C. H. MORGAN.

Forming and Tempering Wire.

No. 207,201. Patented Aug. 20, 1878.

Fig:1.

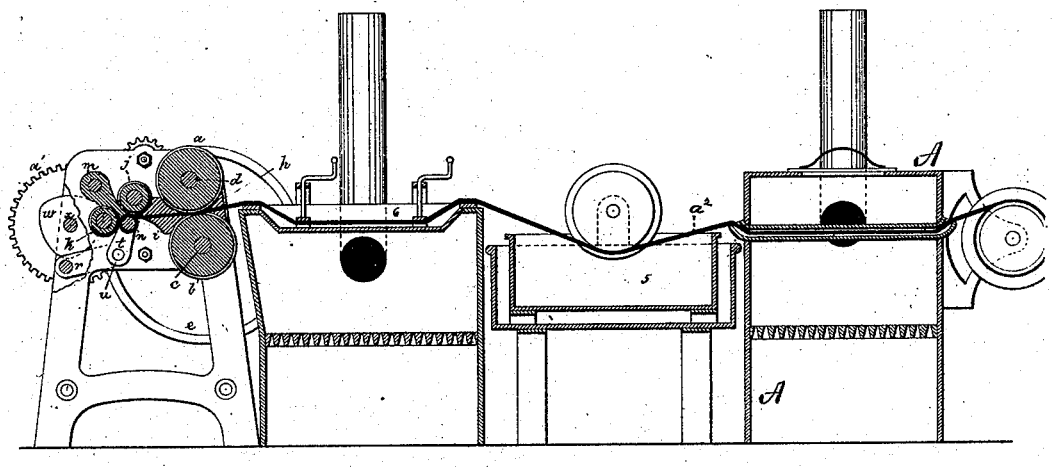

Fig:5.

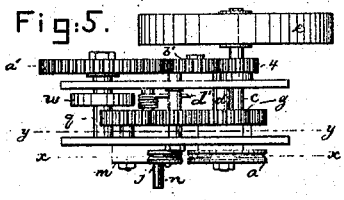

Fig:2.

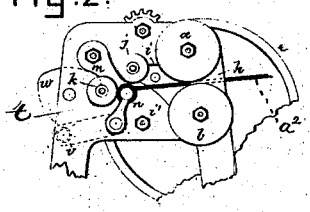

Fig:3.

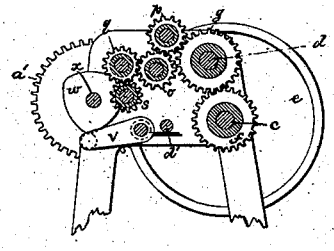

Fig:6.

Fig:7.

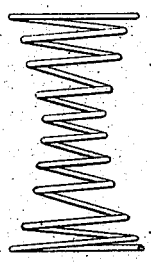

Fig:4.

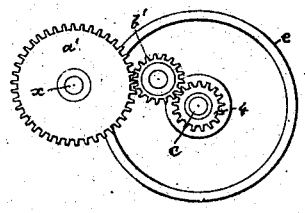

Fig:8.

Witnesses.

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by Crosby & Gregory, Attys

UNITED STATES PATENT OFFICE.

CHARLES H. MORGAN, OF WORCESTER, MASSACHUSETTS.

IMPROVEMENT IN FORMING AND TEMPERING WIRE.

Specification forming part of Letters Patent No. **207,201**, dated August 20, 1878; application filed February 1, 1878.

To all whom it may concern:

Be it known that I, CHARLES H. MORGAN, of Worcester, county of Worcester, State of Massachusetts, have invented an Improvement in Forming and Tempering Wire or Metallic Springs at a Continuous Operation, of which the following is a specification:

This invention relates to the formation of coiled-wire springs; and consists in the herein-described method of successively and continuously heating, hardening, and tempering, and automatically coiling wire while it yet retains its tempering-heat into the shape of the spring which it is desired to produce, said method enabling me to produce coiled springs the natural tendency of which are to remain in coil form, and to produce them cheaper and better than those made in the old way.

Coiled springs are now made from cold iron or steel wire drawn sufficiently hard before being coiled to give it the necessary stiffness, or from cold iron or steel wire more or less stiff, which, after being coiled, is tempered by baking or otherwise, which latter step, it is thought, aids the spring to remain in coiled form. I have discovered by experiment, and the fact is well known, that a piece of iron or steel shaped while yet retaining its tempering-heat will always retain that shape as its normal position, whereas, if a spring metal is shaped cold, the tendency of the metal always is to assume the form into which the said metal was cooled. In the formation of coiled springs this tendency is in a measure overcome by giving the material composing the spring an excess of curve when bent into the spring form.

The invention also consists in the combination, in a spring-forming machine, of rotating feeding-rollers, positively-rotated grooved bending-rollers, and a coiling-roller arranged between the peripheries of the bending-rollers, to operate substantially as hereinafter described; also, in the combination, with wire-feeding mechanism and grooved bending-rollers, of a coiling-roller arranged between the peripheries of the bending-rollers, and a pattern-surface to change the position of the coiling-roller with relation to the bending-rollers, to automatically form a spring of varying shape.

Figure 1 represents my spring-coiling mechanism arranged at the end of a hardening and tempering furnace or apparatus, the latter being shown in central longitudinal section, and the former in section on the lines *x x*, Fig. 5; Fig. 2, a front view of the spring-forming mechanism; Fig. 3, a section through the driving mechanism thereof on line *y y*, Fig. 5; Fig. 4, a partial rear view; Fig. 5, a top view; Figs. 6 and 7, some of the forms of springs which may be made by my mechanism; and Fig. 8 represents the coiling-roller.

The heating, hardening, and tempering mechanism herein employed may be of any ordinary construction; but I have shown, as I prefer, mechanism substantially such as represented in United States Letters Patent No. 31,361, February 5, 1861, to which reference may be had, thereby making it unnecessary to further describe it.

The grooved feeding-rollers *a b*, which feed the wire to the spring-coiling mechanism, are attached to shafts *c d*, the shaft *c* being provided with a driving-pulley, *e*, and with a pinion, *f*, that engages a pinion, *g*, on the shaft *d*. The wire, placed in a guide, *h*, in advance of the feed-rollers, is passed between such rollers at the back thereof, then through the conductor *i*, and between the bending-rollers *j k* and the coiling-roller *n*. The bending-rollers *j k* are grooved, and have their peripheries arranged in the arc of a circle about the coiling-roller, the latter being so arranged between the peripheries of said bending-rollers that each bending-roller comes in contact with portions of the hot wire as it—fed directly from the tempering-bath 6—is coiled into a spring about the coiling-roller.

The coiling-roller, remaining between the peripheries of the two rollers *j k*, as described, acts upon one side of the wire, while the rollers *j k* act upon the other side of the wire at opposite sides the axis of rotation of the coiling-roller, and consequently the wire is positively bent about the coiling-roller, resting between the two rollers *j k*.

Between the contiguous peripherical portions of the rollers *j k* is placed a guide-piece, *m*, preferably concaved at its lower end to direct the wire from the periphery of roller *j* to the periphery of roller *k* and about the

coiling-roller, the said coiling-roller, bending-rollers, and guide co-operating together to simultaneously guide, bend, and wrap or coil the wire about the coiling-roller, it supporting centrally the coil of the spring being made.

The roller *j* has on its shaft a pinion, *o*, engaged by a toothed idle-wheel, *p*, gearing with pinion *g*. This pinion *o* also gears with a second idle-wheel, *q*, supported upon a stud, *r*, and rotates a pinion, *s*, attached to the shaft of roller *k*. The coiling-roller *n* is carried in this instance by an arm, *t*, secured to a shaft, *u*, provided with a second arm, *v*, having a pin adapted to be struck by a cam, *w*, on a rotating shaft, *x*, provided with a pinion, a^1, driven from pinion 4 on shaft *c* through a pinion, b'.

The wire a^2 from which the spring is to be formed is heated in the heating apparatus A, after which it passes through the usual hardening or quenching bath 5, and then into the tempering-bath 6, or vat containing, preferably, fused metal or alloy, from whence it is conducted through the leading-guide between the feed-rollers, thence through the conductor and between the bending-rollers *j k* on the one side, and the coiling-roller on the other side, the latter roller holding the wire up to and between the rollers *j k*, so that the wire, while yet retaining its tempering-heat, may be curved or shaped into the desired form for the spring to be produced, and thereafter the spring will remain in the shape given it.

The curve in the wire is made more or less abrupt or short, according to the position of the coiling-roller with reference to the peripheries of the bending-rollers *j k*, the diameter of the spring being less when the coiling-roller is nearest the bight of the rollers *j k*; but as the coiling-roller is moved away from the rollers *j k* the diameter of the spring is increased. The coiling-roller will be made adjustable with reference to the bending-rollers *j k* for different-sized springs, and when held in one position the spring will be substantially cylindrical. To hold it in one position, I prefer to employ a circular wheel instead of cam *w*. If it is desired to form furniture and other springs of varying diameter from end to end, or of hour-glass shape, the coiling-roller will be caused to vary its position with reference to the bending-rollers *j k* by means of a suitable pattern-cam, *w*, operating, as shown in this instance, on the arm *v*, projecting from the shaft carrying the arm which supports the coiling-roller. The pattern-cam shown in the drawing will move the coiling-roller so as to cause the bending-rollers *j k*, acting in connection with it, to form a spring of hour-glass shape, as shown in Fig. 7; but it is obvious that pattern-cams of other shapes will enable the production of springs of other forms, according to the purposes to which they are to be applied.

The shaft supporting the arm and coiling-roller *n* is provided with a spring, d', to move the arm toward the pattern-cam, and, as the coiled spring is shaped or formed, it passes laterally from the end of the roller *n*.

Instead of the feeding-rollers *a b*, I may employ any other suitable feeding mechanism that will operate to force the wire between the bending-rollers *j k* and the coiling-roller.

I claim—

1. The herein-described method of manufacturing coiled springs from wire, consisting in successively and continuously heating, hardening, and tempering, and then coiling the wire into spring form while it yet retains its tempering-heat, substantially as described.

2. In a machine to form springs, the following instrumentalities, viz: feeding mechanism *a b*, positively-rotated grooved bending-rollers, and a coiling-roller arranged between their peripheries, as shown and described, the bending and coiling rollers co-operating to coil the wire, all substantially as described.

3. A pair of grooved bending-rollers and wire-feeding mechanism, in combination with a coiling-roller arranged between the peripheries of the bending-rollers and a pattern-surface to vary the position of the coiling-roller with reference to the bending-rollers, substantially as described.

4. The feeding mechanism and a conductor, *i*, to direct the wire, in combination with grooved bending-rollers and a coiling-roller, to operate all substantially as described.

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

CHAS. H. MORGAN.

Witnesses:

CHAS. H. BURLEIGH,

FRANK F. BULLARD.