

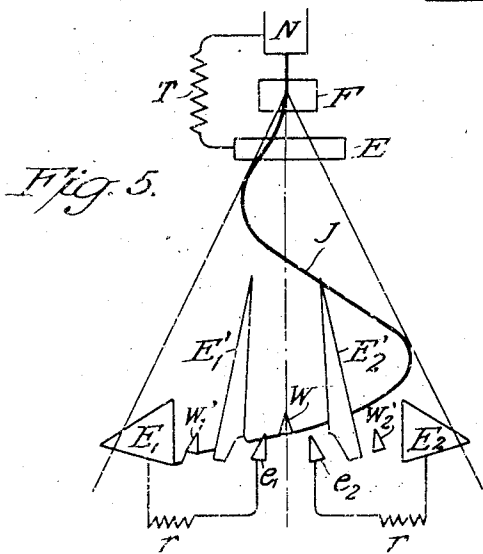
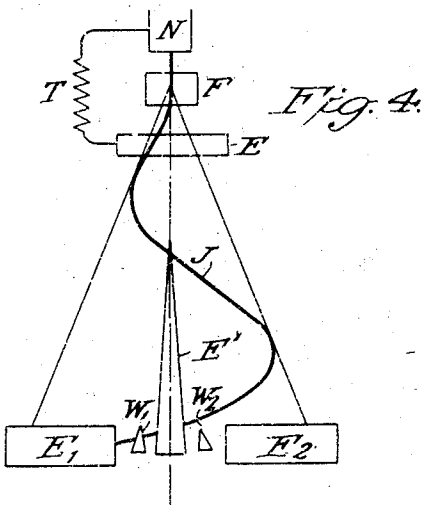
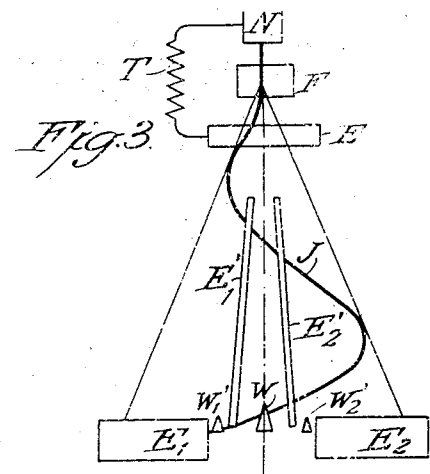
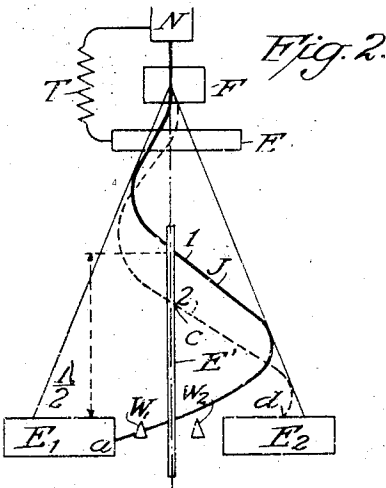
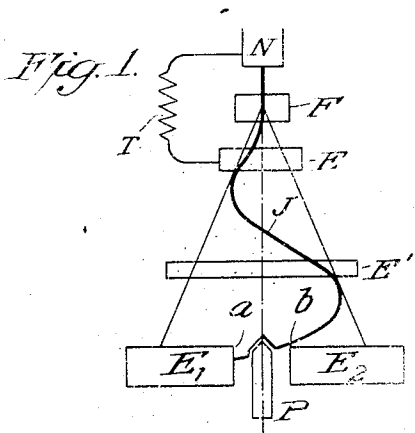
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ELECTRIC JET WAVE COMMUTATOR AND INTERRUPTER

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ELECTRIC JET-WAVE COMMUTATOR AND INTERRUPTER.

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This invention relates to apparatus in which a wave-shaped conductive liquid jet is used for effecting the closing or interruption of an electric circuit, and particularly to the so-called jet-wave commutators and interrupters which are described for instance in my U. S. patent specifications Nos. 1,306,335 and 1,365,491, and the main object of the invention is to provide an improved auxiliary electrode of solid material or part of the same for use in such devices in order to increase the security of service and in some instances to reduce the electric resistances. The term "auxiliary electrode" is used herein for designating an electrode different from the main electrode and serving to conduct current into or away from the jet-wave.

In accordance with the invention one or more of the auxiliary electrodes or auxiliary electrode parts coacting with the conductive jet-wave is or are formed as one or more conductive walls of substantial length arranged lengthwise of the direction of propagation of the jet-wave liquid particles at said wall or walls, or nearly in that direction, and extending over at least one half-wave of the jet, said wall or walls being substantially perpendicular to the plane of the jet-wave which latter, while cut by the wall or walls, remains in contact therewith.

The said conductive wall may be formed as a slender wedge arranged in the plane of symmetry of the commutator or interrupter, i. e. in a plane perpendicular to the plane of the jet-wave and passing through the position of the jet when currentless, with its edge against the direction of propagation of the liquid particles so as to cut the jet-wave during its passage of the said wedge.

The invention further comprises other features which will appear from the following detailed description.

Referring now to the accompanying drawings:

Figure 1 is a diagrammatic view of a jet-wave commutator,

Figures 2, 3, 4 and 5 are similar views of jet-wave commutators including certain embodiments of the invention.

Figure 1 shows a commutator of known type which contains a wave-shaped liquid jet, or shortly a jet-wave J, preferably of mercury, which issues from a nozzle N and moves on in the direction of the axis of the

wave figure and strikes an electrode (main electrode), generally but not always, a two-part-electrode E_1, E_2 , between the component parts E_1 and E_2 of which one or more knives P of insulating or conductive material ordinarily are placed which cut the bends of the jet-wave at the proper moment during the commutation. The jet-wave being during its movement towards the double electrode E_1, E_2 in constant touch with an auxiliary electrode E' , will, alternately connect this latter electrode with the electrode parts E_1 and E_2 . The jet-wave together with the double-electrode E_1, E_2 and the auxiliary-electrode E' thus form a commutator which may be used for the rectification of an alternating-voltage. For this purpose the waves are generally produced by the coaction between a constant magnetic field F and an auxiliary alternating current which is synchronous with the voltage to be rectified. This current may be delivered from the secondary T of a transformer and sent into and out from the jet through the nozzle N and an auxiliary electrode E. Furthermore in order to make the commutator serviceable for the rectification of the alternating voltage the double-electrode is, and must be, adjusted at such a distance from the field, that the jet-bend is cut nearly at the moment in which the alternating voltage alters its sign.

The improvements more particularly described in the following mainly relate to the various auxiliary electrodes of such a jet-wave-commutator but may also be used in several other apparatus in which a jet-wave conductor is used for the closing or interruption of an electric circuit. The general principle can best be explained in connection with the auxiliary electrode E' for conducting the rectified current out from the commutator.

Figure 2 shows a commutator with an electrode E' of the improved type. The electrode E' consists of a comparatively long wall of conductive solid material arranged in the direction of the movement of the liquid-particles at the place where the wall is positioned and substantially perpendicular to the plane of the jet-wave. The wall is furthermore adjusted in such a position that the jet-wave during its movement is cut by the wall, the jet-wave nevertheless being in constant touch with this wall. If the wall

is arranged in the plane of symmetry of the commutator as shown in Figure 2 and is sufficiently high the jet-wave will always connect the wall with either the electrode part E_1 or the electrode part E_2 . In the position 1 of the jet-wave shown in full lines the electrodes E' and E_1 are connected through the part ab of the jet-wave, and in the somewhat later position 2 shown in dotted lines the electrodes E' and E_2 are connected through the part cd of the wave stream. Obviously the condition for an uninterrupted connection between the main-electrode E_1 , E_2 and the auxiliary electrode E' is that the height of the latter is greater than half the wave-length $\lambda/2$ of the jet-wave.

If the electrode E' is arranged in the plane of symmetry of the commutator as shown in Figure 2, knives w_1 and w_2 of conductive or insulating material must generally be placed on either side of the wall to interrupt, at the proper moment, the connection formed by the jet-waves between the electrode parts E_1 and E_2 during the first phase of the commutation.

Instead of one single wall E' two or more walls arranged on opposite sides of the plane of symmetry of the commutator may be used. An electrode of this type with two walls E_1' and E_2' is shown in Figure 3. Here again each wall extends at least over one half-wave of the jet. The mid-most part of the commutator now being left free a single knife w can be positioned here to cut the jet-wave. The lower edges of the walls E_1' and E_2' must be placed at such a level that the jet-wave releases its hold on the edge nearest to that electrode side which the jet-wave is just leaving before the jet-wave is cut by the knife. Otherwise the commutation-spark will appear at said edge, thus in Figure 3 at the left, instead of at the knife. In order to secure the interruption of the connection between the electrode-side and the wall, at the proper moment, two knives w_1' and w_2' may be applied to cut the jet-wave between the parts E_1' and E_2' and the parts E_2' and E_2 respectively.

The herein-described auxiliary electrodes are mainly adjusted in the direction of the motion of the particles of which the jet wave is built up, that is in or nearly in planes perpendicular to the plane of the jet-wave and radiating from the middle-point of the field F .

Experiments have shown that the wall should preferably be shaped as a slender wedge as illustrated in Figure 4, which represents an electrode of the same kind as that shown in Figure 2. The wedge-shape is preferable because otherwise the jet-wave would run the risk of losing its contact with the electrode. As the liquid particles move along straight lines issuing from the middle-

point of the field F , the jet particles when striking the wedge will always possess a velocity-component perpendicular to the wedge-side so that a certain contact pressure is maintained. Electrodes of this type are called wedge-electrodes. They can be constructed in many different forms.

Figure 5 shows a wedge-electrode mainly adapted to act in the same manner as the electrodes E_1' , E_2' illustrated in Figure 3 and consisting of two wedges E_1' and E_2' . However in Figure 5 the sides of the main electrode have each been divided into two parts E_1 , e_1 and E_2 , e_2 respectively. The two pieces e_1 and e_2 are called secondary electrodes. Between the secondary electrode-pieces E_1 and E_2 respectively, resistances r have been inserted for the purpose of reducing the short-circuiting-current which arises during each commutation. The various parts of the electrode aggregate E_1 , E_1' , e_1 , e_2 , E_2' , E_2 including the main electrode E_1 , e_1 , e_2 , E_2 and the auxiliary-electrode E_1' , E_2' are all formed as wedges, and it will be noted that between two wedges belonging to the main-electrode there is placed at both sides of the commutator a wedge w_1' and w_2' respectively belonging to the auxiliary electrode. More compound forms can be produced by augmenting the number of wedges. The advantage of such forms is that they have a comparatively small resistance. On the other hand it has been found that the compound forms have certain disadvantages which are absent in the simpler electrodes and especially in that shown in Figure 4. Thus as a rule they demand a jet-wave of rather constant amplitude.

It has been indicated above that the improvements do not only apply to the auxiliary electrode E' , Figure 1, through which the commutated current is conducted out from the commutator. The auxiliary electrode E in Figure 1 which serves for the introduction of the auxiliary current into the jet-wave may also be constructed in accordance with the present invention.

It must be particularly noted that in the embodiments shown in Figures 3 and 5 where the walls are placed in a substantial distance from the middle-line of the commutator the length of the walls need not exceed half a wave-length ($\lambda/2$) as the waves become shorter towards the sides of the commutator. The magnitude "half a wave-length" is measured along the middle-line of the commutator and has a fixed value, while the waves themselves become shorter towards the sides of the apparatus as will appear from the drawings. It is thus sufficient that the wall extends over at least one half-wave of the jet, namely, at the particular point where the wall is placed. The term "one half-wave of the jet" as used above and in

the following claims is therefore intended to designate a variable magnitude depending upon the particular position of the wall.

Having thus fully described my invention I claim as new and desire to secure by Letters Patent:

1. In an electric jet-wave apparatus the combination of means for producing a conductive liquid jet-wave, and an auxiliary electrode member comprising a solid conductive wall of substantial length arranged lengthwise of the direction of propagation of the jet-wave liquid particles at said wall and extending over at least one half-wave of the jet, said wall being substantially perpendicular to the plane of the jet-wave, which latter while cut by the wall remains in contact therewith.

2. In an electric jet-wave apparatus, the combination of means for producing a conductive liquid jet-wave, an electrode member comprising a solid conductive wall member of substantial length arranged parallel to the direction of propagation of the liquid particles of the jet-wave, and having a length not less than that of one-half wave of the jet, said conductive wall consisting of a slender wedge arranged with its edge against the direction of propagation of the liquid particles so as to cut the jet-wave during its passage of the said wedge, and means comprising a plurality of main electrode members cooperating with said jet-wave after contact with said first mentioned electrode.

3. In an electric jet-wave apparatus, the combination of means for producing a conductive liquid jet-wave, an electrode member comprising a solid conductive wall member of substantial length arranged parallel to the direction of propagation of the liquid particles of the jet-wave, and having a length not less than that of one-half wave of the jet, said conductive wall having a sharp edge and being arranged in the plane passing through the position of the jet when currentless with its edge against the direction of propagation of the liquid particles.

4. In an electric jet-wave commutator the

combination of means for producing a conductive liquid jet-wave, a slender solid conductive wedge arranged in the plane of symmetry of the commutator with its edge against the direction of propagation of the liquid particles and forming an auxiliary electrode adapted to constantly remain in contact with the jet-wave while cutting the same, a two-part main electrode, the component parts of which are arranged at opposite sides of the plane of symmetry of the commutator and adapted to be alternately connected with said wedge-shaped auxiliary electrode through said jet-wave, and a knife placed on each side of said auxiliary electrode and adapted to interrupt the connection formed by the jet-wave between the component parts of the said main electrode during the first phase of the commutation.

5. In an electric jet-wave apparatus, the combination of means for producing a conductive liquid jet-wave, a plurality of main electrode members cooperating therewith for the collection of current therefrom, and an auxiliary electrode for the delivery of current thereto comprising a member arranged in the direction of propagation of said jet-wave, and having a surface disposed in contact with said jet-wave and being perpendicular to the plane of propagation of the wave, said surface forming a small angle in that plane with the line of propagation of the jet-wave liquid particles.

6. In an electric jet-wave apparatus, the combination of means for producing a conductive liquid jet-wave, main electrode members cooperating therewith for the alternate collection of current therefrom, and an auxiliary electrode means for the delivery of current thereto, comprising a member having surfaces cooperating with the jet-wave in the plane of vibration of said jet-wave, said surfaces being respectively inclined to each other and to the line of propagation of the liquid particles of said wave.

In testimony whereof I have affixed my signature.

JULIUS FREDERIK GEORG POUL HARTMANN.