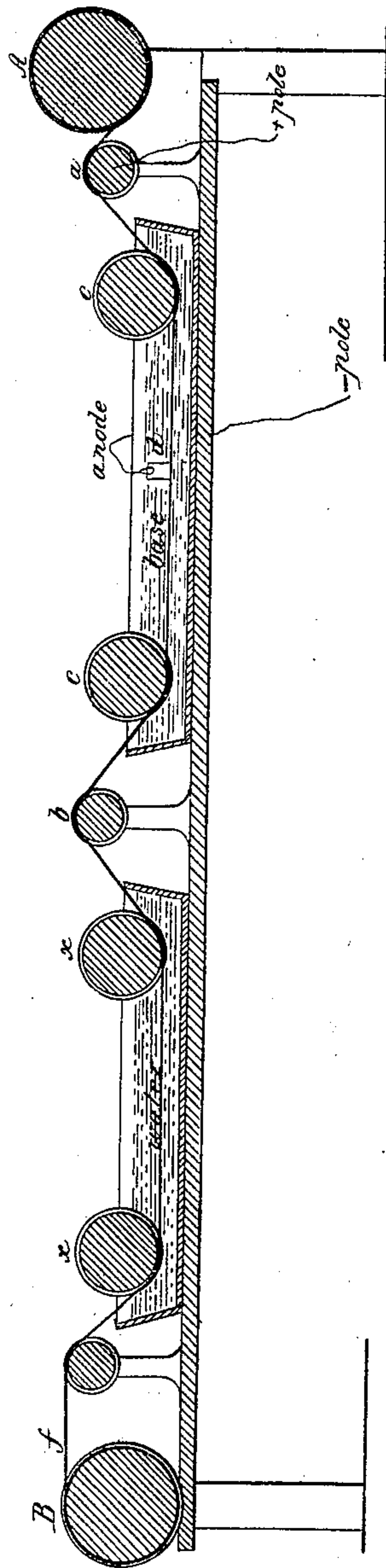


M. MILLER, Jr.  
ELECTROPLATING STEEL WIRE FOR PIANO STRINGS, &c.  
No. 34,640. Patented Mar. 11, 1862.



Witnesses  
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# UNITED STATES PATENT OFFICE.

MARTIN MILLER, JR, OF VIENNA, AUSTRIA.

IMPROVED MODE OF ELECTROPLATING STEEL WIRE FOR PIANO-STRINGS AND OTHER PURPOSES.

Specification forming part of Letters Patent No. **34,640**, dated March 11, 1862.

*To all whom it may concern:*

Be it known that I, MARTIN MILLER, of Vienna, in the Empire of Austria, have invented a new and useful Improvement in the Manufacture of Metallic Music-Wire; and I hereby declare that the following, taken in connection with the accompanying drawing, forms a full, clear, and exact description of the same.

My invention consists, essentially, in a process for protecting against rust all kinds of steel music-wire, as well as wire to be wound upon music-wire, and all other kinds of metallic wire, (whatever their name may be,) liable to rust, by which process the music-wire not only keeps its handsome and full tune, but not being seized by rust or oxidation, is also not so easily broken off, and instruments stringed with such wire keep their tuning better and longer.

It is well known that all music-wire had hitherto the same fate as iron or steel. It is readily attacked by humidity, or is liable to get rusty by the active influence of the atmospheric oxygen, and this rust produces the disadvantageous effect that the music-wire loses its beautiful tune, and getting thinner on its rusted parts keeps but badly its tuning, and is soon broken off. This defect occurs very often to instruments in towns or places where the air is wet by the influence of great waters in the neighborhood. On instruments transported over sea this defect of string-rusting appears in an excessive degree. At Venice, for instance, there is a large number of pianofortes with rusted strings, and if a handsome-tuned instrument is wanted it is necessary to change strings every five years; but this changing strings is not only hurtful to the instrument itself, but also disadvantageous for the tune-holding.

The process or the method by which the above disadvantage is entirely removed is as follows:

Before all is to be prepared the base, consisting of a copper oxide containing a carbonate dissolved in a watery solution of carbonate of potash and cyanide of potassium. In order to prepare this base, take five pounds of vitriol of copper (blue vitriol) and dissolve it in ten pints of water. I then take five pounds of carbonate of potash and dissolve it in ten pints of water. To prevent the overflowing a con-

veniently large wooden, glass, or earthen vessel is to be taken and the first solution to be poured into it. In this first solution pour the second slowly, by which proceeding a precipitate is obtained, which is a carbonate copper oxide, and as a secondary product, sulphate. The latter is to be poured away, and the precipitate (the carbonate copper oxide) is to be washed several times with clean water. Now, a solution is to be prepared in a copper or iron kettle over wood or coal fire, consisting of fifteen pints of water, five pounds of cyanide of potassium, and five pounds of carbonate of potash. This solution is to be heated to boiling, when the above-prepared copper oxide is to be poured in. This mixture is to be left boiling uninterruptedly until strong ammoniacal vapors are rising from it. At this moment the boiler is to be taken away from the fire and allowed to cool. Now the base is ready and fit for my purpose. The liquid, if properly prepared, is of a white-yellowish color. In case the blue prevail more cyanide of potassium is to be added until the blue color shall have entirely vanished.

Another sign of perfect fitness of the above solution is that when a smooth piece of zinc is put in for a few moments it must appear covered with a nice copper coat.

The preparation of the above base is one essential feature of my new method. Until now it is nowhere in use, and especially not yet employed on steel music-wire, steel or iron wire to be wound upon music-wire, or other metallic wires subjected to rust or oxidation; and it is the application of the solution prepared as hereinabove set forth that I wish to be considered as my exclusive property. The ingredients used have been indicated quantitatively, and the proportions given are, to my knowledge, the best; nevertheless I do not limit myself to precisely these proportions.

Having thus prepared the base, I next proceed as follows: The drawing here annexed shows an oblong vessel conveniently large, made of wood or stone, into which is to be poured the above-described base solution. On one side of this vessel a small piece of fine copper called "anode" is suspended on platina wire, whereby it is brought in connection with the negative pole of a galvanic battery con-



sisting of a requisite number of elements. The steel wire, or the wire as ordinarily made, is wound upon the wooden roll A, whence it passes over the roll *a*, which may be of brass or some other metal, and under the two rolls *cc*, where it is immersed into the fluid, through which it is drawn. It then runs over the wooden roll *b*, from which it is caused to enter the water in the second vessel by means of the two rolls *xx*. At *f* it is cleaned and dried with a piece of cloth, and finally reaches the roll B, upon which it is wound in bundles. The brass roll *a*, over which the wire is running, being in connection with the positive pole of the battery and the anode *d*, which hangs on a platina wire at one side of the vessel into the fluid (base) being on the contrary in connection with the negative pole of the same galvanic battery, the galvanizing or coppering of the wire takes place in very quick manner, and the wire that at the roll A has been steel-grey appears on the roll B covered with copper, constituting in such state a new article of manufacture and trade named "coppered-steel music-wire."

In order to produce silvered-steel music-wire, or silvered wire to be wound upon music-wire, the arrangement is the same, with the difference that the anode is a piece of fine silver, and is suspended within a silver solution. This silver solution is made in the following manner: In a china vessel half an ounce of silver is to be dissolved in one ounce and a half of aqua fortis, and the whole thinned with one pint of water in order to increase the volume. This done, a second solution is to be made of one-quarter pound of ordinary salt in one pint of water. The said solution or salt-water is to be poured slowly into the first until a precipitate is being formed. The fluid standing over that precipitate is to be decanted and the white precipitate washed several times in clear water. A third solution is now to be made of four ounces of cyanide of potassium in two pints of water, and the precipitate before obtained mixed with this third fluid produces the white and crystalline silver solution. The wire, already covered with the base or coppered, is now wound upon the roll A, from whence it is run over the brass roll *a*, which is in connection with the positive pole of a battery. It then passes down under the two rolls *cc*, and is drawn through the fluid into which the silver anode above mentioned is suspended over the roll *b*, and under the two rolls *xx* it enters another vessel filled with water, where it is washed. Being dried and cleaned, it is wound upon the roll B in bundles and sold as silvered-steel music-wire.

Gilded steel music-wire is produced thus: A five-dollar gold coin is dissolved in the seven times its weight of aqua regia, and the solution thus obtained is evaporated in a china vessel over wood fire. By thus proceeding chloride of gold is obtained. This done, two ounces and a half of cyanide of potassium are dissolved in two pints of water, and the above

chloride of gold is added. The gold solution is now ready. As anode a piece of fine gold is used, which, by means of platina wire, is suspended upon one side of the vessel. The manipulation is the same as that before mentioned, and the steel music-wire is gilded.

Steel music-wire covered with brass is produced as follows: Take five pints of the above base solution. In five pints of water are dissolved two pounds of cyanide of potassium, and the latter solution is poured into the first said base reduced with water. To this mixture is added half a pound oxide of zinc, and when all is dissolved the fluid is ready. The manipulation is the same as above. The steel wire is wound upon the roll A and drawn through the fluid, as above described, with the difference that a piece of brass is used as anode.

Covering steel music-wire with tin requires the following proceeding: One pound of tin oxide is dissolved in ten pints of water by boiling this mixture in a sufficiently large enameled iron vessel over coal or wood fire. While boiling add by degrees two pounds of carbonate of potash. As soon as the latter is dissolved two pounds of cyanide of potassium are thrown in, and the whole left boiling until all is perfectly dissolved. After being cooled the mixture is ready. To tin steel music-wire the same above-mentioned proceeding is applied to. The anode is a piece of tin.

At all manipulations, the quantitative proportions have been given on account of their being the best; but I do not limit myself to them.

From the manipulations herein-above mentioned it follows that in order to cover steel music-wire with copper, silver, gold, brass, tin, &c., anodes of copper, silver, gold, brass, tin, &c., are immersed into a solution convenient to these anodes, and that this plunging of the anodes into the convenient fluid for the purpose of galvanizing steel music-wire, combined with the two poles of the battery, is the new method which I desire to be considered as my exclusive property.

To execute this my invention I do not operate with anodes of the above-mentioned metals only, but I also use their several compounds—viz., bronze (copper and tin) or a composition of gold, silver, and copper. Furthermore, a composition of gold and silver, known as "green gold," and a composition of silver and copper. In short, I include all compositions, whatever their name may be, only for every chosen anode a solution convenient to it is to be applied to—viz., first, the anode being bronze, (copper and tin,) the solution must consist of one pound of a carbonate of copper oxide in ten pints of water and five pounds of cyanide of potash, to which is added two pints of the before-mentioned tin solution; second, the anode being gold and silver, (green gold,) the following solution is to be applied to: ten parts of the above-named gold solution and one part of the above-inci-



cated silver solution; third, the anode being a composition of gold, silver, and copper, ten parts of the above gold solution, ten parts of the above copper solution, and one part of the above silver solution are to be taken; fourth, the anode being a composition of silver and copper, ten parts of the above silver solution and one part of the above copper solution are to be taken.

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

The production of steel or other music-wire provided with a copper, silver, gold, or other metallic coating, substantially in the manner and for the purposes herein set forth.

In testimony whereof I have signed my name to this specification before two subscribing witnesses.

MARTIN MILLER, SOHN.

Witnesses:

JOHN KRETSCHMER,  
TG. RAITH.