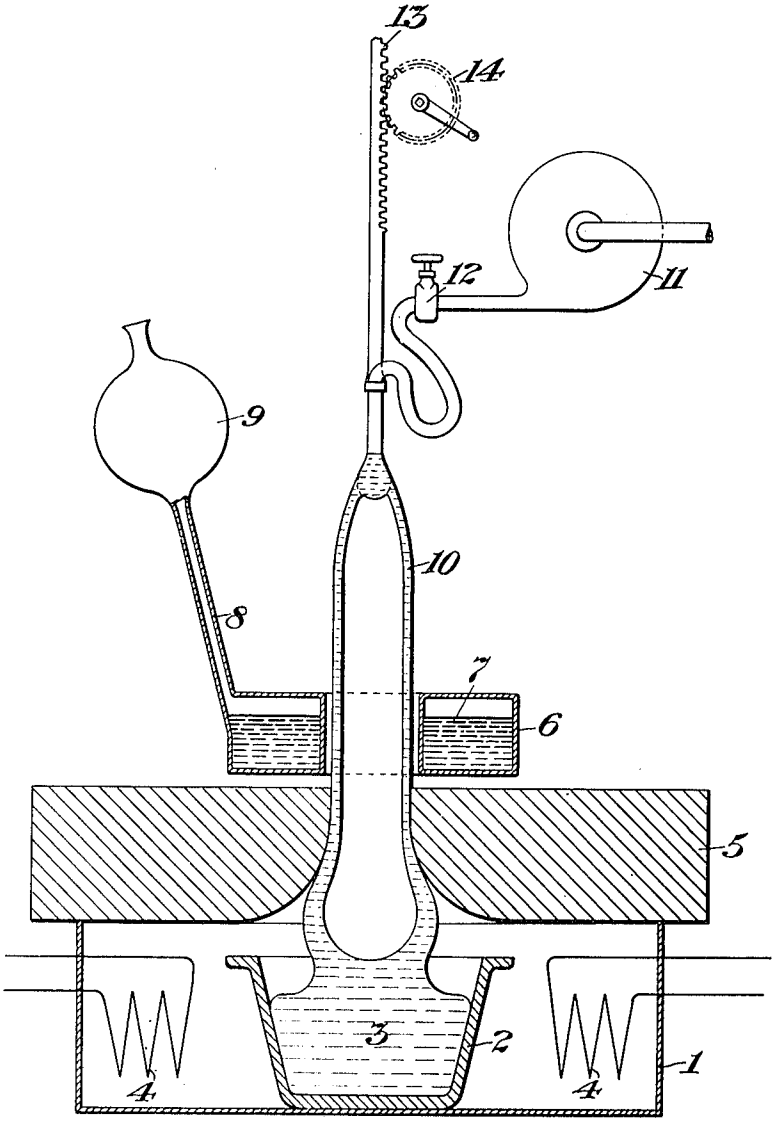
F. G. KEYES.

TUBE MANUFACTURE.

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1,291,921. Patented Jan. 21, 1919.



WITNESSES:

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TUBE MANUFACTURE.

1,291,921. Specification of Letters Patent. Patented Jan. 21, 1919.

Application filed February 18, 1913. Serial No. 749,124.

To all whom it may concern:

Be it known that I, FREDERICK G. KEYES, a citizen of the United States, and resident of Boston, county of Suffolk, State of Massachusetts, have invented certain new and useful Improvements in Tube Manufacture, of which the following is a specification.

The object of my invention is to provide means for drawing a tube of any material admitting of such treatment, in such a manner as to insure the formation of a tube having a uniform external diameter and a central opening substantially regular. The material to be formed or shaped is originally contained in a refractory crucible where it exists as a rigid body requiring the application of heat in order to bring it to a liquid or viscous state. The crucible is generally contained within a muffle and heat, as from an electric coil or coils, is applied to it within said muffle. The heating means may, however, be any suitable means for developing high temperatures sufficient to liquefy the material within the crucible. For example, the crucible may be contained within a graphite resistor or the muffle containing the crucible may be set in a coke resistance furnace, the muffle being heated by means of the coke resistance. In this way the material is liquefied, or rendered fluid. A tube of suitable material is then dipped into the upper part of the liquid and is afterward drawn upward, a portion of the viscous liquid adhering to the lower end of the tube. The tube is then lifted by some source of power and at the same time led through a heat resisting die. The die is maintained at such a temperature that the material which is being drawn through it will not be chilled below the point of flow; but outside the die a chilling process, preferably graduated from warmer to cooler conditions, may be employed.

An appropriate source of air pressure, such as a blower, provided with a regulating valve, is so applied to the central tube as to maintain an opening in said tube corresponding in the main to the character of the external surface of the tube.

The drawing clearly illustrates the features above mentioned, showing at 1, the muffle; at 2, the crucible, containing glass, quartz, or other material, 3; at 4, 4, electric coils for supplying heat for liquefying the material 3; at 5, the die; at 6 the cooling means comprising a locally closed annular holder containing boiling metal, 7, and connected by a tube, 8, with a condensing chamber, 9, open to the air, the central tube at 10 showing a mass of material to be treated, a considerable portion of it being shown above the cooling means 6 in the form of a tube which has passed through the die 5 and received its shape therefrom, the blower, 11, and regulating valve, 12, forming the means for transmitting to the central tube air under pressure for assisting in the forming of the material into tube shape.

To the tube 10 is connected a rack, 13, capable of being operated by the pinion, 14.

A coating of tungsten on the lower side of the die 5 may sometime advantageously be employed.

The crucible may also be of tungsten.

As the body 7 constituting the cooling means, I may make use of boiling mercury, which, in comparison with the heat of the die and the tube passing through the same may possess a relatively low temperature, but not sufficiently low to cause a sudden chill to affect the tube which is in process of formation.

The condensing chamber has been hereinbefore described as open to the air. This might become an objection if the metal in the annulus 6 were of high boiling point, since the condensing metal might react with the air. In such cases a suitable means may be provided to prevent such action as, for example, passing a slow current of illuminating gas, hydrogen, or other gas indifferent to the metal, into the condensing chamber and thereby excluding oxygen. Or, a porous plug may be used for filling the opening from the condensing chamber 9 to the outer air.

I have mentioned mercury as a suitable metal for use in the cooler 6, but it will be understood that in those cases where the metal in the annulus 6 is of high boiling point, such metal might be arsenic, or cadmium, or zinc, or antimony, or lead, or silver, or tin.

I claim as my invention:

1. The combination with a container for material capable of being liquefied, of heating means for said container, a tube capable of gathering up a mass of viscous liquefied material, means for lifting and lowering said tube, air pressure apparatus joined to the

free end of said tube, in combination with a die above the crucible and cooling means above the die.

2. In an apparatus for bringing a liquefiable material to a viscous state and for drawing tubes therefrom, a device for drawing away from viscous liquefied material a portion thereof, and automatic means for providing a graduated temperature in the neighborhood of the viscous material outside the source thereof, in combination with a die through which the viscous material is adapted to be forced.

3. In an apparatus for bringing a liquefiable material to a viscous state and for drawing articles therefrom, a crucible in which material may be brought to a viscous or liquid state, and means for drawing the said material from the crucible, in combination with cooling means surrounding the path of the drawing means and consisting of a container holding boiling metal.

4. In an apparatus for bringing a liquefiable material to a viscous state and for drawing articles therefrom, a crucible in which material may be brought into a viscous or liquid state, means for drawing the said material from the crucible, in combination with cooling means surrounding the path of the drawing means and consisting of a container holding boiling metal, means for carrying away the vaporized metal, and means open to the air for condensing the same.

5. In an apparatus for bringing a liquefiable material to a viscous state and for drawing articles therefrom, a crucible in which material may be brought into a viscous or liquid state, and means for drawing the said material from the crucible, in combination with cooling means surrounding the path of the drawing means and consisting of a container holding boiling mercury.

6. In a tube drawing machine, a crucible, a bait movable into and away from said crucible, in combination with cooling means surrounding the path of the bait and consisting of a container holding boiling metal, a duct for carrying away the vaporized metal, and a condensing chamber open to the air.

7. In a tube drawing machine, a crucible, a bait movable into and away from said crucible, in combination with cooling means surrounding the path of the bait and consisting of a container holding boiling metal.

8. In a tube-drawing machine comprising a crucible and a muffle inclosing the same, heating means coöperating with the crucible, a bait also connected therewith, means for lifting and lowering said bait, air pressure apparatus joined to the free end of said bait in combination with a die above the crucible and cooling means above the die.

Signed at New York, in the county of New York, and State of New York, this 15th day of February, A. D. 1913.

FREDERICK G. KEYES.

Witnesses:
WM. H. CAPEL,
THOS. H. BROWN.