(No Model.)

A. H. EMERY.

METHOD OF MANUFACTURING GIRDERS.

No. 322,049. Patented July 14, 1885.

Fig: 1.

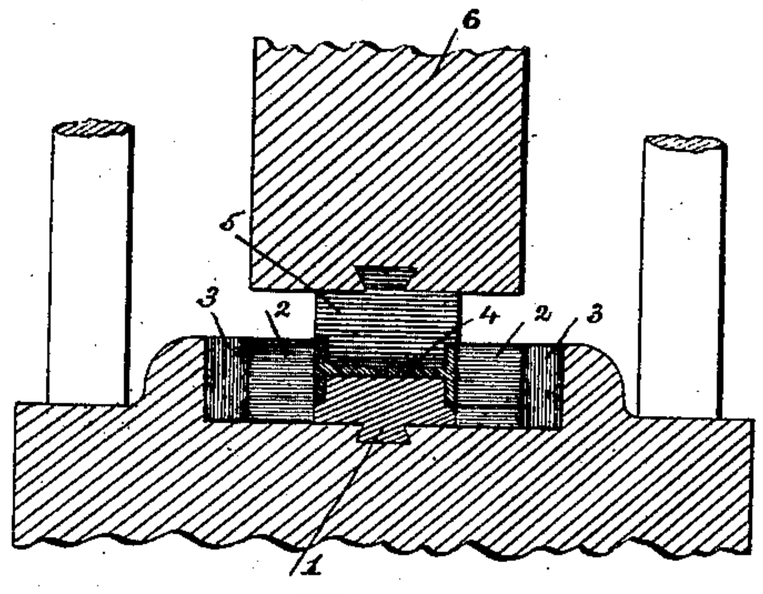


Fig: 2.

Fig: 3.

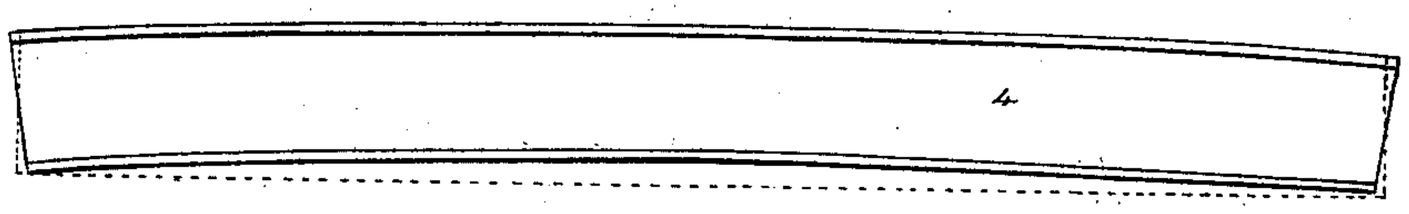


Fig: 4.

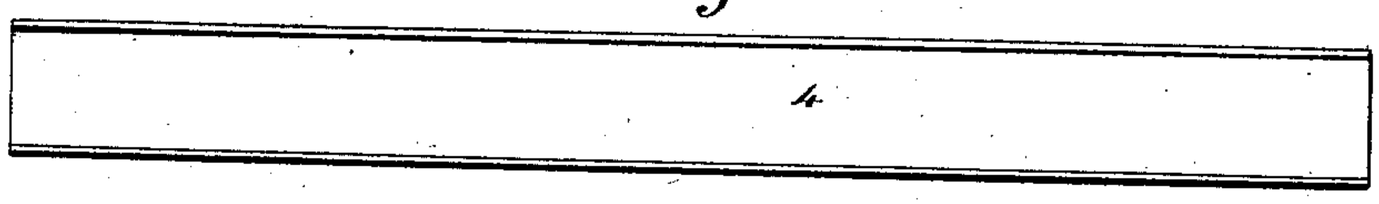
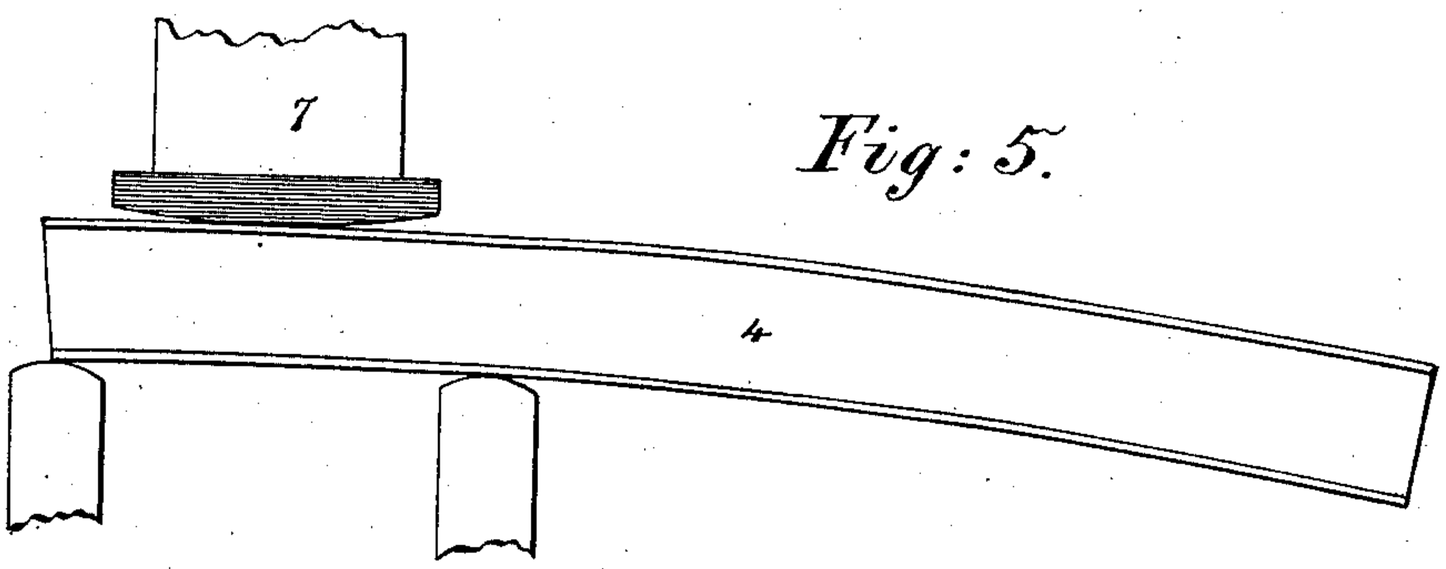


Fig: 5.



Witnesses
H. H. Young
Wm. J. Sayers

Inventor
Albert H. Emery
By Knight Bros.
Attorneys

UNITED STATES PATENT OFFICE.

ALBERT H. EMERY, OF STAMFORD, CONNECTICUT.

METHOD OF MANUFACTURING GIRDERS.

SPECIFICATION forming part of Letters Patent No. 322,049, dated July 14, 1885.

Application filed April 2, 1883. (No model.)

To all whom it may concern:

Be it known that I, ALBERT H. EMERY, of Stamford, in the county of Fairfield and State of Connecticut, formerly of New York, in the State of New York, have invented an Improved Mode or Process for Increasing the Rigidity and Strength of Beams or Girders, of which the following is a specification.

The object of the invention is to increase the rigidity and ultimate strength of beams or girders and like members designed to bear transverse loads in buildings, bridges, and other structures.

To this end my invention consists, first, in subjecting the material to compression while in a cold or moderately-heated state, so as to condense the metal; and, secondly, in bending the beam or girder while in a cold or moderately-heated state from an upwardly-arched or curved condition to the normal shape it is to have in use, imparting a permanent set of tension to the lower flange or part of the beam or girder and of compression to the upper flange or part thereof. These being the strains to which the structure will be subjected when loaded, its rigidity and elastic limit and its ultimate strength will be materially increased.

By the expression "in a cold or moderately-heated state" I refer to metal which would be called "cold" with reference to the ordinary rolling, swaging, and forging operations—that is to say, the metal must not be sufficiently heated to impart ductility or adapt it to flow readily under pressure. It is evident that this condition of rigidity adapting, the metal to be what is termed "cold compressed," so as to be condensed and receive a permanent set with strains differing from those which the metal received in cooling, may exist before the iron reaches the temperature of the atmosphere or an actually "cold state," as this term is most commonly used without reference to metal-working. I prefer to work the metal cold, and I do not use the term "moderately heated" to imply that it can in carrying out my invention have any near approach to the ordinary condition for forging or swaging. It should be practically "cold," as this term is used with reference to metal-working.

In the accompanying drawings, Figure 1 is a vertical transverse section of the dies and press-ram and a beam or girder under compression. Fig. 2 is an end view of the curved beam or girder. Fig. 3 is a side elevation of the same. Fig. 4 is an elevation of the same bent downward to its normal or nearly straight form in which it is to be used, the dotted line in Fig. 3 showing the extent of set to be imparted to the beam. Fig. 5 is an elevation illustrating one mode of bending down the beam.

1 represents a bed-die formed to fit one side or face of the beam or girder 4, which is placed thereon, and 2 a pair of side dies adjustable to and from each other on the bed-die 1, and formed on their faces to fit the faces of the beam or girder, against which they are forced and firmly held and supported by wedge-shaped followers 3 or hydraulic rams or other adequate means. The working-faces of the top and bottom dies are straight in the central and principal part where the maximum pressure is applied, and recede slightly toward the ends, so that for some distance on each side of the part under the maximum pressure the metal will be subject to a smaller pressure, insufficient to cause a flow or attenuation of the metal, but sufficient to confine and prevent the outward flow of the metal which is under maximum pressure. This curvature of the faces of the dies is exaggerated in the drawings for the purpose of illustration. The side dies are correspondingly formed when necessary.

5 is an upper die formed to fit the upper surface of the beam or girder 4, and forced down to apply pressure thereto by any adequate means—such, for example, as one or more hydraulic rams, 6. In Fig. 5, 7 represents a hydraulic ram pressing the curved beam or girder in sections for the purpose of forcing it from the arched form shown in Fig. 3 to the straight or nearly straight form shown in Fig. 4. This may, if preferred, be effected by the use of rolls, or the entire beam may be pressed down at one operation by interposing between the ram or rams and the curved beam a pattern-beam adapted by its shape to bear first on the center or most prominent part, and over a more extended surface as the movement progresses, and to gradually press the said curved beam downward to a sufficient extent beyond its required shape, that it will, in

springing back, permanently assume the shape it is to have in use.

In carrying my invention into effect I construct a beam or girder with the curvature indicated in Fig. 3, either by assembling the parts of a compound beam or girder in this form or by forging a beam in one piece with such curvature or by rolling a straight beam in the ordinary manner and bending it while hot to the curved or arched form represented. The beam or girder is afterward, while in a cold or moderately-heated state, subjected to pressure between dies in a press, as illustrated in Figs. 1 and 2, the pressure being sufficient in extent to impart a permanent condensation to the metal, and being preferably continued for a considerable length of time; or, in the case of the compound beam or girder, the compression to condense the metal may be applied to the separate parts by means of dies or rolls before they are assembled. The pressure for this purpose may be from forty thousand pounds to one hundred thousand pounds to the square inch, (more or less,) depending on the nature of the metal.

Instead of the fixed supports 3, hydraulic rams or other suitable means may be used for lateral compression of the beam. The condensation of the metal largely increases its limit of elasticity and ultimate strength, and therefore is in itself highly beneficial to the beam. The beam or girder is then, while still cold, or nearly so, pressed downward from the form shown in full lines in Fig. 3 to the nearly straight form indicated by dotted line at bottom and represented in full lines in Fig. 4, with the effect already explained of producing extension at bottom and compression at top and imparting a permanent set to the beam in its new form.

I am aware that rails or bars of irregular section have been curved while hot by rolls or other means in order to cause them by the unequal contraction of their parts to assume a straight form by cooling.

Having thus described my invention, the following is what I claim as new therein and desire to secure by Letters Patent—

1. The improved mode or process for increasing the rigidity and strength of a beam or girder designed to bear a transverse load, which consists in compressing the material between dies having receding faces, as described, while in a cold or moderately-heated state, so as to permanently condense the same.

2. The improved mode or process for increasing the rigidity and strength of a beam or girder designed to bear a transverse load, which consists in bending it downward while in a cold or moderately-heated state to the shape it is to have in use, thereby putting a permanent set of tension on the lower part, which is to bear a strain of tension, and a permanent set of compression on the upper part, which will be subjected to compression when the beam or girder is loaded.

3. The improved mode or process for increasing the strength and rigidity of a beam or girder which is to bear a transverse load, the same consisting in compressing the material while in a cold or moderately-heated state, so as to permanently condense the same, and bending the structure downward to the shape it is to bear when loaded, so as to apply a permanent set of tension to the lower part and a permanent set of compression to the upper part, as explained.

4. The improved mode or process for increasing the strength of a beam or girder which is to bear a transverse load, which consists in forging or bending the same while in a heated state, or constructing it, if compound, with a permanent upward curvature, and subsequently, while cold or in a moderately-heated state, bending it downward, so as to apply a permanent set of tension to the lower part and a permanent set of compression to the upper part, substantially as and for the purposes set forth.

ALBERT H. EMERY.

Witnesses:
HARRY E. KNIGHT,
WM. S. SAYERS.