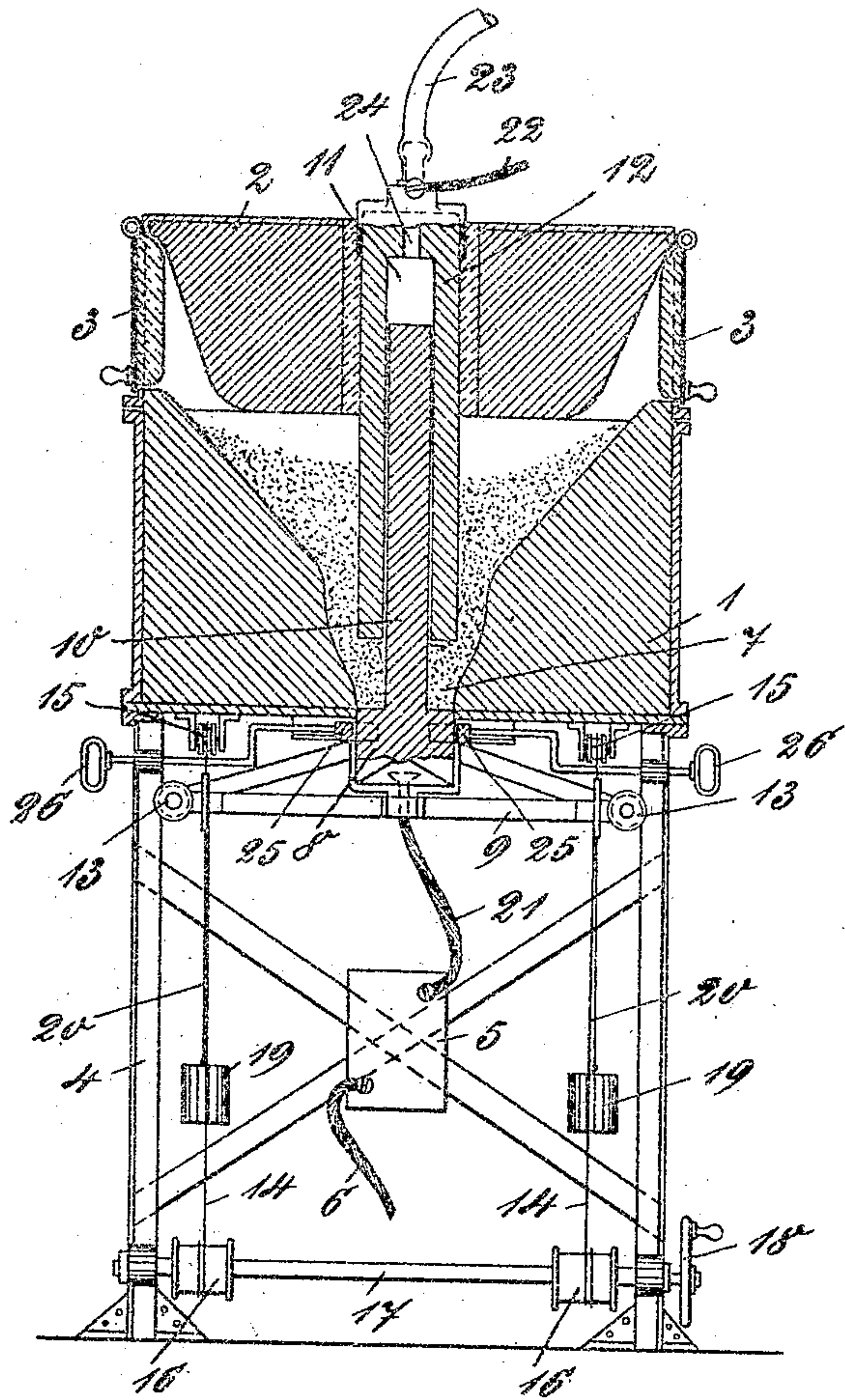


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ELECTRIC FURNACE.  
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989,671.

Patented Apr. 18, 1911.



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# UNITED STATES PATENT OFFICE.

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## ELECTRIC FURNACE.

989,671.

Specification of Letters Patent.

Patented Apr. 18, 1911.

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*To all whom it may concern:*

Be it known that I, AUGUST VOELKER, a citizen of the Empire of Germany, residing at Beuel, near Bonn-on-the-Rhine, in the Empire of Germany, have invented a new and useful Electric Furnace, of which the following is a specification.

All those acquainted with the nature of quartz know, that there is a wide difference between ordinary glass and quartz, which must be taken into consideration. In an electric furnace the raw quartz (arenaceous quartz, quartz-sand) can be turned into a semi-liquid hot state, but it can never be made to melt, but will at once volatilize the moment, that the temperature is further increased beyond that point at which the quartz has become semi-liquid. It is impossible to run molten quartz off from the furnace through a tap-hole, and so it is necessary to take the softened quartz body for further treatment out of the furnace, after a part of the latter has been taken off.

My invention relates to improvements in electric furnaces, whereby they are adapted to successfully turn raw quartz into a semi-liquid hot state and to form bodies from the semi-liquid quartz during its discharge.

The chief improvement consists in the employment of a covered hearth with a central bottom opening.

Another improvement consists in the employment of a vertical prismatic electric connection between two prismatic poles of carbon or graphite and adapted to remain in contact with both of them, whereby the formation of an arc is avoided.

A third improvement consists in securing the upper pole in the cover of the hearth and in rendering the lower pole movable, so that it is adapted to normally close the bottom opening in the hearth and to move downward while supporting the body in its course of formation from the semi-liquid quartz.

A fourth improvement consists in the reduction of the cross section of the electric connection in proportion to that of the two poles, so that the maximum heat is produced in the material in contact with the electric connection between the two poles, since this portion of the connection presents the maximum resistance to the current in the whole furnace.

A fifth improvement consists in the employment of means for vertically moving

the lower pole with the electric connection, so that by gradually lowering the lower pole the heat of the electric connection can be increased and distributed over an increasing surface of the mass in the course of the process. Other improvements will be hereinafter set forth.

I will now proceed to describe my invention with reference to the accompanying drawing, which represents a vertical longitudinal section through an improved electric furnace.

The furnace proper is shown to consist of a hearth 1 and a cover 2 of any known construction and to be provided with charging doors 3, 3, through which the raw quartz can be introduced. The furnace proper is supported by a suitable frame 4 of any known construction, which is shown to be provided with a metallic plate 5 insulated from it and connected by a conductor 6 with the respective source of current (not shown). The hearth 1 has a central bottom opening 7, through which the softened quartz can be permitted to issue downward. A lower pole 8 of carbon or graphite is supported by a cross-head 9 and is adapted to normally close the bottom opening 7 of the hearth 1. It is shown to be made in one with a vertical prismatic electric connection 10 of carbon or graphite, which is guided in the cavity 11 of an upper pole 12 of carbon or graphite secured in any known manner in the cover or top 2 of the furnace. The crosshead 9 is at its ends provided with rollers 13, 13, which are adapted to roll on vertical guides forming parts of the frame 4, whereby the lower pole 8 and the electric connection 10 are vertically guided. The crosshead 9 is suspended from the ends of two ropes 14, 14 or the like passing over pulleys 15, 15 and fastened with their other ends on two drums 16, 16 on a shaft 17, which latter can be turned by means of a hand-wheel 18 for raising and lowering the pole 8 with the connection 10. Two weights 19, 19 suspended by cords 20, 20 from the crosshead 9 may help to pull the latter downward. The lower movable pole 8 is electrically connected with the already mentioned plate 5 by an elastic conductor 21, which can follow the motion of the pole 8. The upper stationary pole 12 is connected by a conductor 22 with the said source of current, so that the current can pass through the two poles 8, 12 and the connection 10. Ex-



changeable dies 25, 25 of steel or the like are horizontally guided at the bottom of the furnace and are provided with handles 26, 26 by means of which they can be operated.

5 When by means of the hand-wheel 18 the lower pole 8 has been so much lowered as to be just beneath the dies 25, 25, the latter can be pushed inward by their handles 26, 26 and will form an annular mouth around the electric connection 10.

10 The electric furnace is operated as follows: At the commencement the movable pole 8 with the cross-head 9 occupies the uppermost position shown, so that there will be the minimum distance between the lower pole 8 and the lower end face of the upper pole 12 and the connection 10 will present its minimum surface to the raw material introduced. After the charge of the hearth 1 with raw quartz (arenaceous quartz, quartz-sand) through the doors 3, 3 the current is turned on. The part of the connection 10 between the lower pole 8 and the lower end face of the upper pole 12 having the smallest cross section and presenting the maximum resistance to the current will be strongly heated, so that the raw material surrounding it will soften rapidly and form a body. Then the cross-head 9 is pulled downward so much by means of the hand-wheel 18, that the dies 25, 25 can be pushed inward by their handles 26, 26 to form the annular mouth through which the softened quartz is afterward permitted to issue downward from the hearth 1. When the body surrounding the connection 10 has attained a sufficiently high temperature, the lower pole 8 is by means of the hand-wheel 18 a little lowered, so as to uncover an increasing surface of the connection 10, so that the white heat of the part of the connection 10 between the poles will be distributed over an increasing quantity of the material and the raw quartz surrounding the electric connection 10 between the softened body already formed and the end of the upper pole 12 will be likewise softened, and consequently the body is lengthened. Afterward the lower pole 8 is once more a little lowered for uncovering a further surface of the connection 10, when a further quantity of raw quartz will be softened. In this manner the lower pole 8 is gradually lowered for softening a further quantity of the raw quartz, so that a quartz tube is formed on the connection 10. Where so preferred, at or shortly before the end of the process compressed air may be introduced into the furnace, for example into the cavity 11 of the upper pole 12 through a hose 23 or the like and a hole 24 in the pole, for forcing the body of softened quartz out of the furnace. During the descent of the lower pole 8 with the crosshead 9 the electric connection 10 will engage in the tubular body in its course

of formation from the softened quartz and may serve as a core, which afterward requires to be removed.

As already mentioned above, the electric connection 10 is guided in the cavity 11 of the upper stationary pole 12, so that it remains in electric contact with the pole 12, when it is lowered and no arc can be formed. It does not matter what section the two prismatic poles 8 and 12 and the prismatic connection 10 are given, but it is essential that the connection 10 has a smaller cross section and consequently presents a larger electric resistance than the two poles 8 and 12. The connection 10 may be a round bar, as described above, or it may be a square or rectangular bar or a plate. The lower pole 8 may be made in one with the connection 10, as described above, or it may be made separately and provided with a central or middle hole or recess for holding and guiding the lower end of the connection 10, or it may consist of two parallel bars adjoining opposite sides of the end of the connection 10 and therewith connected in any known manner. The upper stationary pole 12 may be tubular as described above, or it may consist of two parallel plates between which the electric connection 10 is vertically guided. The body of quartz to be formed in the electric furnace depends upon the shape of the two poles 8 and 12 and of the electric connection 10 described above.

Of course more than one pair of poles with their electric connection may be disposed in the furnace, if this should be rendered necessary. The sizes of these parts will require to be selected and proportioned in accordance with the objects to be attained.

The electric furnace can be varied in many respects without departing from the spirit of my invention.

I claim:

1. In an electric furnace, the combination with a covered hearth provided with a bottom opening, of a pendent prismatic pole secured in the cover of said hearth, a movable pole adapted to normally close the bottom opening of said hearth, a vertical prismatic connection connected with said movable pole and adapted to remain in electric contact with said pendent pole, and means for vertically moving said movable pole, said vertical prismatic connection being of smaller cross section than said two poles.

2. In an electric furnace, the combination with a covered hearth provided with a bottom opening, of a pendent prismatic pole secured in the cover of said hearth, a movable pole adapted to normally close the bottom opening of said hearth, means vertically guiding said movable pole, means for moving said movable pole, a vertical prismatic connection connected with said movable pole and adapted to remain in electric contact



with said pendent pole, it being of smaller cross section than said two poles, and a circuit including said two poles and said prismatic connection.

5 3. In an electric furnace, the combination with a covered hearth provided with a bottom opening, of a pendent prismatic pole secured in the cover of said hearth, a movable pole adapted to normally close the bottom opening of said hearth, means vertically guiding said movable pole, means for moving said movable pole, a vertical prismatic connection connected with said movable pole and adapted to remain in electric contact  
15 with said pendent pole, it being of smaller cross section than said two poles, means for varying the cross sectional area of the bottom opening of said hearth besides said vertical prismatic connection, and a circuit including said two poles and said prismatic connection.  
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4. In an electric furnace, the combination with a covered hearth provided with a bottom opening, of a pendent prismatic pole  
25 secured in the cover of said hearth and provided with a vertical prismatic cavity, a movable pole adapted to normally close the bottom opening of said hearth, a vertical prismatic connection connected with said  
30 movable pole and guided in the cavity of said pendent pole whereby the formation of an arc is prevented, it being of smaller cross section than said two poles, and means for vertically moving said movable pole.

35 5. In an electric furnace, the combination with a covered hearth provided with a bottom opening, of a pendent prismatic pole se-

cured in the cover of said hearth and provided with a vertical prismatic cavity, a movable pole adapted to normally close the bottom opening of said hearth, means vertically guiding said movable pole, means for moving said movable pole, a vertical prismatic connection connected with said movable pole and guided in the cavity of said pendent pole whereby the formation of an arc is prevented, said prismatic connection being of smaller cross section than said two poles, and a circuit including said two poles and said prismatic connection.  
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6. In an electric furnace, the combination with a covered hearth provided with a bottom opening, of a pendent prismatic pole secured in the cover of said hearth and provided with a vertical prismatic cavity, a movable pole adapted to normally close the bottom opening of said hearth, means vertically guiding said movable pole, means for moving said movable pole, a vertical prismatic connection connected with said movable pole and guided in the cavity of said pendent pole whereby the formation of an arc is prevented, said prismatic connection being of smaller cross section than said two poles, means for varying the cross sectional area of the bottom opening of said hearth around said vertical prismatic connection, and a circuit including said two poles and said prismatic connection.  
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