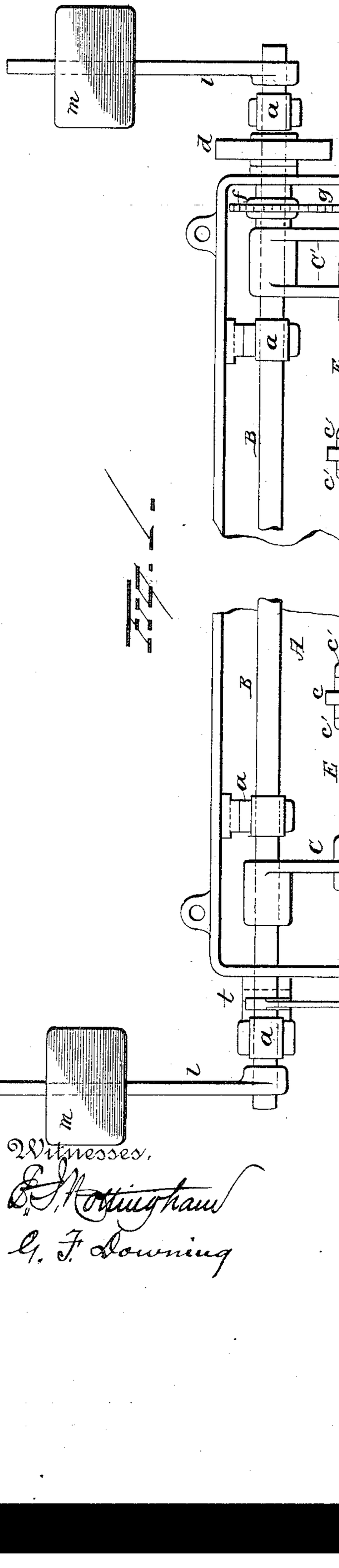
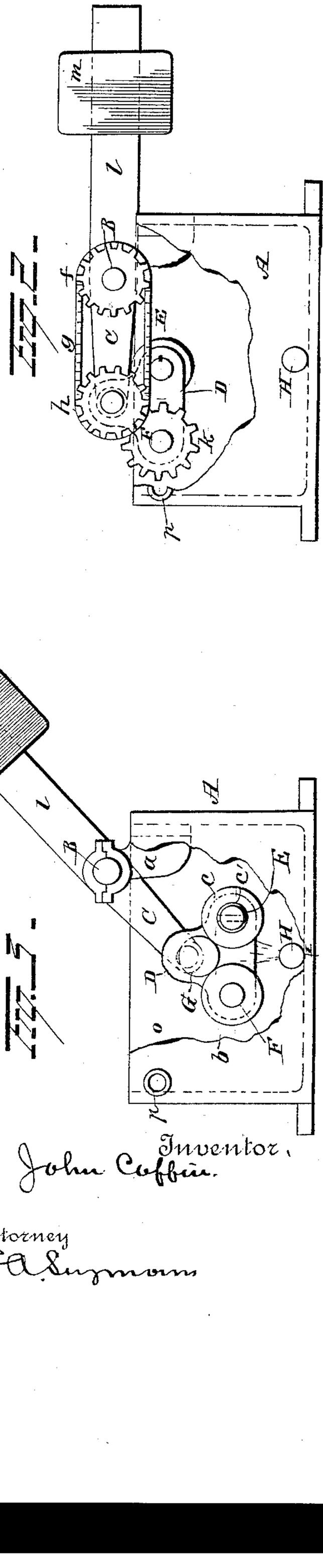
(No Model.)

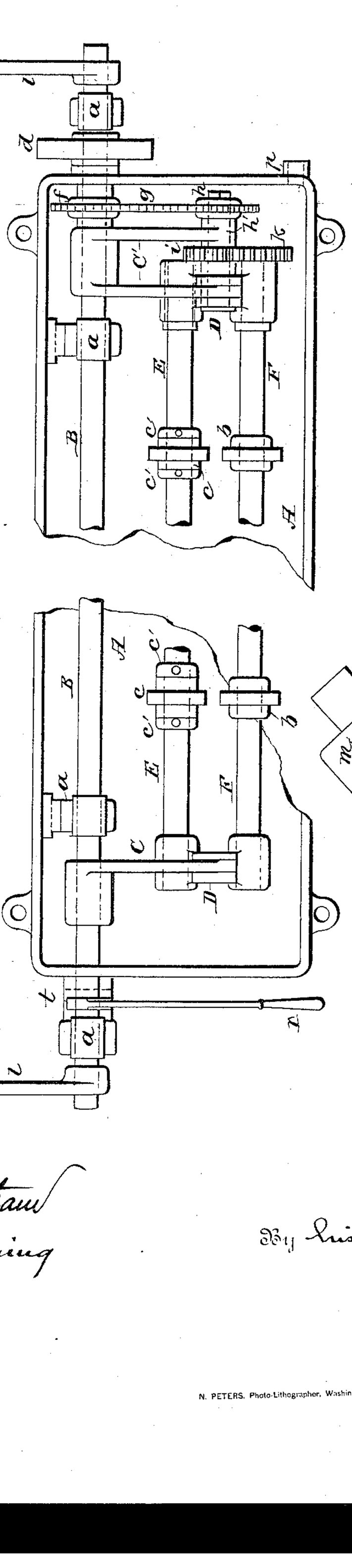
J. COFFIN.

PROCESS OF TOUGHENING STEEL AXLES.

No. 399,380. Patented Mar. 12, 1889.







Witnesses,
E. S. Mottinghaw
G. F. Downing

Inventor,
John Coffin.

By his Attorney
H. A. Seymour

UNITED STATES PATENT OFFICE.

JOHN COFFIN, OF JOHNSTOWN, PENNSYLVANIA, ASSIGNOR TO THE CAMBRIA IRON COMPANY, OF PENNSYLVANIA.

PROCESS OF TOUGHENING STEEL AXLES.

SPECIFICATION forming part of Letters Patent No. 399,380, dated March 12, 1889.

Application filed March 10, 1888. Serial No. 266,827. (No model.)

To all whom it may concern:

Be it known that I, JOHN COFFIN, of Johnstown, in the county of Cambria and State of Pennsylvania, have invented certain new and useful Improvements in the Process of Toughening Steel Axles; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to an improved process or method of treating steel axles after they are forged into form in order to toughen them and render them less liable to break when subjected to percussion as well as twisting strains.

In patent of record, No. 367,961, I have shown and described a process and apparatus for toughening steel axles, in which the axle is first evenly heated and then immersed in a bosh or bath of cool water, there being proper mechanical devices located in the bosh or box, which are adapted to sustain and revolve the axle as soon as it is fairly in contact with the "cradle," as the revolving device is termed. After the axle is in position and revolving a series of sprays of cold water or other cooling-liquid is forced through the water of the bath near the axle to agitate the water of the bath, and thus assist in cooling the axle to a proper degree, after which the axle is removed from the bath and allowed to get entirely cold by exposure to the atmosphere.

It has been found that it is not absolutely necessary to immerse the axle in a bath, but that if it is first forged and cooled off, then reheated to afford an even diffusion of heat throughout its mass, then placed on proper revolving mechanism that will rapidly rotate the hot axle, and finally force copious jets of cold water or other cooling-liquid upon the rotating axle throughout its length, a sufficient surface-chill may thus be uniformly communicated to the axle, so as to cool off the outer surface and a proper depth below the surface, leaving a hot core, the internally contained heat of which will be sufficient to reheat the entire mass, re-arrange its molecules, and so alter the structural arrangement of these atoms as to greatly toughen the axle and render it capable of resisting such strains as are incident to its service, when it finally becomes cold by exposure to the ordinary mean temperature of the atmosphere.

In carrying into effect the process just indicated, and which is the subject of my present invention, I prefer to use the apparatus, which I show and describe in patent, of record, No. 367,961; but I do not wish to be restricted to such an apparatus, as it is evident that other means may be employed to rotate the axle and spray cooling-liquid on it.

I will now give a description of the preferred form of mechanism I employ to practically effect the toughening of axles by my present improved process.

In the drawings illustrating the apparatus used, Figure 1 is a plan view of the bosh and attached mechanism. Fig. 2 is an end elevation of the device, with mechanism in position to receive a heated axle. Fig. 3 is an end elevation of the device with an axle in position to receive the jets sprayed upon it.

Referring to the drawings, A represents the water tank or bosh. It is also a supporting-frame for the operative mechanism by which the axle is rotated and vibrated vertically in the aqueous bath.

a a are bracket-arms that are furnished with perforated bosses or boxes that support and permit the rotation of the shaft B.

C′ C are projecting arms that are rigidly secured to the shaft B by their hubs. These arms pivotally support upon their free ends the swinging hangers D D. The hangers D D are provided at their lower ends with perforated bearings for the reception of the shafts E and F. The shaft F is loosely supported in its bearings, free to turn or rotate therein. The shaft E is keyed or otherwise firmly attached in place to its supporting-boxes that are formed integral with appropriate arms of the bifurcated hangers D D. Upon the shaft F the hubbed disks or wheels *b b* are secured with their peripheries concentric with this shaft. The position given these wheels *b b* is shown in Fig. 1. The wheels *c c*, that are loosely mounted upon the shaft E, are held directly opposite their mated wheels *b b* by the fixed collars *c′*, which prevent a lateral displacement but permit free rotative

movement on their supporting-shaft E. The distance between the shafts F and E is such that the peripheries of the wheels *b b c c* are near each other but do not have actual contact. The tight and loose pairs of wheels *b c b c* form a cradle or support for the axle G to be operated upon, it being placed to rest between their opposed curved edges, as shown at G in Fig. 3.

Upon the shaft B the pulley *d* is mounted, and upon the same sleeve or extended hub to which this pulley is affixed the sprocket-wheel *f* is also rigidly secured. The sprocket-wheel *h* is fixed to the outer end of the short shaft *h'* that is journaled and has its bearings in the boxes formed on the free ends of the twin arms C'. The endless chain *g* is placed upon the wheels *f* and *h*, as shown in Fig. 1, and serves to transmit motion from the pulley to the shafts E F, as will be explained. Upon the shaft *h'* the gear-wheel *i* is also mounted between the boxes on the outer ends of the bracket-arm C'. The gear-wheel *i* meshes with a mated pinion, *k*, that is fastened upon the outer end of the shaft F.

The arms *l* are attached to the outer ends of the shaft B, and they have adjustable counterpoise-weights *m* movably secured upon them. At *t*, Fig. 1, the lever or handle *r* is fixed upon the shaft B to permit by a vertical vibration the oscillation of the superimposed axle G and its sustaining-cradle.

At I in Figs. 2 and 3 the spray-pipe H is located. It is extended longitudinally through the lower portion of the bosh A and is attached by one of its ends to a feed-water pipe that communicates with a reservoir or other assured water-supply that will deliver water continuously under proper head or pressure. The pipe H is perforated through its top surface at proper intervals from end to end, and these orifices are of such size as to permit strong jets of water to be forcibly ejected upwardly to impinge upon the surface of the supported axle when it is in position upon the cradle hereinbefore described.

The sides and bottom of the bosh A may be perforated to allow the spray-water to escape from the bosh as fast as it is introduced.

When rotary motion is given the pulley *d* by a belt connected to a pulley on a line-shaft or any other source of power, the heated axle G, that is placed between the edges of the supporting-wheels *b c b c*, will have rotary motion given it and the sprays or jets of water issuing from the pipe H will impinge upon the surface of this axle.

I would further explain that I prefer to take an axle from the hammer after it is forged complete and allow it to cool until it is black, it being best to permit the carbon to pass into the non-hardening state. When it is reheated, the expansion and consequent separation of the component molecules will accomplish a rearrangement of the atomic particles of matter. The axle when reheated is raised to a temperature corresponding to a low orange color, care being taken to prevent scale forming to any extent. The axle when it is heated to the temperature just stated is removed and deposited on the cradle formed by the revolving wheels *b c b c*, they being in motion, and the cradle raised by depressing the counterpoise-weights *l*, as seen in Fig. 2. The axle G is then depressed and brought into contact with the spraying-jets from the pipe H. If the water has been of sufficiently low temperature, a preferred average being from 50° to 60° Fahrenheit, the axle will assume a black color or unheated appearance upon its exterior surface. This chill, however, should be only a shell, or not over one-half the distance to the center of the axle, the core or heart of the axle being still highly heated. The axle being laid upon a level surface that is dry, is now allowed to gradually cool by contact with the air without exposure to drafts of the same that might cool it unequally and cause it to spring or warp lengthwise. The concentrated heat that remains in the center or core of the axle when removed from the water bath will be sufficient to raise the exterior chilled surface to a low red heat in the dark if the process is properly conducted.

Having fully described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. The within-described process of toughening steel axles, consisting of cooling off a forged axle, then reheating it, then placing it on rotating devices that revolve it, and simultaneously with its revolution spraying jets of cold water or other cooling-liquid on the axle through its entire length, and finally removing the axle while it has sufficient contained heat to render it uniformly of a low red color in the dark.

2. The within-described process of toughening steel axles, consisting in cooling off a forged axle, then reheating it, then rapidly rotating the axle, and simultaneously with its revolution spraying jets of cold water or other cooling-liquid on the axle through its entire length.

In testimony whereof I have signed this specification in the presence of two subscribing witnesses.

JOHN COFFIN.

Witnesses:
E. J. BURKHART,
C. M. BRENISER.