A. W. MACHLET.

STRAIGHTENING AND HARDENING APPARATUS.

APPLICATION FILED FEB. 1, 1906.

976,891.

Patented Nov. 29, 1910.

3 SHEETS—SHEET 1.

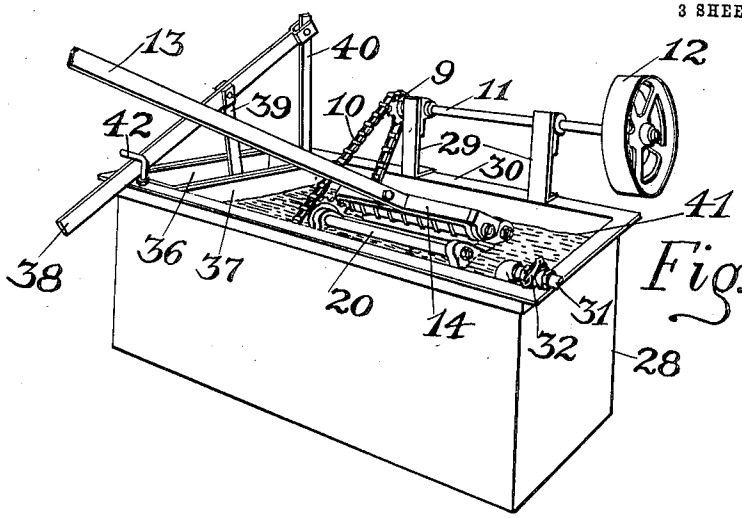


Fig. 1.

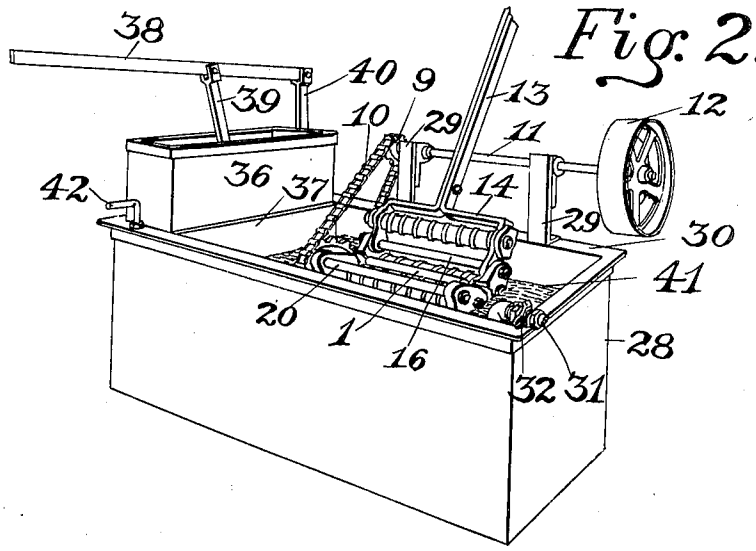


Fig. 2.

WITNESSES:

Philip C. Ostermann

Geo. L. Hirtzel Jr.

INVENTOR

Adolph W. Machlet

BY

D. C. Stickney

ATTORNEY

A. W. MACHLET.

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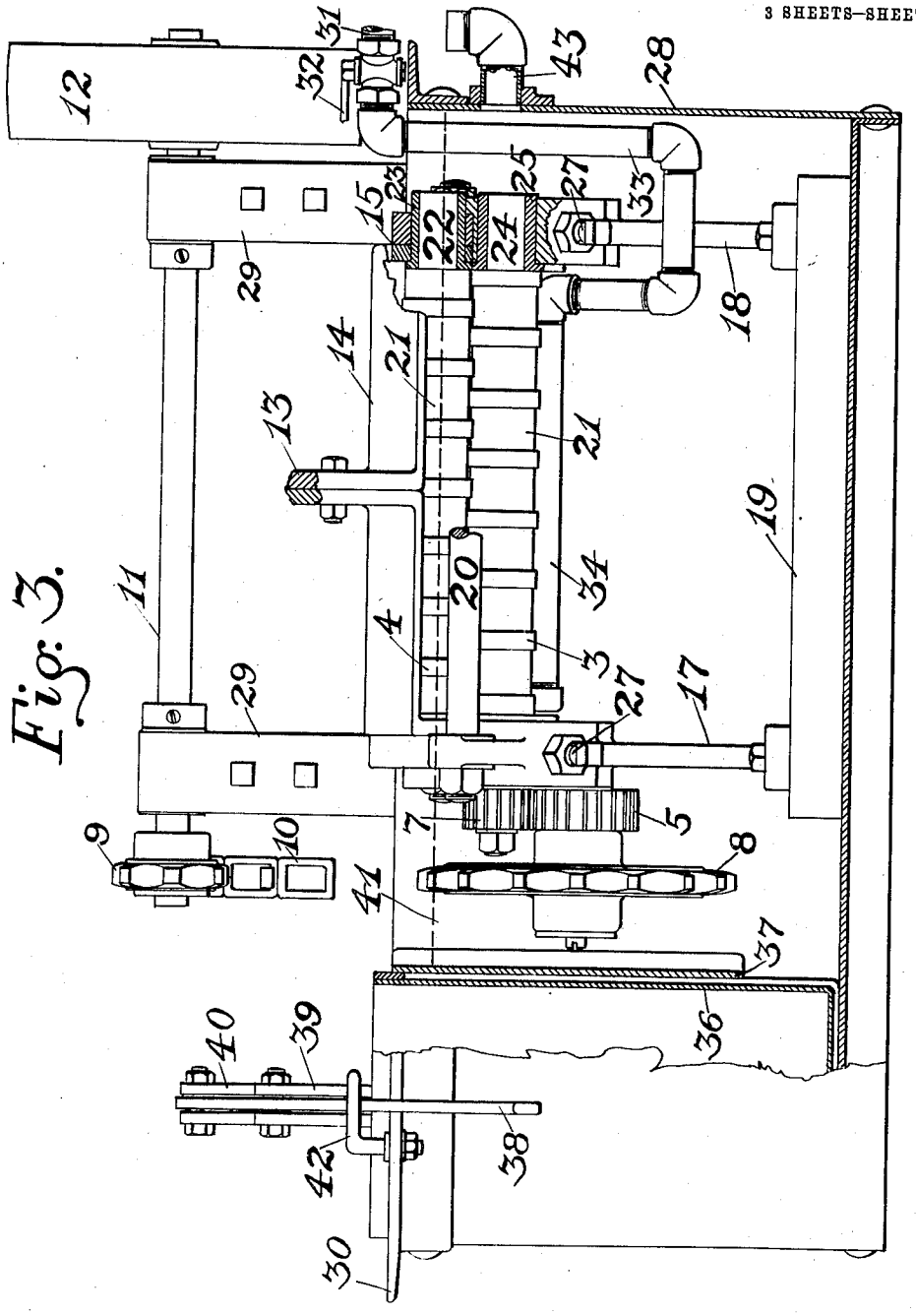


Fig. 3.

WITNESSES

Philip C. Ackerman

Geo. L. Fitzgel Jr.

INVENTOR

Adolph W. Machlet

BY H. Stickney

ATTORNEY

A. W. MACHLET.

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3 SHEETS—SHEET 3.

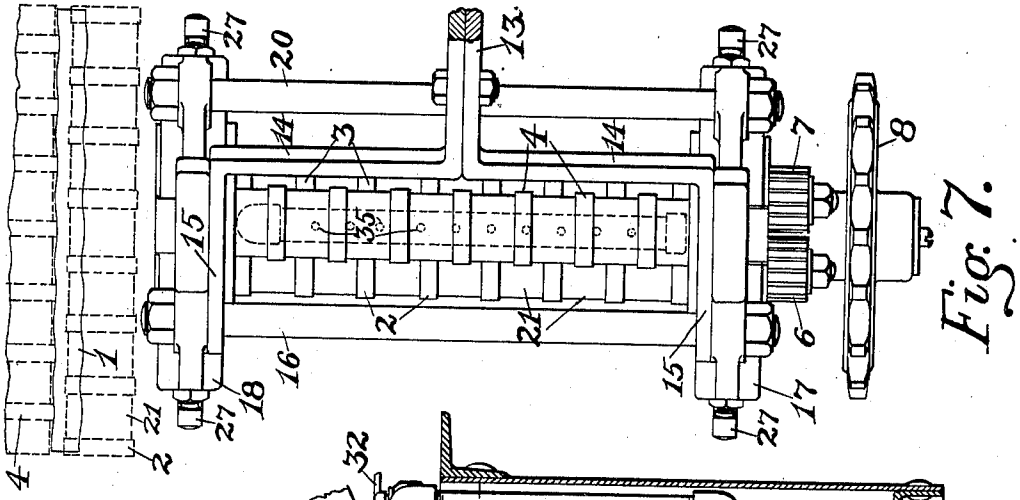


Fig. 7.

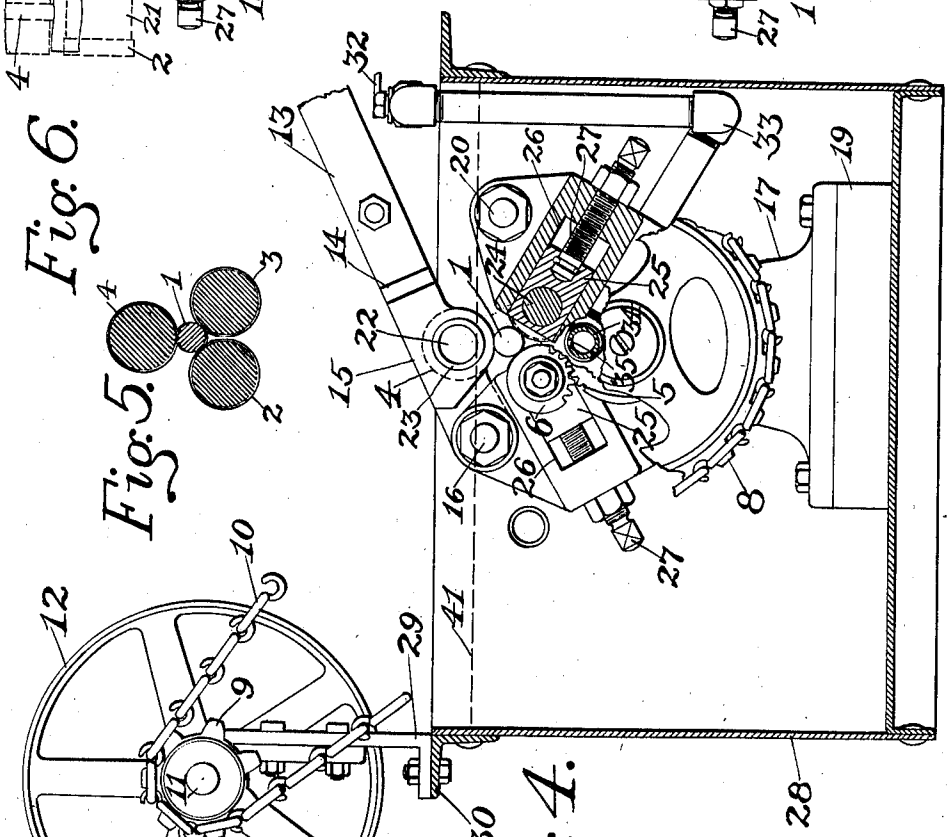


Fig. 6.

Fig. 5.

Fig. 4.

WITNESSES

Philip C. Osterman

Geo. L. Hirtzel Jr.

INVENTOR

Adolph W. Machlet

BY

Attorney

ATTORNEY

UNITED STATES PATENT OFFICE.

ADOLPH W. MACHLET, OF ELIZABETH, NEW JERSEY.

STRAIGHTENING AND HARDENING APPARATUS.

976,891. Specification of Letters Patent. Patented Nov. 29, 1910.

Application filed February 1, 1906. Serial No. 298,948.

To all whom it may concern:

Be it known that I, ADOLPH W. MACHLET, a citizen of the United States, residing in Elizabeth, in the county of Union and State of New Jersey, have invented certain new and useful Improvements in Straightening and Hardening Apparatus, of which the following is a specification.

This invention relates to means for straightening relatively long cylindrical bodies, such as shafts, rods, tubes and the like.

One object of the invention is to produce a mechanism, whereby the shafts may be quickly changed from slightly warped or crooked form to a form of absolute or substantial straightness, and without the necessity of relying upon the accuracy of the eyesight or skill and judgment of the mechanic in hammering or manipulating.

Another object of the invention is to harden the shaft without liability of warping or distorting it.

In the form of the invention, which is illustrated in the accompanying drawings, the shaft or rod, which is first heated so that it is readily workable, is placed in the grip of three sets of rotating rolls, which bear upon three sides of the shaft. All of the rolls are well separated, and they are so related that they slightly crimp the shaft or cause it to assume a sinuous form while being rotated in the grip of the rolls. Thus the different portions of the shaft throughout its length are worked or kneaded back and forth, and as a result the bend or bends in the shaft are worked out, and it is rendered straight. While the rolling and pressing operation continues, the shaft may be chilled by water or other fluid, thereby producing a straight hardened shaft.

In the accompanying drawings, Figure 1 is a perspective view of the apparatus illustrating the operation of chilling the shaft after straightening. Fig. 2 is a similar view showing the upper set of rolls lifted and the apparatus in condition to begin operations upon the shaft. Fig. 3 is a sectional front elevation of the apparatus, the parts being in the working positions seen at Fig. 1. Fig. 4 is a cross-section through the tank, and shows the shaft in the grip of the rolls. Fig. 5 is a sectional diagram taken through the rolls and shaft gripped thereby. Fig. 6 is a diagram illustrating in an exaggerated manner the crimping action of the rolls upon the heated shaft. Fig. 7 is a plan of the shaft-straightening machine.

The shaft 1, which is usually heated to a red heat, is seen at Figs. 4 and 5 in the grip of three sets of rolls which bear upon three sides of the shaft preferably at intervals which are equi-distant around the shaft. The rolls 2 and 3 of the two lower sets, in this instance, have their axes about in the same horizontal plane, and the shaft is seen resting between these rolls, which engage the lower sides of the shaft. The axis of the top rolls 4 is in a vertical plane which is about midway between the axes of the bottom rolls, and said rolls 4 bear upon the top of the shaft 1.

Rotation of the rolls is effected by means of a driving gear 5 which meshes with pinions 6 and 7, which are fixed respectively to the rolls 2 and 3; the gear being connected by large and small sprocket wheels 8 and 9 and a chain 10 to a driving shaft 11 carrying a pulley 12, the small sprocket being on the shaft 11.

Powerful downward pressure of the top rolls 4 upon the shaft 1 is effected preferably by a lever 13, which at the fulcrum end is forked or formed into a bail or frame 14, in the ends 15 of which the rolls 4 are journaled. Said bail is hinged upon a tie rod 16, which connects a pair of heads 17, 18, erected upon a base 19, said heads being also connected by another tie rod 20, whereby a rigid framework is formed. The rolls in each of the sets are well separated, and in this instance are integral, being formed by cutting grooves 21 at intervals in a long cylindrical drum or roll.

The rolls 2 are placed opposite the rolls 3, as seen at Fig. 7; but the top rolls 4 are placed about midway of the grooves or intervals 21 of the lower sets of rolls, so that when the shaft 1 is in the grip of the rolls, the downward pressure of the top rolls effected by the lever 13 may be sufficient to produce slight flexure or sinuosity of the heated shaft, as illustrated diagrammatically at Fig. 6, the flexure shown at this fig-

ure being somewhat exaggerated for the sake of illustration. The rolls or bearing members may be otherwise formed, disposed and operated for the purpose of the invention. The top roll shaft is formed with gudgeons 22 to fit in bushings or journal boxes 23, which are suitably supported in the bail ends 15. The lower roll sets are provided with gudgeons 24, which are journaled in slides or bearings 25, and the latter are mounted in inclined slideways 26 formed in the opposite heads 17, 18; screws 27 being threaded into the heads and engaging said bearings or slides, so as to effect fine adjustments of the latter in the slideways both to accommodate different diameters of shafts placed in the grip of the rolls, and also to effect independent fine adjustments of the ends of the roll sets, so as to true them up. Said slideways incline downwardly and outwardly from the shaft 1, and as seen at Fig. 4 form an angle with each other of about 120 degrees, whereby the desired opening and closing of the lower rolls may be readily secured, while a solid support for these rolls is always afforded.

In operation, the heated shaft 1 is placed between the lower rolls, and the lever 13 is swung over to the Fig. 4 position, and pressed down with great force, the rolls being started in rotation by any suitable means. Any irregularities that may exist in the shape of the shaft 1 will make themselves known by tending to throw the lever 13 up at intervals; but as soon as the operator, who is holding down the lever, feels that the shaft is running smoothly in the rolls, he understands that the straightening of the shaft has been effected and throws back the lever 13 to permit the removal of the straightened shaft and the insertion of a fresh shaft.

I provide also for hardening the straightened shafts, by mounting the straightening rolls in a tank 28; the base 19 of the framework being supported upon the bottom of the tank, and the pulley shaft 11 being carried by brackets 29 that are secured upon the arm 30 of the tank. Water may be supplied through a pipe 31 having a cock 32, said pipe connected by elbow-connections 33, within the tank, to a horizontal length of pipe 34 which extends along between the lower rolls, and has a large number of orifices 35 in its upper side, so as not only to supply cold water in the immediate vicinity of the shaft 1, but also to insure such circulation of water about said shaft as may be necessary in order to harden the same properly.

I prefer first to subject the shaft to the rolling pressure until it is straight, and thereupon to immerse the shaft suddenly, and to this end I provide a plunger preferably in the shape of a float 36, which may be an empty box, and made to fit in one end of the tank, being confined by a partition 37 and operated by a lever 38 and link 39, said lever fulcrumed upon a standard 40. When during the straightening operation, the lever 13 ceases to jerk the operator's hand, he pulls down the lever 38, thereby forcing down the float to the positions seen at Figs. 1 and 3, and raising the level of the water in the tank to the line 41, thus immersing the shaft 1, and chilling the same. A latch 42 may be pivoted upon the tank rim for locking down the lever 38. The rotation of the rolls and the downward pressure upon the lever 13 are both maintained during the immersion of the shaft 1, and as a result a straight hardened shaft is produced. The lever 38 is thereupon released, and the lever 13 thrown back to the Fig. 2 position, and the straightened shaft is removed, and a fresh shaft inserted between the rolls. An outlet 43 may be provided in the tank preferably in the form of a double elbow, although any other desired form of outlet may be provided for preventing water from rising to the rim of the tank.

In order to accommodate shafts of considerable length, numerous rolls are provided in each set, and they may be placed at such intervals that there will be little or no liability of flexing the heated shaft beyond the limit of elasticity, so that the latter will assume a normal straight form, as soon as the pressure is relieved. It is preferable to bring down the lever 13 with a light pressure and gradually to increase the pressure until it is heavy enough to effect the straightening of the shaft, and to maintain such heavy pressure during the chilling of the shaft. It is desirable to have the action of the system of rolls uniform from one end to the other thereof, so that not only are the lower rolls adjustable by the screws 27 at each end of each set, so as to true up the rolls, but the pressure is exerted upon the frame 14 about midway of the latter, so as to equalize the pressure upon the set of rolls carried by said frame, or in other words, the upper set of rolls is caused to bear evenly throughout its length upon the shaft to be straightened.

Many variations may be resorted to within the scope of the invention, and portions of my improvements may be used without others.

Certain features of the rolling mechanism *per se* are made the subject of my divisional application No. 427,157, filed April 15, 1908.

Having thus described my invention, I claim:

1. An apparatus for straightening and hardening shafts or the like, comprising means for straightening the heated shaft by pressing and simultaneously rolling the

same, a tank arranged to contain liquid, and means to effect a relative movement between the rolling means and the liquid contained in the tank, to submerge the shaft after it is straightened and while it is being still pressed and rolled.

2. A shaft-straightening and hardening apparatus comprising a set of shaft-straightening members provided with manually controlled means for forcing the heated shaft into a slightly sinuous form, means for effecting between the shaft and the straighteners a relative rolling movement circumferentially of the shaft while the latter is distorted by the straighteners, and means for immersing the shaft in a chilling bath as soon as it becomes straight and before the cessation of the movement of the shaft-straightening members.

3. A shaft-straightening and hardening apparatus, comprising a tank arranged to contain liquid, a system of shaft straightening rolls, means for rotating them, and means for effecting a relative movement between the rolls and the liquid contained in the tank, for immersing the shaft and rolls while the shaft is being rotated in the grip of the rolls.

4. An apparatus for straightening and hardening shafts or the like, comprising a tank arranged to contain liquid, sets of cooperative shaft straightening rolls journaled within said tank, manually operated means for controlling the grip of said rolls upon the heated shaft, means for rotating the rolls while gripping the shaft under such control; the rolls being so separated and related and controlled as to produce sinuosity of the heated shaft during the rotating movement, and means to submerge the shaft and rolls in liquid contained in the tank while the rolls are in operation.

5. A shaft-straightening apparatus comprising a tank arranged to contain liquid, a system of shaft-straightening rolls mounted within the tank, means for rotating the rolls and causing them simultaneously to grip the shaft, means to effect a relative movement between the rolling means and the liquid contained in the tank, to immerse the shaft, and means extending along the rolls within the tank for supplying cooling fluid to the shaft throughout its length.

6. A shaft-straightening and hardening apparatus comprising a tank, means for supplying water to the tank, the latter being provided with an outlet below its rim, a system of shaft-straightening rolls mounted within the tank, means for rotating the rolls, and means for causing the rolls to grip the heated shaft; the rolls being mounted in the tank in such position that the shaft gripped thereby lies below the level of said outlet.

7. The combination with a tank, of means within the tank for giving the desired shape to a heated metal article, while the water in the tank is at a level below the heated article, and means for suddenly raising the level of the water which is in the tank, so as to chill the article.

8. The combination with a tank, of a mechanism therein for straightening heated shafts by rolling while the water is below the level of the shaft, and a plunger for suddenly raising the level of the water in the tank to submerge the heated shaft.

9. The combination with a tank, of a mechanism therein for straightening heated shafts by rolling while the water is below the level of the shaft, a plunger for suddenly raising the level of the water in the tank to submerge the heated shaft, and means for locking said plunger in effective position.

10. The combination with a tank and a set of shaft-straightening rolls therein provided with rotating means, of means for supplying water to the tank, the latter being provided with an outlet at its upper portion, a float guided in said tank, and a lever for depressing said float, so as to raise the level of the water which is in the tank.

11. The combination with a tank and a set of shaft-straightening rolls within the tank, of means for effecting relative movement between the shaft-straightening rolls and the body of water in the tank, so that the hot shaft can be first straightened by the rolls and then immersed in the water.

12. A roll-straightening and hardening apparatus comprising a tank arranged to contain liquid in combination with a system of shaft straightening rolls mounted within the tank, means for causing said rolls to grip the shaft to be straightened, gearing for rotating the rolls, a chain and sprockets for driving said gearing, supports erected upon said tank, a shaft journaled in said supports and carrying one of said sprockets, a pulley upon said shaft, and means to immerse the rolls in liquid contained in the tank.

13. The combination with a set of rolls to straighten a heated shaft, of means, including a plunger, for hardening the shaft by immersing it in a chilling bath during its rotation in the rolls, and manually operated means for forcing the shaft into a sinuous form prior to and during the hardening operation.

14. The combination with a cooling tank arranged to contain liquid, of means to shape a heated metal article in the tank, and a plunger to raise the level of liquid in the tank, to immerse the heated article.

15. The combination with a tank arranged to contain liquid, of rolls mounted therein, one of said rolls carried upon a

movable frame having a handle, and means for suddenly effecting immersion of said rolls in said liquid.

16. The combination with a tank, of rolls mounted therein, one of said rolls carried upon a movable frame having a handle, and means for suddenly effecting immersion of said rolls; means being provided to supply cool liquid to the tank and to drain off surplus liquid from the top of the tank.

ADOLPH W. MACHLET.

Witnesses:

SAMUEL R. OGDEN,

PHILIP C. OSTERMAN.