Sept. 28, 1937. P. F. SCOFIELD 2,094,219

VIBRATOR AND CIRCUIT THEREFOR

Filed Feb. 27, 1934

Fig. 1.

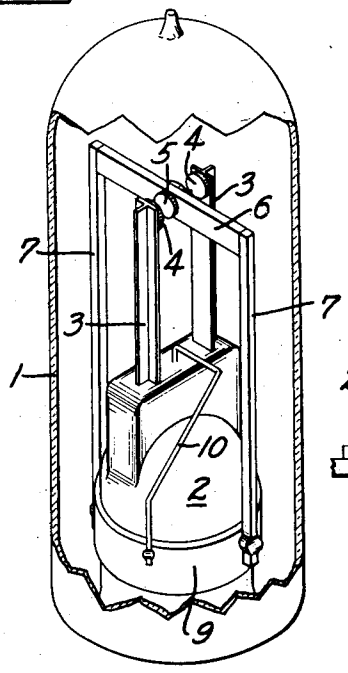


Fig. 2.

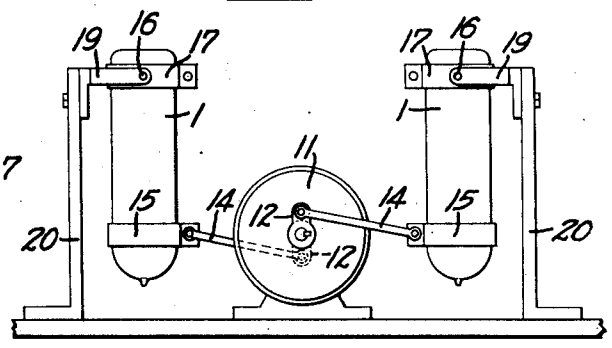
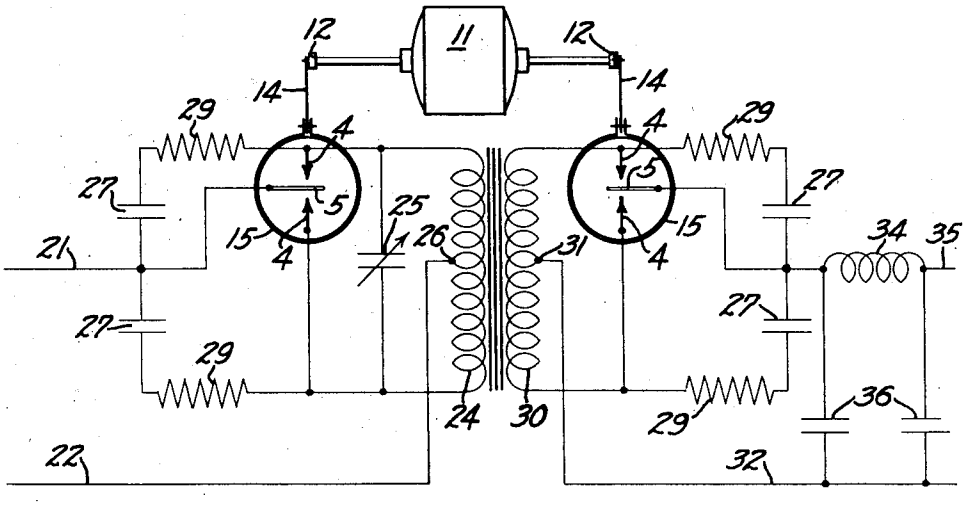


Fig. 3.



INVENTOR,
PHILIP F. SCOFIELD.

BY Lippincott & Metcalf
ATTORNEYS.

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VIBRATOR AND CIRCUIT THEREFOR

Philip F. Scofield, Palo Alto, Calif., assignor to Heintz & Kaufman, Ltd., San Francisco, Calif., a corporation of Nevada

Application February 27, 1934, Serial No. 713,123

1 Claim. (Cl. 200—30)

My invention relates to means and method for converting low voltage direct current to high voltage direct current, and is particularly adapted for use in places where high voltage direct current is not available, i. e., for ships or similar locations.

The principal object of my invention is to provide the combination of mechanical means for producing alternating current in conjunction with means for raising the potential of the alternating current, and means for rectifying the high potential alternating current to reform it into a direct current. This invention, preferably, utilizes a mechanically operated vibrator, such as disclosed and claimed in my copending application, Serial No. 705,039, filed January 2, 1934.

In the above referred to application the vibrator itself was described and claimed, but no claims were made therein to the combination of the vibrator and its associated circuits, to which this present application is directed.

Further objects of my invention are: to provide means for simultaneously creating and rectifying alternating current; to provide a means for creating alternating current, raising its potential, and thereafter rectifying the alternating current to produce a high voltage direct current; to provide such an arrangement wherein the means for producing the alternating current and the rectifying means are mechanically linked together in proper phase relationship; to provide a circuit in combination with a pair of mechanical vibrators whereby the potential of a direct current may be increased; to provide such an arrangement wherein a pair of interlocked mechanical vibrators are used for the creation of alternating current and the rectification of the produced current; and to provide a simple, efficient, and compact mechanically operated potential raising device.

Other objects of my invention will be apparent or will be specifically pointed out in the description forming a part of this specification, but I do not limit myself to the embodiment of the invention herein described, as various forms may be adopted within the scope of the claim.

The broad aspect of my invention may be more fully understood by reference to the drawing in which:

Figure 1 is a cut-away view of a preferred type of mechanical vibrator, such as was described and claimed in the application above referred to.

Figure 2 is a view of the mechanical linkage of a pair of such vibrators.

Figure 3 is a circuit utilizing the interlinked vibrators, as shown in Figure 2, in conjunction with a voltage raising circuit, the figure being diagrammatic and reduced to lowest terms.

In detail, the mechanical vibrator of my invention comprises an envelope 1 provided with a pinched stem 2. Two heavy and inflexible contact supports 3—3 are provided in the stem and equipped with relatively large, stationary, electrical contacts 4—4. A movable contact 5 is supported between the two stationary contacts 4—4 by means of a supporting bar 6, which is in turn supported by risers 7—7 fastened to a stem clamp 9. Electrical connection is made to the movable contact through the bar 6, the risers 7—7 and a movable contact lead 10. As fully described in the above identified application, the risers 7—7 are made of soft, easily deformable material, and deformed during the travel of the movable contact from one stationary contact to the other, beyond their elastic limit, thus holding the movable contact in close and firm touch with a stationary contact until forceably removed therefrom. I prefer to supply this force by a motor 11 which has a pair of opposite crank arms 12—12, attached by connecting rods 14—14, to rod bands 15—15 on the end of the vibrator envelope. The vibrator is journaled on bearings 16—16, held by clamps 17—17 to the stem end of the envelope, and by bearing brackets 19—19, supported by uprights 20—20. The force is preferably applied to cause the movable contact to alternately cross the space between the stationary contacts, and the motor 11 may be regulated in its speed so that the frequency of make-and-break can be closely regulated.

The circuit which I prefer is shown in Figure 3. Direct current mains 21 and 22 are provided, the lead 21 passing directly to the movable contact 5 of one of the vibrators. The two stationary contacts 4—4 are connected across a transformer primary 24. This primary is tuned by a variable condenser 25. The direct current lead 22 leads to a center tap 26 on the transformer. The movable contact 5 is also connected to each of the stationary contacts through a sparking condenser 27 and a resistor 29, which acts to control any tendency toward sparking on the break. I prefer, of course, to rotate the motor 11 at a speed which will give a frequency to this vibrator which will resonate with the tuned circuit formed by the inductance 24 and the condenser 25.

A secondary 30 is provided on the transformer, which is so wound as to raise the voltage to the desired degree, allowing for the drops which follow. This secondary is provided with a

secondary center tap 31 which forms one of the output direct current leads 32. The movable contact 5 of the second vibrator is connected through a smoothing inductance 34 to the other output direct current main 35. I then prefer to bridge a pair of smoothing condensers 36 across the mains at each end of this inductance. The movable contacts 4—4 of the second vibrator are connected directly across the secondary, and are also shunted, as in the first vibrator, by resistances 29 and sparking condensers 27.

In operation, direct current is supplied to the mains 21 and 22, the motor is started up, and the vibrators are caused to mechanically open and close in accordance with the rotation of the cranks on the motor. The first vibrator, feeding into a tuned circuit comprising primary 24 and condenser 25, provides a voltage across the entire primary winding of around 160 volts from a 110 volt source because of the center-tap 26, and the use of the tuned circuit creates a change in the waveform of the interrupted current from a practically square shaped wave to a shape approaching that of a sine wave, thus raising the efficiency of transformation. The secondary 30 is likewise center-tapped and as both vibrators have an extremely low voltage drop, the output voltage across the leads 35 and 32 may be maintained at practically any value desired, limited only by the ability of the contacts in the second vibrator to handle the voltage. The secondary of the transformer, being wound to increase the voltage, will carry high voltage alternating current which is rectified by the action of the second vibrator, passed along through the filter formed by the smoothing inductance 34 and the associated condensers 36, so that high voltage direct current is obtained across the output mains 35 and 32. This direct current may then be used, for example, for the plate supply of radio transmitting and receiving sets, or for other purposes which will be apparent to those skilled in the art.

It will be noted that the two vibrators are on cranks extending 180° from each other, and are therefore out of phase, thus allowing for the 180° phase shift occurring in the transformer. It should also be noted that the vibrators, being positively mechanically operated, give a relatively square wave alternating current, and as the two vibrators are completely mechanically interlinked, that the cooperation between them is perfect and therefore the complete operation is highly efficient. The use of the soft supports in the vibrators themselves cuts down bounce or uncertain contact, and the end result of the entire circuit is the production of high voltage direct current with a minimum of loss.

It will be obvious that other means can be used for interlocking the two vibrators. While I prefer them to be mechanically interlinked, it is obvious that a pair of synchronous motors could be used, if properly adjusted.

I claim:

In combination, a synchronous switch comprising a pair of envelopes each containing a pair of fixed contacts, and a movable contact positioned when moved to alternately touch said fixed contacts, said movable contact having a non-resilient support, thereby being free from natural periods of vibration, each of said envelopes being mounted to revolve on a center substantially coinciding with the base of said non-resilient support, means interlinking the opposite ends of said envelopes, and means for reciprocating said interlinking means to produce synchronous operation of said contacts at a predetermined frequency.

PHILIP F. SCOFIELD.