(No Model.)

F. PURDY.

METHOD OF AND APPARATUS FOR TEMPERING WIRE.

No. 482,879. Patented Sept. 20, 1892.

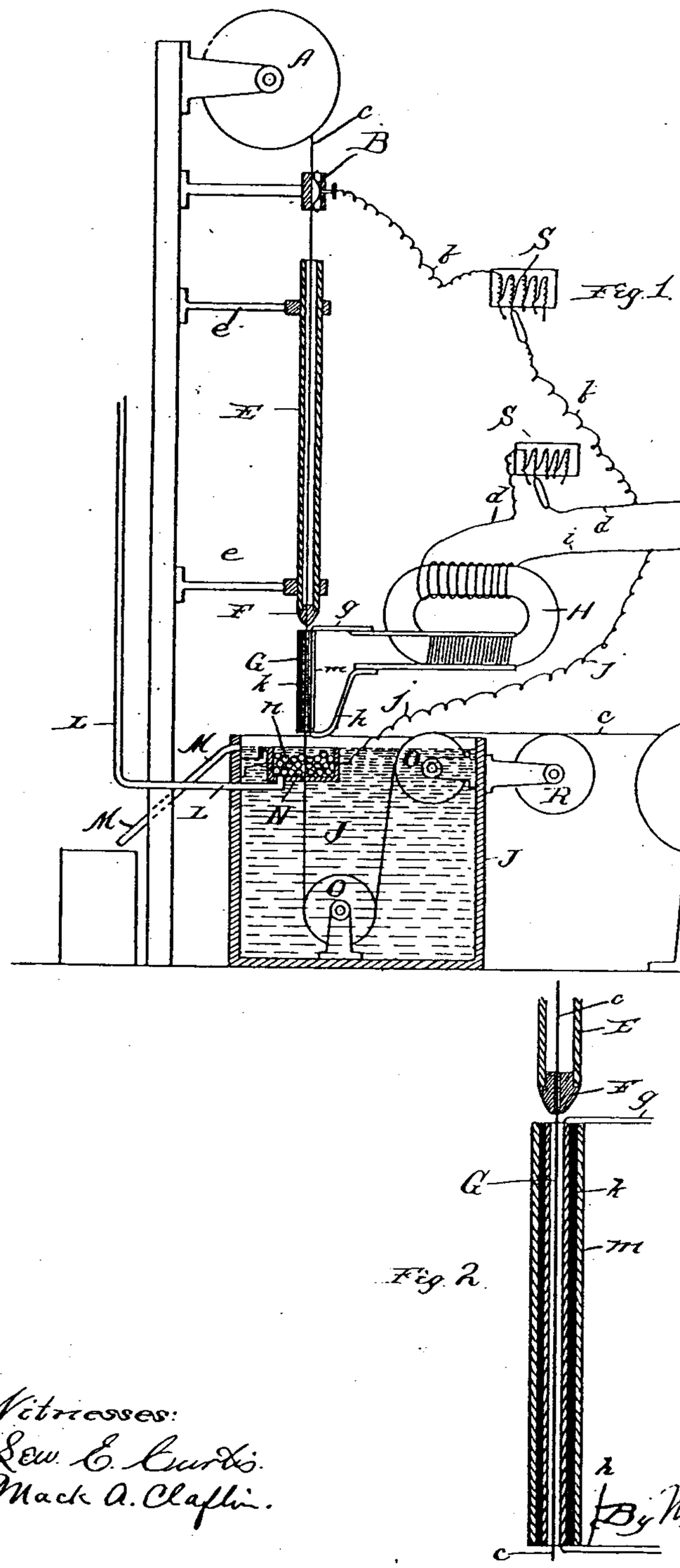

Fig. 1.

Fig. 2.

Witnesses:
Lew. E. Curtis.
Mack A. Claflin.

Inventor:
Fred Purdy
By Munday Evarts & Adcock
His Attorneys:

UNITED STATES PATENT OFFICE.

FRED PURDY, OF ENGLEWOOD, ASSIGNOR TO THE AMERICAN SPRING COMPANY, OF CHICAGO, ILLINOIS.

METHOD OF AND APPARATUS FOR TEMPERING WIRE.

SPECIFICATION forming part of Letters Patent No. 482,879, dated September 20, 1892.

Application filed November 7, 1889. Serial No. 329,533. (No model.)

To all whom it may concern:

Be it known that I, FRED PURDY, a citizen of the United States, residing at Englewood, in the county of Cook and State of Illinois, have invented a new and useful Improvement in Methods of and Apparatus for Tempering Wire, of which the following is a specification.

This invention relates to the method of tempering wire or ribbons of steel by the use of electricity as the heating agent and is an improvement upon the method set forth in the patent to Frederick Sedgwick, No. 369,560, dated September 6, 1887.

In the practice of the said Sedgwick invention it has been found that where the wire being treated varied in gage or in the amount of its carbon or in density of material, or where it was unevenly annealed, the resistance which it would offer to the electrical current would vary proportionately with these causes, so that the heat generated in the wire would be different in degree in different sections, some parts being heated to a greater degree than others Being thus unevenly heated, when it enters the hardening-bath it assumes different degrees of hardness just in proportion to the different degrees of heat it has received from the electricity, and the result is that the temper of the wire is hard in some spots and sections, burned in others, and soft in others, forming a spring of uneven temper.

To avoid this difficulty, which I have found to be a serious obstacle to successful electrothermic tempering, I have devised my present invention, which consists in heating the wire at least partially by radiation, instead of relying wholly upon a current passing directly through the wire. This heating by radiation is best accomplished by passing the wire through a tube, which is heated to the requisite degree by connecting it to the poles of a dynamo or other source of electricity, and in which tube the wire is protected from air-drafts and other external disturbing causes which might render the degree of heat unequal in different portions. I have also found that an alternating current in this process is much preferable to the continuous current heretofore used, because it can be more perfectly regulated and be changed to any required potential to suit various conditions and it leaves no magnetism in the wire treated, so that I am enabled to temper the mainsprings of watches and other like springs where the magnetism would be a serious objection.

I have shown in the accompanying drawings an apparatus designed for the carrying out of my invention and which is the best form of such apparatus now known to me.

In the drawings, Figure 1 is a side elevation, partly in section, of the apparatus; and Fig. 2 is a section of the tube wherein the wire is heated by radiation.

In the drawings, A represents a spool loose upon its arbor, upon which the wire *c* to be tempered is wound, and from which it passes first through a spring-contact B, which is connected by the wires *b* and *d* to the dynamo D. It next enters and passes through a tube E, which is designed to protect it from air-drafts and conserve what heat is imparted to it by the direct current which it may receive from the dynamo between the point B and the other connections with the dynamo presently to be described. This tube I prefer to make of porcelain, and it is fixedly supported by stationary brackets *e*. I also provide it with a metal plug F at its lower end, such plug having an aperture but slightly larger than the wire to be treated, the function of which is to guide the wire truly into the center of the heating-tube G and prevent contact by the wire with the interior surface of the latter tube, and to prevent air-current through the tube. The heating-tube G, the use of which constitutes the main feature of my invention, I make preferably of platinum, as that metal is highly refractory and non-oxidizable. It is supported upon electrical connections *g h* from the converter H, and the latter is connected with the dynamo by the wires *d* and *i*. It is preferable that the current, which is fed to the wire by the connections by the wire *d b* upon the one side and the connections *i j* on the other side, shall heat the wire to a degree somewhat less than that required for the tempering. The tube G must be raised, of course, to a high temperature, and for this reason it is desirable to cover it with a non-conductor of heat. I employ for this purpose the packing of asbestus *k*, and surround the latter with an outer

protecting-tube *m*. I thus retain all the heat imparted to the inner tube, protect that tube from the air, and prevent the distortion or bending of it which might accompany the heating due to expansion and contraction, while at the same time the wire being treated is efficiently covered against all air-drafts which might affect its temperature. This tube imparts to the wire an even heat at all points, and the same then passes therefrom into the chilling-bath J, which is a tank made, preferably, of wood or similar material and contains the tempering fluid. It is desirable that the fluid circulate through the inflow-pipe L and out through the overflow-pipe M, and thus be kept at a uniform temperature.

N is a cup set into the bath and supplied with shot *n* or other suitable wiping medium, which will serve to remove the bubbles that may form on the wire when it enters the bath. This cup is preferably removable, as thereby the starting of a length of wire through the apparatus is facilitated. The inflow-pipe L may conduct the fluid in the first instance to this cup, and this cup also receives the end of the electric wire *j* and forms one of the electrodes by which the direct current is sent through the wire. After passing through the cup N the wire being treated is carried around the idler-pulleys O O, and thence on to the spool, where it is wound. The tube G acts not only to supply any deficiency of heat which there may be in the wire, but also to equalize the heat throughout its length, so that it passes into the tempering-bath at a uniform temperature. It may be of any other conducting material which can be heated by electricity; but I prefer the platinum tube, as specified.

While I have shown a current running through the wire from B to N to assist in heating the wire preparatory to the chilling-bath, I do not wish to be understood that such feature is requisite, as the tube G can be relied upon as the sole heating device if it be sufficiently long and the wire be moved slowly through it. Of course in any case the passage of the wire should be not too rapid and at a uniform speed.

The operation of the device will be sufficiently understood from what has already been said. I have found that the wire takes on a uniform temperature in passing through the heating-tube regardless of variations in the gage or carbon or density or unequal annealing, and the result is a uniform temper. The speed with which the wire travels offers a means of regulating the heat that the wire receives. The current should also be under perfect control, so that the requisite heat shall not be exceeded, and to this end suitable current-regulating devices—such as resistance-coils S—may be interposed in circuit between the dynamo and wire, and also between the dynamo and converter. The dynamo D should produce an alternating current for reasons already stated. Other currents I find are apt to leave the wire magnetized, and they are not so easily controlled to the extent requisite.

In order to secure a uniform speed of the wire in its passage through the apparatus, I pass it around a power-driven pulley or roll R, which is located between the chilling-bath and the receiving-spool P, the latter being driven at a speed which will vary with the amount of wire upon it. I do not illustrate the actuating devices of the pulley R or spool P, as such devices may be greatly varied, and their construction is well known to all mechanics.

I claim—

1. The improvement in the tempering of wire, consisting in heating the wire by means of a current of electricity passing through it and equalizing the heat by moving the wire through a heated tube and then chilling the wire, substantially as set forth.

2. In apparatus for tempering wire, a dynamo or other source generating an alternating electric current, in combination with a heating-tube G, electric connections from said dynamo to said tube, and other connections adapted to carry the current from the dynamo to the wire, substantially as set forth.

FRED PURDY.

Witnesses:
EDW. S. EVARTS,
H. M. MUNDAY.