Sept. 3, 1940. F. SCHILGEN 2,213,553

PERIODIC INTERRUPTER OF DIRECT CURRENT

Filed Nov. 18, 1938

Fig 1

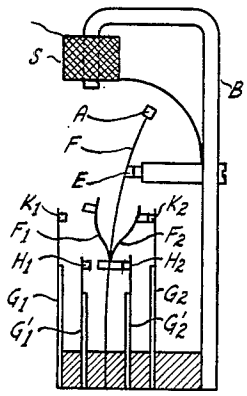
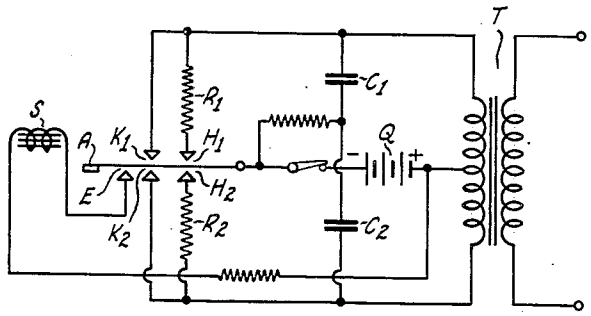


Fig 2



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Patented Sept. 3, 1940

2,213,553

UNITED STATES PATENT OFFICE

2,213,553

PERIODIC INTERRUPTER OF DIRECT CURRENT

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Application November 18, 1938, Serial No. 241,158
In Germany October 15, 1937

6 Claims. (Cl. 175—365)

In the operation of inverse rectifiers which are designed to interrupt or chop a direct current by means of contacts at a rate of, say, 100 c. p. s., sparking is produced at the contacts and these are liable to lead to permanent arcs especially where the potentials and the loads are high with the result that the contacts are destroyed.

To prevent sparking according to the invention, an auxiliary contact is connected in parallel relation to the periodically opened and closed main contact and in series with an ohmic resistance, the said auxiliary contact being subject to synchronous control in such a way that first the auxiliary contact is closed, then the main contact, while first the main contact and then the auxiliary contact is opened.

The advantage residing in the invention flows from this consideration: The opening spark is due to the occurrence of a sudden rise of the potential at the main contact at the instant the current is broken. Now, the said voltage leap is substantially lessened if part of the current previously flowing has a chance to continue to flow by way of the auxiliary contact and the ohmic resistance so that the occurrence of an undue voltage leap is prevented. The closing spark similarly is due to the fact that, in closed condition, the entire potential to be handled is active at the contact, and this voltage is then very abruptly short-circuited. But if, as here suggested, first the auxiliary contact is closed, the potential difference will first have a chance partially to equalize across the resistance in a somewhat gradual way so that when the surfaces of the main contact come into physical touch, there prevails no longer across them any unduly high potential. The auxiliary contact itself will be called upon to carry no undue stresses or load because of the fact that the ohmic resistance is connected in series with it.

Another advantage resides in the fact that the curve-shape of the interrupted current will come more closely to the sine form because of the potential across the main contact being subject to several rises and falls by stages; hence, the current will contain fewer harmonics than is true of a periodic direct current interrupter of the conventional type.

An exemplified embodiment of the invention is shown in Fig. 1 as applied to a pendulating or vibrating type of inverse rectifier the circuit diagram of which is shown in Fig. 2. In the lower part of the clip-shaped member B is clamped unilaterally the leaf spring F so that it is capable of free oscillations. The upper, downwardly bent end of the clip supports the exciting coil S which by way of the exciting contact E at the spring periodically acts upon the keeper A in such a way that the spring vibrates at its own natural period. The spring F supports on two outrigger springs F1 and F2 a surface of the working contacts K1, K2, respectively, the other surfaces being disposed on firmly secured counter-springs G1 and G2. The spring F moreover carries upon each face a surface of two auxiliary contacts H1, H2, of which the respective co-operating surfaces are attached to two fixed cooperating springs G1' and G2'. The intervening space of the working surfaces of the auxiliary contacts H1 and H2 is less than the distance between those of the main contacts K1 and K2 so that, when the spring vibrates, it is first the auxiliary contacts and then the main contact that is closed, while the sequence in opening is reversed.

The fixed surfaces of the auxiliary contacts are connected with the fixed surfaces of the main contacts each by way of an ohmic resistance R1 and R2, respectively, of say 500 ohms each. The assumption is made that the ohmic resistance of the primary of transformer T which, in the usual way, is connected with the chopper, is essentially smaller and may be equal to about 40 ohms, for instance. The source of direct current voltage Q of, say, 100 v. has its negative poles united with the center tap of the primary of the transformer, whereas the positive pole by way of the vibrating spring and one of the contacts K1, K2, is now connected with one end, and now with the other end of the primary coil in alternate and periodic change.

In parallel relation to the primary coil of the transformer is a series arrangement of two condensers C1, C2, the center tap of which is united by way of another ohmic resistance with the vibrating spring. The size of the said condensers in conjunction with the primary winding of the transformer and the resistances R1 and R2 is decisive and governing for the voltage change which occurs between contact-making at the main contacts and that of the auxiliary contacts.

The entire device may be accommodated inside a bulb made of glass or iron which is free from oxygen and which, optionally, may instead be filled with nitrogen or hydrogen under a slight overpressure, so that sparking will be still further suppressed.

I claim:

1. In a device of the kind described, a source of

direct current, an armature adapted to be vibrated between two extreme positions, a transformer having a primary winding and a secondary winding, a resistance and means cooperating with said armature for connecting said source of direct current across at least a portion of said primary winding through said resistance for an interval of time which commences just after the armature in moving toward one extreme position leaves a point which is in the vicinity of the midpoint between said positions until just before it gets back to a point which is in said midpoint vicinity and means cooperating with the armature for short-circuiting said resistance during an intermediate time interval of said first named time interval.

2. In a device for changing direct current into alternating current, a transformer having a primary winding and a secondary winding, a vibrating armature and a driving means therefor, a pair of input terminals across which is to be connected a source of direct current, a connection between the armature and one of said terminals and means connecting the other input terminal to an intermediate point of said primary winding, a pair of contact points positioned with respect to the vibrating armature so that the armature contacts first one and then the other thereof in moving to one of its extreme positions, a second pair of contact points positioned with respect to the armature so that the armature contacts first one and then the other thereof in moving to its other extreme position, each of the two contact points of said two pairs which are contacted first by said armature being connected to their respective ends of the primary winding through a comparatively high resistance path, each of said other two contact points being connected to their respective ends of the primary winding through a comparatively low resistance path.

3. An arrangement as described in the next preceding claim characterized by that in operation the armature breaks contact in moving from one extreme position toward the other thereof first with the contact point that it was last to contact with in approaching that extreme position.

4. In a device of the kind described a transformer having a primary winding and a secondary winding, a vibrator armature adapted to be vibrated between two extreme positions, a first pair of contact points positioned in the path of the vibrator armature so that the vibrator armature contacts first one and then the other of said points in moving to one of its extreme positions, a second pair of contact points positioned in the path of said armature so that the vibrator armature contacts first one and then the other thereof in moving to the other of its extreme positions, a pair of input terminals across which is adapted to be connected a source of direct current, means connecting one of said input terminals to the armature and the other thereof to an intermediate point of said primary winding, a low impedance connection between one end of said primary winding and that one of said first pair of contact points which the armature contacts last, a connection including resistance means between the other of said first pair of contact points and said end of the primary winding, a low impedance between the other end of the primary winding and the contact point of the second pair of contact points which the armature contacts last and a connection including resistance means between the other of said second pair of contact points and said last named end of the primary winding, and means for vibrating said armature.

5. In a device of the kind described, a pair of terminals adapted to be connected across a source of current, a transformer having a primary winding and a secondary winding, means for connecting a point of said primary winding to one of said terminals, a vibrating armature adapted to be vibrated between two extreme positions, a current limiting device, means cooperating with said armature and effective during vibration of the armature, for periodically connecting the current limiting device between the other of said pair of terminals and another point of said primary winding for a predetermined portion of each cycle of operation of the armature, and means cooperating with the armature and effective during its operation for short-circuiting the current limiting device during an intermediate part of said portion of each cycle of operation of the armature.

6. In a device of the kind described, a pair of of terminals adapted to be connected to a source of direct current, a transformer having a primary winding and a secondary winding, means for connecting a point of said primary winding to one of said terminals, a vibrating armature adapted to be vibrated between two extreme positions, a current reducing impedance, means cooperating with said armature and effective during vibration of said armature, for connecting said current reducing impedance between the other of said pair of terminals and another point of said primary winding for a portion of each cycle of operation of the armature, and means cooperating with the armature and effective during its operation for short-circuiting the current reducing impedance with each cycle of operation of the armature for an interval of time which starts just after the beginning of said portion of each cycle of operation of the armature and ends just before the end of said portion of each cycle of operation of the armature.

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