K. FARKAS.

METHOD OF DRAWING FINE WIRES OF REFRACTORY METALS.

APPLICATION FILED JUNE 23, 1911.

**1,008,808.** Patented Nov. 14, 1911.

Fig. 1.

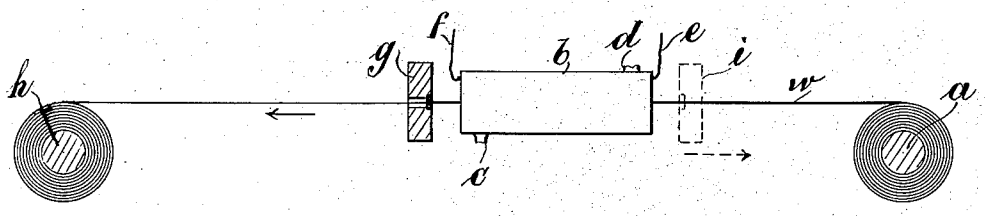



Fig. 2.

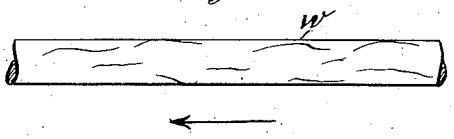
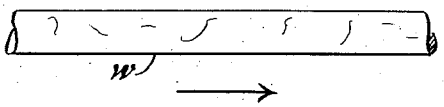



Fig. 3.

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# UNITED STATES PATENT OFFICE.

KARL FARKAS, OF GLEN RIDGE, NEW JERSEY.

## METHOD OF DRAWING FINE WIRES OF REFRACTORY METALS.

1,008,808. Specification of Letters Patent. Patented Nov. 14, 1911.

Application filed June 23, 1911. Serial No. 635,011.

*To all whom it may concern:*

Be it known that I, KARL FARKAS, a citizen of the Kingdom of Hungary, and a resident of Glen Ridge, county of Essex, and State of New Jersey, have invented certain new and useful Improvements in Methods of Drawing Fine Wires of Refractory Metals, of which the following is a specification.

This invention has reference to a novel method of drawing fine wires or filaments from rods or relatively heavy wires of refractory metals such as tungsten for instance. These very fine wires or filaments are used as incandescents or illuminants in the drawn wire filament lamps.

When wire is drawn out according to the well known methods, particularly of metals which are not ductile to the highest degree then slight irregularities are found in the drawn wire which often may be detected solely with the aid of a powerful magnifying glass or microscope. This is easily explained when it is considered that the metal is usually stretched at ordinary temperature in one direction and naturally a certain strain must exist in the wire. It is self-evident that drawn wire metal filaments of that description are not as uniform as desirable and when used as incandescents in electric lamps the slightly thinner portions even if so to say microscopically only present a higher resistance to the current and therefore are heated to higher incandescence emitting more light from those points and imperiling the life of the lamp because the filament breaks on those points before the natural life time of the lamp is reached.

To overcome the described deficiencies I have devised a new method of drawing out exceedingly fine wires so that they are uniformly dense throughout and free from the microscopical defects above referred to.

The invention may be carried out in suitable apparatus one form of which is diagrammatically illustrated in the accompanying drawing in which:

Figure 1 represents in diagrammatic view an apparatus for drawing fine wires of refractory metals. Fig. 2 illustrates on an enlarged scale a piece of wire drawn through the apparatus in one direction, and Fig. 3 is a like view of a like piece of wire drawn through the apparatus in the opposite direction.

One feature of the invention is that the wire which is drawn repeatedly through dies having various openings is drawn first through one die in one direction and then through another die with finer bore in the opposite direction whereby the strain exerted on the wire by the first drawing out of same is counteracted or counterbalanced. The slight irregularities or microscopic defects produced by drawing the fine wire in one direction are removed by drawing the same wire in the opposite direction thus making the wire dense and regular.

An other feature of the invention is that the wire is not drawn at ordinary temperature but is electrically heated in an atmosphere of an inert gas before it passes through the die whereby even a relatively brittle metal of the character of the refractory or nearly infusible metals may be drawn out into very fine wire without undue strain thereon, the electrically heated wire being of course more ductile so to say than wire when at ordinary temperature. Necessarily these exceedingly fine wires for the purpose intended must be made from chemically pure metals because any impurity therein will produce unevenness in the diameter of the finished wire where such impurities occur.

Referring now to the apparatus diagrammatically illustrated on the drawing, *a* represents a spool on which relatively heavy wire *w* is wound to be drawn out, *b* illustrates an electric heating device having a gas inlet *c* and a gas outlet *d*. The gas introduced into the heater *b* may be hydrogen or a mixture of hydrogen and nitrogen. The hydrogen has the well known reducing effect and prevents surface oxidation on the heated wire and the nitrogen is wholly inert and chemically inactive. Upon leaving the electric heater the heated wire passes the die *g* by means of which it is reduced in diameter. The die *g* may be of any approved construction. The drawn out wire is then wound onto a spool *h*.

As described the wire is electrically heated before it passes the die *g* and therefore in a relatively soft and rather ductile condition. Should however any possible strain have occurred then this is counteracted by the second operation of drawing the wire finer yet. Accordingly the wire which is now all on the spool *h* is returned to the spool *a* and passed through the heating apparatus *b* as

before. A new die *i* with finer bore has been placed near the heater *b* on its opposite side as shown in dotted lines in Fig. 1 and the wire is passed therethrough in the direction of the arrow shown in dotted lines in said figure. In this manner any unevenness in the fine wire is remedied and any possible strain therein from the first operation counteracted. These operations are repeated until the wire has obtained the desired fineness.

The fine wire produced according to the described method is uniform in diameter and density to the highest degree and very well adapted for the purpose of producing therefrom drawn metal wire filaments for incandescent lamps.

I claim as my invention:

1. The method of drawing fine wire consisting in heating the wire electrically, drawing out the heated wire in one direction, heating it electrically again, and drawing the heated wire out to a finer degree in the opposite direction.

2. The method of drawing fine wire of refractory metals consisting in heating the wire electrically, drawing out the heated wire in one direction, heating it electrically again, and drawing the heated wire out to a finer degree in the opposite direction.

3. The method of drawing fine tungsten wire consisting in heating the tungsten wire electrically, drawing out the heated wire in one direction, heating it electrically again, and drawing the heated wire out to a finer degree in the opposite direction.

4. The method of drawing fine tungsten wire consisting in heating it electrically in an atmosphere of inert gas, drawing out the heated wire in one direction, heating it electrically again, and drawing the heated wire out to a finer degree in the opposite direction.

5. The method of drawing fine tungsten wire consisting in heating it electrically in an atmosphere of hydrogen, drawing out the heated wire in one direction, heating it electrically again, and drawing the heated wire out to a finer degree in the opposite direction.

Signed at New York, N. Y., this 22nd day of June, 1911.

KARL FARKAS.

Witnesses:
CORINNE MYERS,
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