No. 740,428.

PATENTED OCT. 6, 1903.

J. O. HEINZE, JR.

SPARK GAP.

APPLICATION FILED MAY 20, 1903.

NO MODEL.

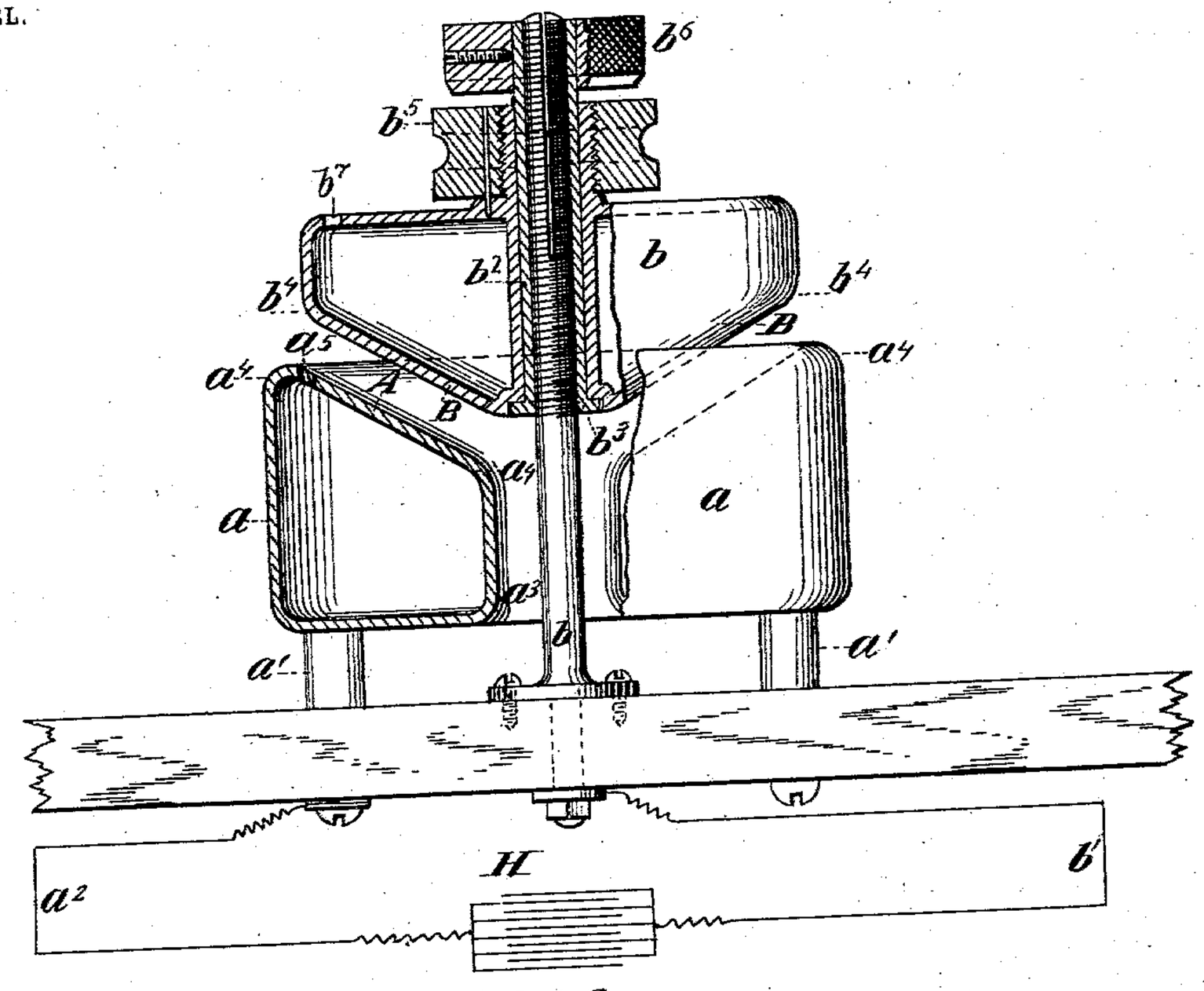

Fig. 1.

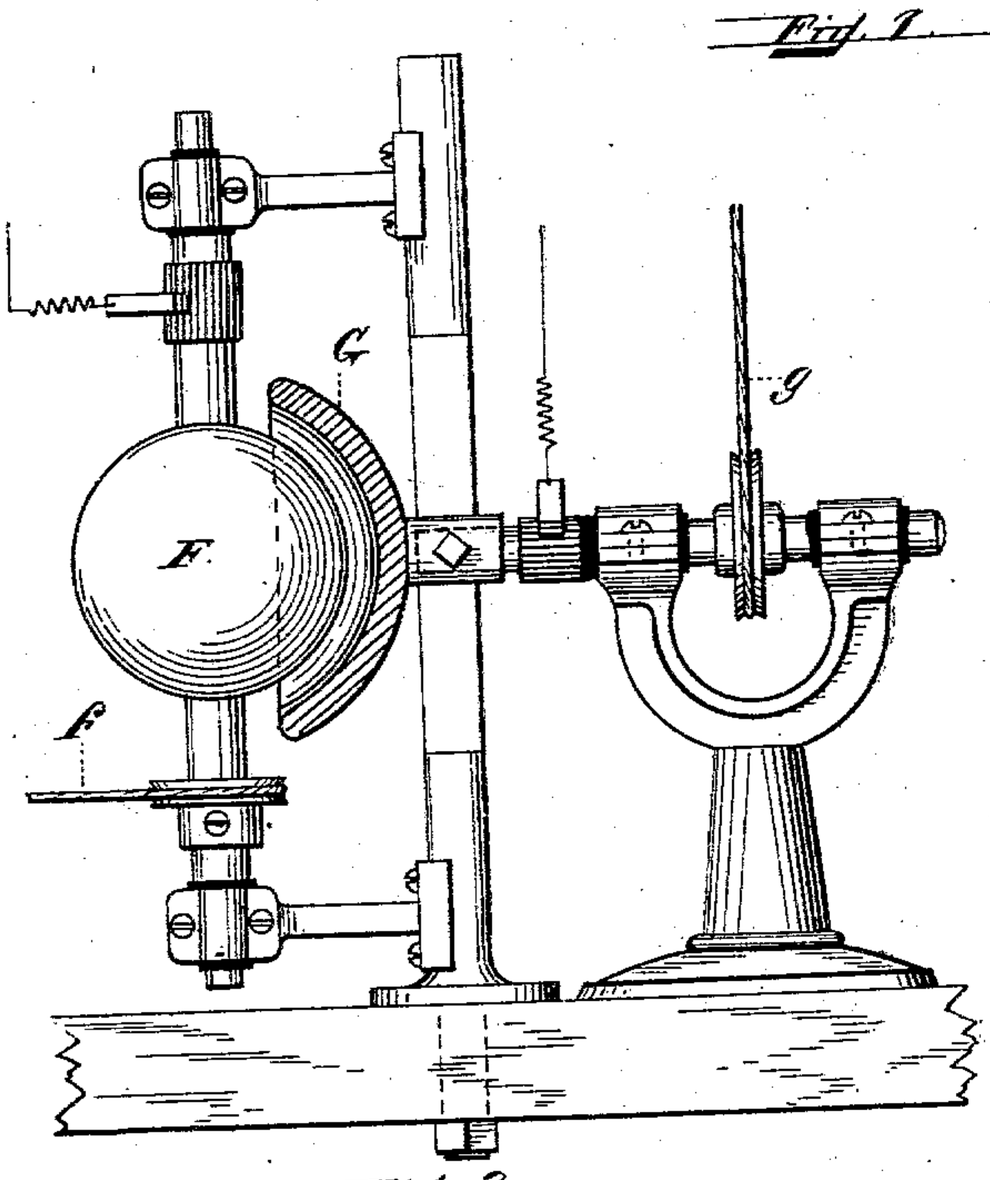

Fig. 3.

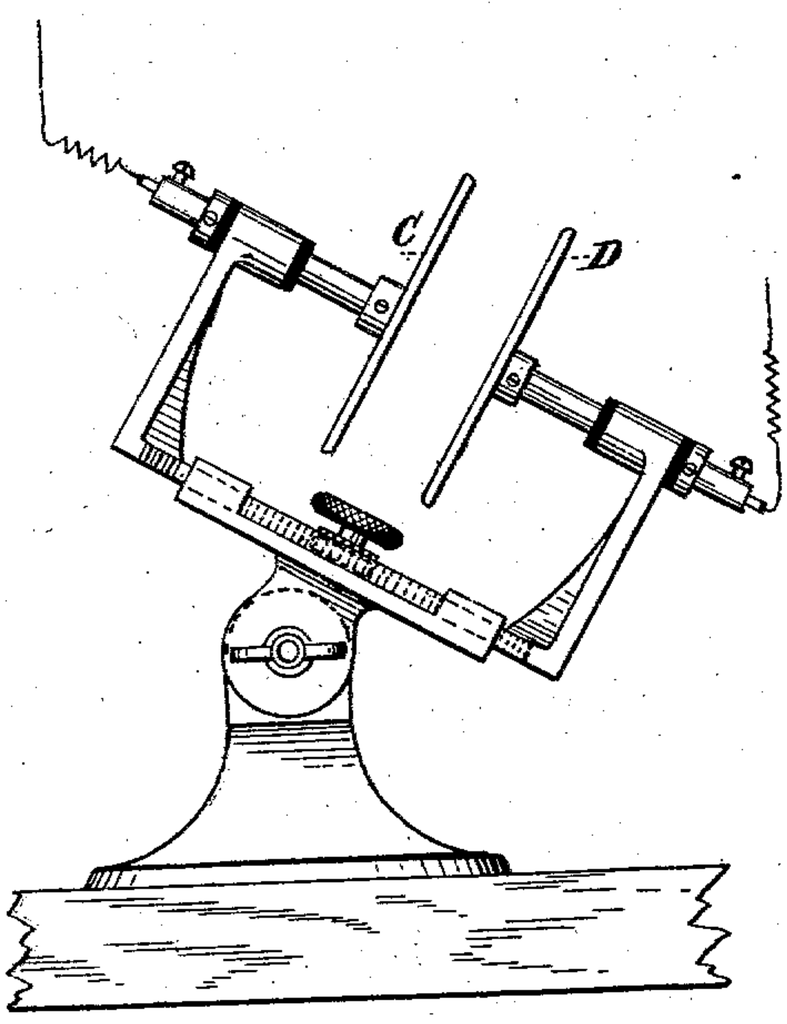

Fig. 2.

Witnesses:
W. B. Remick.
H. E. Remick Jr.

Inventor:
John Otto Heinze, Jr.
by his attorney
Charles F. Richardson

No. 740,428. Patented October 6, 1903.

UNITED STATES PATENT OFFICE.

JOHN OTTO HEINZE, JR., OF LOWELL, MASSACHUSETTS.

SPARK-GAP.

SPECIFICATION forming part of Letters Patent No. 740,428, dated October 6, 1903.

Application filed May 20, 1903. Serial No. 157,999. (No model.)

To all whom it may concern:

Be it known that I, JOHN OTTO HEINZE, Jr., a citizen of the United States, residing at Lowell, in the county of Middlesex and State of Massachusetts, have invented certain new and useful Improvements in Spark-Gaps, of which the following is a specification.

The principal object of my invention is to provide a spark-gap so designed that sparking between its spark-surfaces will be between different points of said respective surfaces instead of the same points, which after continuous sparking soon form metal globules or points that thus shorten the sparking distance between said surfaces and facilitate the electrical discharge between said surfaces by lowering the resistance or potential necessary to produce a spark, and therefore enabling the condenser, which is to discharge its energy across this spark-gap, to discharge at a lower capacity.

While experimenting with vertical parallel spark-surfaces I have found that sparking usually takes place at the upper edges of the spark-surfaces, said sparking beginning either there or at some other portions of said surfaces and then rapidly moving to said edges, where it remains and soon forms the objectionable metal globules or corrosions above described. It is a well-known fact that as a conductor for electricity warm air is better than cool air. Sparking between the surfaces heats the intervening air, which at once begins to rise, and as it rises the sparking rapidly rises with it and all the while adds more and more heat to the upwardly-moving column of warm air. Now I accomplish the object of my invention by providing means whereby the tendency of warm air to move upward is so controlled or retarded in its upward movement that the sparking is not confined to the upper edges of the spark-surfaces; but by having the parallel spark-surfaces extending upwardly, but not vertical, and their outer portions rounded rearwardly in the usual manner the atmospheric conditions between the surfaces are such that the sparking wanders from place to place first in one direction and then another without stopping long enough here or there to form said metal globules, corrosions, or roughness due to oxidation. However, should the electric currents employed be so powerful that the atmospheric conditions between the spark-surfaces would not cause the desired movement of the sparking then I provide a spark-gap one or both of whose parallel spark-surfaces may be moved either by hand or power in order to present different portions of the sparking surfaces to each other and in this way prevent for any length of time sparking between the same points on said surfaces, and therefore the formation of said metal globules, points, or corrosions.

Figure 1 is an elevation showing a spark-gap embodying my invention, partly in section; and Figs. 2 and 3 show modified forms of my invention.

In the drawings illustrating the principle of my invention and the best mode now known to me of applying that principle, A and B are metal spark-surfaces of electrodes *a b* of a spark-gap.

The electrode *a* is supported upon an insulated base by posts *a'*, electrically connected with wire a^2, and consists of a metal cylinder having a cylindrical axial aperture a^3, which opens out and forms in the top portion of said cylinder a frusto-conical depression constituting the spark-surface A, whose edge portions a^4 a^4 are rearwardly rounded. In order that the electrode *a* may contain water or other cooling liquid, it is made hollow and provided with a hole a^5, communicating with its interior. If desired, some material, such as lead, being a poor conductor of heat may be substituted for said cooling liquid. Fixed to said base and extending up through the axial aperture a^3 of electrode *a* is a threaded rod *b*, electrically connected with a wire *b'*, designed to engage the interior threads of a sleeve b^2, having near its bottom a shoulder b^3. Loosely mounted upon said sleeve b^2 and supported by said shoulder is electrode *b*, which, like electrode *a*, is cylindrical and has an axial aperture therethrough, into which fits said sleeve b^2, the bottom portion of said cylindrical electrode *b* being a frusto-conical projection that forms the spark-surface B with rounded edge portions *b b* and has the same angularity as the spark-surface A.

A small pulley b^5 is fixed to the top of the electrode *b*, so that the electrode *b* is rotatable about its axis—that is, when the pulley is

belted as in the drawings it may be continuously rotated or if not so belted movement much or little may be imparted to the electrode by moving the pulley by hand.

Fixed to the top of the sleeve b' is a finger-piece b^6, whereby the sleeve may be turned by hand to adjust the spark-surfaces in proper relation to each other.

The wires a^2 b' are connected with a suitable source of electrical energy, as a condenser H. Like electrode a electrode b is hollow and has a communicating hole b^7 for the introduction and removal of cooling water or material.

The operation of my spark-gap is, in brief, as follows: Knowing the amount of energy required when this spark-gap is used with a high-frequency coil, the operator adjusts the electrodes a b so that their spark-surfaces A B will be the proper distance apart by turning the finger-piece b^3 in the direction that will cause the electrode b to approach or recede from the electrode a, as the case may be. The electric current having been turned on and the sparking having begun, such air as is required to take the place of the warm air, which tends to move upwardly between the not vertical spark-surfaces A B, freely enters through the axial aperture a^3 of electrode a. The sparking takes place at many different parts of the sparking surfaces and will not be confined to any one portion. If after a time portions of the spark-surfaces become oxidized, as sooner or later they will, and the electrical efficiency begins to drop, then by a partial turn of the pulley b^5, as by hand, new and different portions of said surfaces will be brought opposite each other and their efficiency is thus prolonged for many days. In short, it will be noticed that when the electrodes are assembled and adjusted for use the spark-surfaces are always parallel, but neither vertical nor horizontal, and that the space between said surfaces is such that the movements of different bodies of warm air are retarded and modified more or less by the not vertical surfaces. Should the current be sufficiently powerful practically to overcome the advantages resulting from the retarded and modified movements of the warm air between the spark-surfaces, then the electrode b may be constantly rotated by means of a belt belted to the pulley b^5 and operatively connected with some suitable driving mechanism. By this method the spark-surfaces have different points of their surfaces positively brought into position for possible sparking.

In Fig. 2 I have shown in elevation a spark-gap, two electrodes provided with parallel but oblique plane spark-surfaces C D, whose outer edge portions are rounded rearwardly. The method of insulation, adjustment, and electrical commotions is too plain from the drawings to require further description.

In Fig. 3 I have shown, partly in section, a spark-gap one of whose electrodes has a working hemispherical spark-surface F, while the other has a concave spark-surface G, which is parallel to said hemispherical spark-surface, the axes of the electrodes being at right angles to each other. If an ordinary electrical current is to be used, these spark-surfaces may be stationary during sparking, the success of the sparking depending upon the movement of the warm air; but should a powerful current be needed then one or both of the electrodes may be continuously rotated, as by belts f g. In this construction by causing each electrode to rotate at a speed differing from that of the other the possibility of the same sparking points coming opposite to each other is reduced to a minimum. This figure so clearly discloses the physical and electrical construction and operation of this spark-gap that further description seems unnecessary.

Having described my invention and desiring to claim it in the broadest manner legally possible, what I claim is—

1. In a spark-gap, two electrodes having parallel but not vertical, upwardly-extending spark-surfaces, having their edge portions rearwardly rounded.

2. In a spark-gap, two electrodes having parallel, but not vertical, upwardly-extending spark-surfaces, having their edge portions rearwardly rounded, and means for moving and adjusting one surface toward or away from the other surface.

3. In a spark-gap, two electrodes having parallel, but not vertical, upwardly-extending spark-surfaces, having their edge portions rearwardly rounded, said electrodes being so mounted that one may be turned relatively to the other, to present new portions of said sparking surfaces, opposite each other.

4. In a spark-gap, two electrodes having parallel, but not vertical, upwardly-extending spark-surfaces, having their edge portions rearwardly rounded, said electrodes being so mounted that one may be turned relatively to the other, to present new portions of said sparking surfaces, opposite each other; and means to cool said sparking surfaces.

5. In a spark-gap, two electrodes, one having a projecting frusto-conical spark-surface, the other, a frusto-conical depressed spark-surface, said surfaces being in parallelism, and having their edge portions rounded rearwardly; means whereby they may be moved into and out of adjustment, in their axial direction; and means whereby, notwithstanding said adjustment, said electrodes may have new portions of their sparking surfaces presented to each other.

6. In a spark-gap, two electrodes, one having a projecting frusto-conical spark-surface, and being loosely mounted upon a metal threaded sleeve, the second electrode having for a spark-surface, a frusto-conical depression; both said surfaces having their edge portions rearwardly rounded; a metal threaded rod passing through the axis of said sec-

ond electrodes, and having mounted thereon, said threaded sleeve, supporting the first electrode, said sleeve and rod being the means whereby the spark-surfaces are moved into adjustment.

7. In a spark-gap, two electrodes, chambered to contain cooling material, one, having a projecting frusto-conical metal spark-surface, and being loosely mounted upon a threaded metal sleeve, the second electrode having for a spark-surface, a frusto-conical depression, both said surfaces having their edge portions rearwardly rounded; a threaded metal rod passing through the axis of said second electrode, and having mounted thereon said threaded sleeve supporting the first electrode, said sleeve and rod being in an electric circuit and being the means whereby the spark-surfaces are moved into and out of adjustment.

In testimony whereof I affix my signature in presence of two witnesses.

JOHN OTTO HEINZE, JR.

Witnesses:
S. P. GALLAGHER,
THOMAS H. WALSH.