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J. A. MAS

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PARALLEL OPERATION OF VIBRATOR SYSTEMS

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Fig. 1

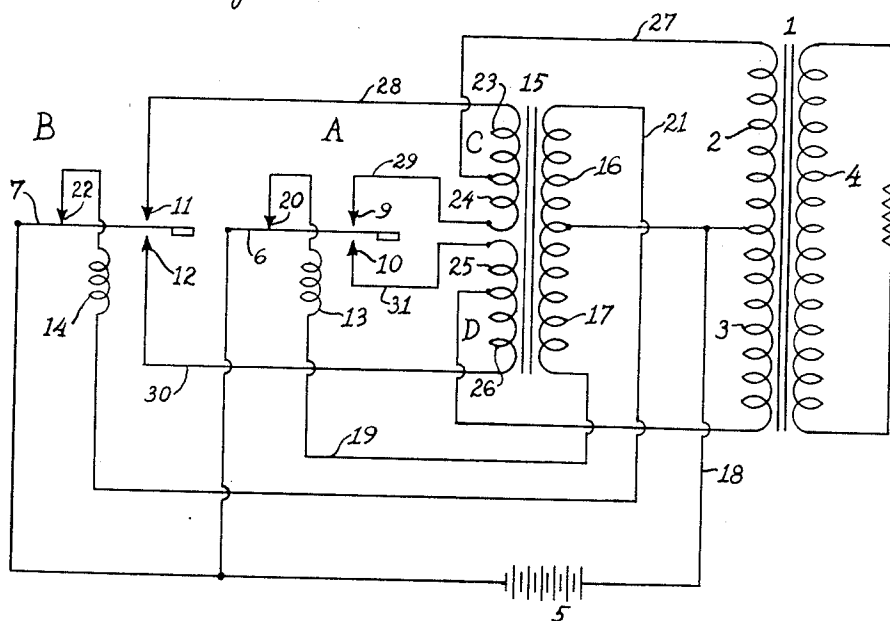
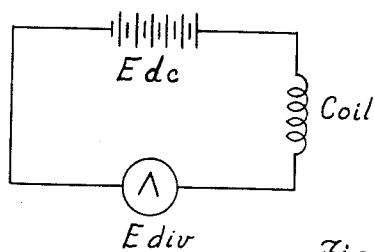


Fig. 2

BY

INVENTOR.
JOSE A. MAS
W. P. Hahn

ATTORNEY.

UNITED STATES PATENT OFFICE

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PARALLEL OPERATION OF VIBRATOR SYSTEMS

José A. Mas, Indianapolis, Ind., assignor, by mesne assignments, to Cornell-Dubilier Electric Corporation, South Plainfield, N. J., a corporation of Delaware

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2 Claims. (Cl. 321-49)

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The present invention relates to vibrator interrupter systems and more particularly to vibrator interrupter systems having at least two vibrator interrupters.

One of the objects of my invention is to provide a vibrator interrupter system having at least two vibrating interrupters operating substantially in synchronous frequency and in phase.

Another object of my invention is the provision of a vibrating interrupter system having at least two vibrating interrupters with means for insuring the operation of the interrupters in phase by imposing on the interrupters a voltage proportional to the amount of phase deviation so as to bring the lagging interrupter up in phase and slowing down the leading interrupter until the interrupters are in phase.

For the purpose of disclosing my invention I have illustrated an embodiment thereof in the accompanying drawing, in which:

Fig. 1 is a diagrammatic view of a vibrating interrupter system embodying my invention; and

Fig. 2 is a diagrammatic view showing an equivalent circuit of each vibrator coil insofar as their potentials are concerned.

Referring to the diagrammatic illustration shown in Fig. 1, the vibrating interrupter system comprises a first vibrating interrupter circuit A and a second vibrator interrupter circuit B. Each of these circuits is connected to a transformer 1 having a split primary winding comprising two sections 2 and 3 and a secondary winding 4. The primary winding is provided with a center tap connected with one side of a battery 5 which provides a direct current source and while I have illustrated the source as being a battery, it will be understood that any source of unidirectional current may be provided. The opposite side of the battery 5 is connected to the vibrating reed or contact 6 of the interrupter A and likewise to the vibrating reed or contact 7 of the vibrating interrupter B. The vibrating contact member 6 vibrates between a pair of oppositely disposed relatively stationary contacts 9 and 10 and the vibrating reed or contact 7 vibrates between a pair of relatively stationary contacts 11 and 12.

For driving the contact member 6, I provide a driving magnet having a coil 13 and for driving a member 7, I provide a driving magnet having a coil 14.

In addition to the load transformer 1, I provide a deviation transformer 15 having a split secondary winding comprising the sections 16 and 17. The center tap of this winding is connected by a conductor 18 with one side of the bat-

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tery 5. The outer terminal of the winding 17 is connected by a conductor 19 with the driving magnet winding 13, the opposite terminal of which is connected to a relatively stationary contact 20 in engagement with the vibrating contact 6, when the vibrating contact 6 is in neutral position. The outer terminal of the winding 16 is connected by a conductor 21 with one terminal of the driving magnet winding 14 for the vibrating contact 7, the opposite terminal of this winding 14 being connected to a relatively stationary contact 22 in engagement, when the vibrating contact 7 is in neutral position, with the vibrating contact 7.

For the purpose of identification, contacts 10 and 12 are disposed on the same side of the vibrating contact members 6 and 7 and may be referred to as the magnet-side contacts. Contacts 9 and 11 are likewise disposed on the same side of contacts 6 and 7 and may be referred to as rebound contacts.

The deviation transformer is provided with a pair of primary winding sections C and D. The primary C is a split primary winding having the two sections 23 and 24 and similarly the primary winding D is a split winding having the two sections 25 and 26. The center tap of the primary winding C is connected by a conductor 27 with the outer terminal of the primary winding 2 and similarly the center tap of the winding D is connected to the outer terminal of the primary winding section 3. The outer terminals of sections 23 and 24 of the winding C are respectively connected by conductors 28 and 29 with the rebound contacts 11 and 9 and the outer terminals of the winding D are respectively connected by the conductors 30 and 31 with the magnet-side contacts 12 and 10.

Windings 23 and 24 are so constituted that when the interrupter contacts 6 and 7 are in phase the net flux in the core of the transformer 15 is zero. The voltage induced in windings 16 and 17 is, therefore, also zero. The driving magnet coils 14 and 13 are receiving the same voltage, namely the voltage of the source of continuous power.

The moment that one vibrator tries to lag or lead, a deviating voltage from the deviation transformer, proportional to the phase shift, is developed which is so phased that it gives a momentary kick to the lagging vibrator and lowers momentarily the voltage to the other, thus the vibrators are brought back in phase and the deviation time is kept at a minimum. For the purpose of example, we will assume that vibrator

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contact 6 becomes a lagging contact. Under these circumstances vibrator 7 will complete a circuit through section 23 of the primary winding C, inducing a voltage in the deviation transformer secondary windings which will be added to the voltage of the battery to impress upon the winding 13 of the lagging contact an additional voltage which will give it a momentary kick. At the same time an opposing voltage will be imposed on the circuit of the coil 14 through the secondary section 16, thus lowering the voltage of the coil 14 to bring the two vibrating contacts back into phase. It is apparent, therefore, that through the deviation transformer I am enabled to, in event the vibrating contacts operate out of phase, boost the voltage of one driving magnet and lower the voltage of the other until the two vibrating contacts are brought into phase relation. The circuit including the coils 25 and 26 is for dividing the load current on the contacts of the two vibrators.

Fig. 2 shows the equivalent circuit of each vibrator coil insofar as the A. C. components are concerned. The driving coil receives an injection of A. C. from the deviation transformer sufficient to synchronize it, and an added pulse, correctly phased from the deviating transformer. The A. C. components of the injection are in phase. The pulses are not. They are 180° out of phase. The voltage of each driving coil is therefore:

$$E_1 = E_{dc} + E_{div} \text{ (deviation voltage)}$$

$$E_2 = E_{dc} - E_{div} \text{ (deviation voltage)}$$

If the vibrators are in phase, the net deviation flux in the driving coil is zero. The moment that one vibrator tries to lag or lead, a deviation voltage proportional to the phase shift is developed and this voltage is such that it gives a momentary kick to the lagging vibrator and lowers momentarily the voltage at the other.

I claim as my invention:

1. A vibratory interrupting system comprising, in combination, at least two vibratory interrupters each having a vibratory contact, a relatively stationary magnet side contact and a relatively stationary rebound side contact between which the vibratory contact operates, a separate driving magnet for each vibratory contact including a coil, and a synchronizing transformer for maintaining the vibratory members of the interrupters in phase comprising a secondary winding having a center tap adapted to be connected to one side of a direct current source of supply, an outer terminal connected to one terminal of one of said driving magnets and a second outer terminal connected to one terminal of the other driving magnet, each interrupter having also a pair of driver contacts, one carried on the moving element of the interrupter and the other stationary and connected to the second terminal of the driving magnet, both of the interrupters adapted to be connected to the other side of said direct current source, and a primary winding for said transformer having

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a center tap for connection to a direct current source of supply, the outer terminals of said primary winding being respectively connected to the respective rebound contacts of the interrupters.

2. In an electrical system for converting current from a direct current source into alternating current and supplying same to a load, said system comprising transformer having a primary winding with two ends and a center tap and a secondary winding supplying alternating current to a load, the center tap of said primary winding being connected to one side of a direct current source of supply, at least two vibratory interrupters each having a vibratory contact, a relatively stationary magnet side contact and a relatively stationary rebound side contact between which the vibratory contact operates, a separate drive magnet for each vibratory contact including a coil, a synchronizing transformer for maintaining the vibratory members of the interrupters in phase comprising a secondary winding having a center tap adapted to be connected to one side of a direct current source of supply, an outer terminal connected to one terminal of one of said driving magnets and a second outer terminal connected to one terminal of the other driving magnet, each interrupter having also a pair of driver contacts, one carried on the moving element of the interrupter and the other stationary and connected to the second terminal of the driving magnet, both of the interrupters adapted to be connected to the other side of the direct current source and a primary winding for said transformer having a center tap connected to one terminal of the primary winding of said first mentioned transformer, the outer terminals of said synchronizing transformer primary winding being respectively connected to the respective rebound contacts of the interrupters and a second primary winding for said synchronizing transformer having a center tap connected to the other outer terminal of the primary winding of said first mentioned transformer and its respective outer terminals connected to the respective magnet side contacts of the respective interrupters.

JOSÉ A. MAS.

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