: *AISC Textbook of Structural Shop Drafting*, vol 1, 1953)



Riveting with a stationary riveter a section for an Empire State Building built-up column section. (Photo: from the film *Making A Skyscraper (Steel)-Empire State Bldg.*, Prelinger Archives, San Francisco)



Stationary riveter (Photo: from *Hanna Riveter Catalog*)



Shop riveted column completed and ready for shipment to the Empire State Building construction site. (Photo: from the film *Making A Skyscraper (Steel)-Empire State Bldg.*, Prelinger Archives, San Francisco)



Shop riveted column being set at the Empire State Building construction site. "The Empire State erection plans were complex, and included drawings not usually required, such the erection schedule drawing prepared by Post & McCord." (p 43, *Building The Empire State*, A 1930s Notebook)



A shop fabricated riveted column is set in place with a derrick crane. (Photo: from the film *Making A Skyscraper (Steel)-Empire State Bldg.*, Prelinger Archives, San Francisco)



Shop riveted column is set and ready for field riveting. (Photo: from the film *Making A Skyscraper (Steel)-Empire State Bldg.*, Prelinger Archives, San Francisco)