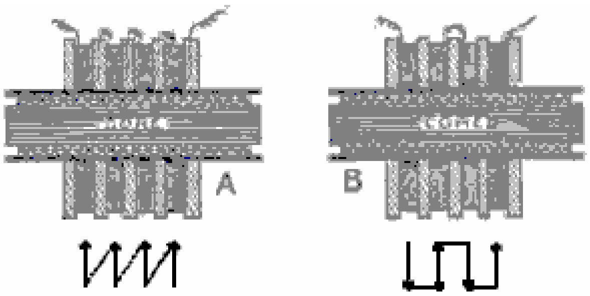


Methods of Connecting the Secondary Sections

If connected as shown in example “A”, where the inside of one section is connected to the outside of the next section, the maximum voltage which can exist between the adjacent sections in this case is equal to the e.m.f. generated by one “pie” and is equal throughout. Connecting as shown in case “B” where the outside of one coil is connected to the inside of the next one, the voltage ranges from zero at the points where they are connected, to twice the e.m.f. developed by any one section. This is the better method and every second coil is turned around horizontally to allow for the reversed direction of current flow.

After the secondary is assembled, the coil should be submerged in an airtight tank containing melted paraffin wax. The tank is then connected to a vacuum pump and the air pumped out. This causes any air bubbles in the windings to be pumped out. After standing for a while, the vacuum is released and the air pressure then causes the bubble gaps to be filled with paraffin wax.

SECONDARY DIMENSIONS

Spark Length	**Wire Gauge**	**Amount required**	**No. of sections**	**Length** (1 inch = 25.4 mm)
0.5 inch (12 mm)	36 (0.193 mm)	0.5 lb (0.227 Kg)	1	3 inches
1 inch (25 mm)	34 (0.234 mm)	1 lb (0.454 Kg)	2	5 inches
2 inches (50 mm)	34 (0.234 mm)	2.5 lb (1.134 Kg)	4	7 inches
4 inches (100 mm)	32 (0.274 mm)	8 lb (3.629 Kg)	12	8.5 inches
6 inches (150 mm)	32 (0.274 mm)	12 lb (5.443 Kg)	20	10 inches

It should be noted that the very experienced Alfred Morgan flatly contradicts the standard theory of symmetrical transformer operation when he states that “*the ratio of the number of primary turns of an induction coil to the number of secondary turns, bears no relation to the ratio of the primary and secondary currents*”. That is a highly significant statement.

Carlos Benitez added an extension to his patent, saying:

The advantages of such an improvement will be better understood by considering the drawing left with the Provisional Specification and this additional drawing, as they illustrate two different methods of carrying out the invention, but in practice, far better results can be attained by the use of the commutator shown here:

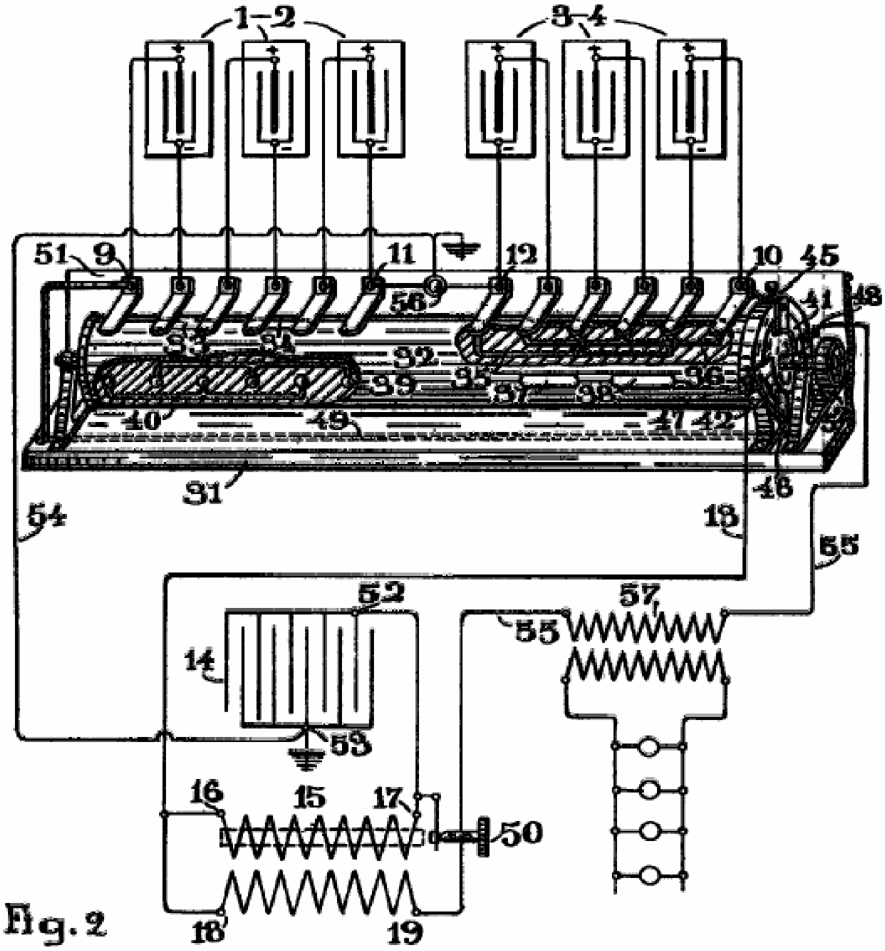
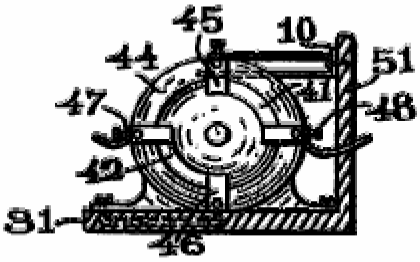
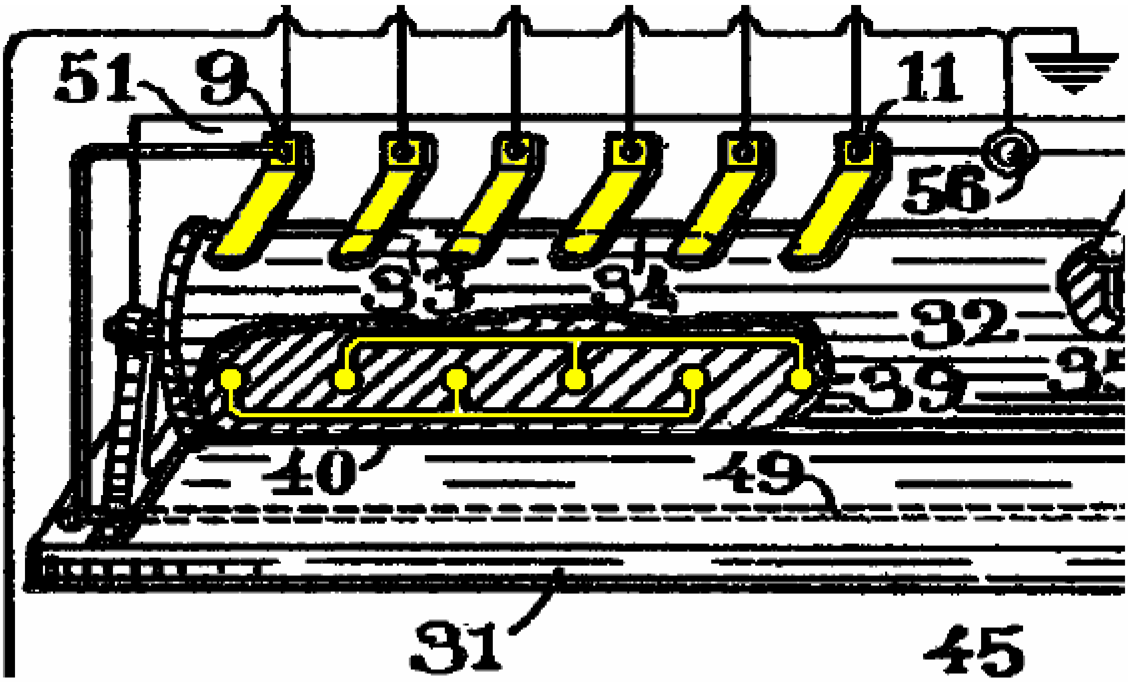


Fig. 2





As the resistance offered to the passage of the electric currents by the primary of the transformers is not high, it is possible to simplify the former arrangement, obtaining the high-frequency currents directly from the same induction coil **15**, in which case the poles **18**, **19**, of the secondary of said coil must be respectively connected to the poles **16**, **17**, of the primary of the same said coil, and the second battery of capacitors **22** and high-frequency transformer **26**, **27**, can be omitted. Under these conditions, the breaker or interrupter employed in said induction coils, acts as a spark-gap and capacitor **14** discharges in the form of oscillations through the primary and secondary of the same coil, thus directly increasing the amount of electrical energy furnished by the accumulators.

Each one of the poles of the accumulators forming batteries **1-2** and **3-4** are connected to the poles of commutator **31**. This commutator consists of a rotary cylinder **32**, provided with the paths **33, 34, 35, 36, 37, 38, 39** and **40**, each properly isolated and positioned on the surface of the cylinder in such a way as to connect alternately in series or in parallel, the different units composing batteries **1-2** and **3-4**.

Cylinder **32** has two conductive paths **41**, **42**, which can be better seen in the cross-sectional view. The cylinder passes through a ring **44**, fixed to the same base of the apparatus **31**, and it has contacts **45, 46, 47** and **48**. Pole **45** of this ring is connected to pole **10** of battery **3-4**, and its pole **46** is connected through wire **49** to pole **9** of battery **1-2**. Pole **47** is connected through wire **13** to pole **16** of the primary of a transformer, and pole **48** is connected through wire **55** to the back contact stud **50** of an ordinary breaker.

A back wall **51**, fixed to the same base of the commutator, is provided with the metallic strips or brushes that can be clearly seen in the figure, in contact with the cylinder **32**, and connected respectively to each one of the poles of the accumulators; and finally, the rotative shaft of the cylinder has a handle or pulley **52** for rotating the commutator.

Capacitor **14** of the induction coil is connected as usual by its pole **52** to pole **17** of the primary of the same transformer, and its other pole **53** instead of being connected to the back contact stud **50** of the breaker, as is generally the case, is grounded through wire **54** and pole **56** of the commutator.

Under these conditions, when the circuit is broken by the interruptor, capacitor **14** is charged and immediately afterwards discharges via primary **15** of the transformer, the secondary of the transformer, wire **55**, pole **48**, path **41** of the commutator, and battery **3-4** which is connected in parallel.

As a consequence of the passage of the electric current produced by this discharge through the primary **15** of the transformer, induced currents are produced in its secondary and one of these currents, the inverse passing through pole **19** is immediately utilised for the charging of the same said battery in parallel. The direct current that is produced when the discharge of capacitor **14** is finished, passing through pole **18** and entering the primary **15** through pole **16**, produces a new charge in the same capacitor **14**, that again discharges in identical manner, and the same phenomena are reproduced several times in the beats or intervals of breaks and makes produced by the interruptor.

On the other hand, if the pole **56** of the commutator is not grounded, each time that capacitor **14** receives a new charge, the neutral fluid of its outer coating is influenced through its dielectric and an induced electric current is forced to move via wire **54** and pole **56**. In other words, this extra energy equally increases the normal output of battery **1-2**.

By these means, the current given by the accumulators connected in series, is properly increased by the induced currents produced in the secondary of the induction coil, and by the rapid chargings and dischargings of the capacitor produced in manner described above, and the accumulators connected in parallel thus receiving a proper amount of current, can be fully charged while the first battery is discharging. However, as the first battery is discharging, its voltage is progressively decreasing, and in order to maintain in the circuit, a given current for the charging of the second battery, the resistance of the circuit must be reduced accordingly.

In order to attain this result without touching the wiring, the back contact stud **50** of the breaker can be adjusted in order to secure a proper resistance through the interruptor in accordance with the decreasing voltage, and in this manner it is always possible to maintain a given current in the circuit until the very last limit of energy in the discharging battery is attained.

Better results in every respect can still be obtained by the use of a closed core type of transformer combined with an electrolytic interrupter, since with these interrupters there is practically no lost time in the intervals between breaks and makes, and the resistance of such devices can be easily adjusted at a distance whenever the operator may desire.

Once the limit of energy in the discharging battery is attained, the connections of the accumulators must be reversed, and with this object in view, the commutator shown in the figure can be used, and cylinder **32** must be revolved until paths **37, 38, 39** and **40** come in contact with the brushes connecting the poles of the accumulators, and contacts **45**, **47**, are connected through path **42**. By so doing, the functions of both batteries are at once reversed and accumulators **3-4** being now connected in series, they will discharge through pole **10**, via poles **45**, **47**, wire **13**, primary **15**, wire **55**, pole **48** (now in connection with pole **46** through path **41**), wire **49** and pole **9** of battery **1-2**, which is now connected in parallel through paths **39**, **40**.

In other words, the working conditions can be thus completely reversed by the simple operation of the commutator, and a continuous current can be maintained through wire **55**, in which the primary **57** of an ordinary transformer, or any other suitable device, can be inserted in series in order to profit the surplus of the electrical energy thus obtained, without impairing in the least, the running of the mechanism.

Obviously, a mechanism can be made to produce and automated operation of the commutator from time to time, in accordance with the capacity of the accumulators, and so, for a given weight of batteries, greater power can be secured by this process, with smaller capacities, than with larger units since the same 4 volts can be obtained from a 60 Amp-Hour accumulator, as with a 10 Amp-Hour capacity accumulator.

I desire also to explain clearly that the arrangements shown are entirely illustrative. In practice, the accumulators composing each battery can be connected as described or a suitable combination of series-parallel can be arranged in each group, and that the conditions of the several apparatus employed can be varied in accordance with the particular conditions of power that must be satisfied.

Carlos Benitez also produced another very clever design, still using four batteries and a very slow switching rate, although no longer using the series and parallel switching which we think of as the Tesla Switch. In this design, he shows a remarkable high-frequency power-gain system where 400 watts of input power produces 2400 watts of output power (COP=6):

Carlos Benitez Patent GB 121,561 24th December 1918

New Process for the Generation of Electrical Energy

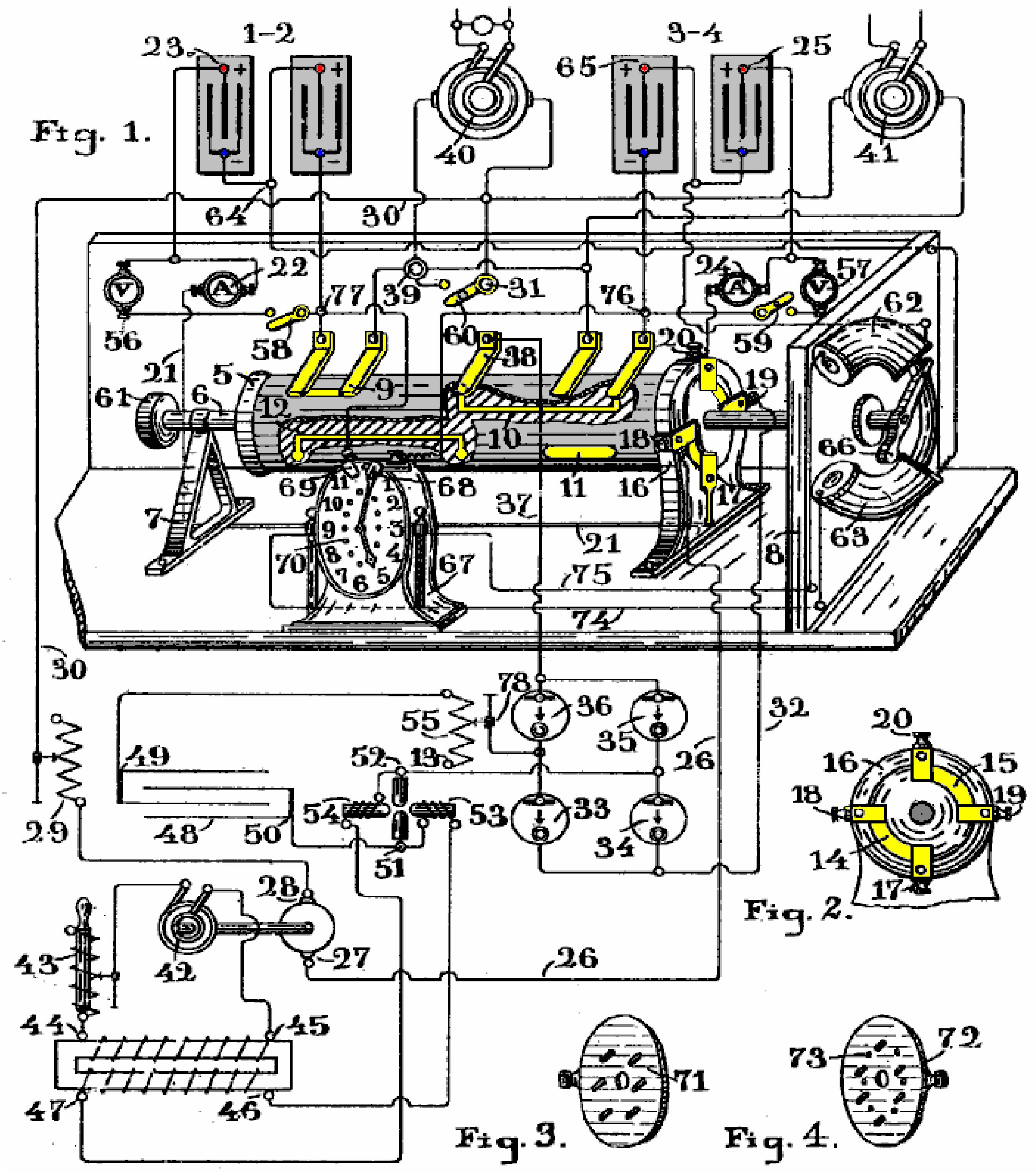
I, Carlos Benitez, Civil Engineer, of 141, Ocampo Street, in Guadalajara, Mexico, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in, and by, the following statement:

This invention relates to a new utilisation of the high frequency currents or electrical oscillations, by means of which, a constant production of electrical energy can be secured, under unusually simple, economic and practical conditions.

Such results are attained by means of the procedure disclosed in present applicant’s English Patent specification No. 14,311, filed on October 9th, 1915, but in order to obtain a better utilisation the high-frequency currents and the automatic operation of the mechanisms employed in such a procedure, I have invented a novel arrangement of parts from which is derived several other advantages that will be here described and set forth.

Two batteries are used, one of which has already been charged. This charged battery discharges through a circuit which utilises the greater part of this power and the remainder drives an oscillating circuit connected to the second battery. This oscillating circuit contains a rectifier which directs the electrical oscillations in such a manner that they are forced to pass constantly through the second battery from the positive to the negative terminal. As the number of oscillations per second in that circuit can be varied at will, the current intensity developed by those oscillations can be regulated so that the second battery is fully charged in the same period of time during which the first battery is discharged. Therefore, it is only a matter of reversing the connections to the two batteries in order to obtain the continuous production of electrical energy.

The invention is illustrated here:



This circuit shows the circuit connections of the arrangement and a perspective view of a commutator. Figure 2 is a lateral view of a part of the same apparatus, and figures 3 and 4 are parts of the same machine, whose location and use will be explained later.

The figure shows two battery banks **1 & 2** and **3 & 4,** both of which are connected in series. Their positive poles **23** and **25** are connected to terminals **17** and **20** of the commutator, through the ammeters **22** and **24**. The commutator is a cylinder **5**, mounted on a rotating shaft **6**, which passes through two supports **7** and **8**. The cylinder is provided with conductive paths **9, 10, 11** and **12** insulated from the cylinder **5**. It also has conductive paths **14** and **15** which can be seen better in **Figure 2** and which make contact with brushes **17** & **18** and **19** & **20**, properly insulated and fixed to ring **16** which encircles cylinder **5** and is fastened to the base of the apparatus. These brushes connect to the batteries and terminal **17** is connected to the positive pole **23** of battery **1 & 2**. Terminal **20** is connected to the positive pole **25** of battery **3 & 4** through ammeter **24**. Terminal **18** connects through wire **26** to terminal **27** of a DC motor whose terminal **28** connects through the variable resistor **29** and wire **30** with terminal **31** of the commutator. Finally, terminal **19** is connected through wire **32** to terminals **33** and

34 of an electrolytic rectifier whose other two rectifiers **35, 36** connect via wire **37**, to brush **38** of the commutator.

This apparatus is also provided with terminal **39** which is alternately connected to the negative poles of the batteries through the brushes which can be seen in the figure, in contact with cylinder **5**. Under these conditions, the apparatus **40** and **41**, which are employed to provide a practical output independent of the running of the "plant", and which are connected to both terminals **31** and **39**, will be alternatively in circuit with the discharging battery, and thus, part of the power produced by the battery discharging, is used by this apparatus without impairing the normal running of the whole mechanism, as explained below.

On the other hand, an alternator **42**, is coupled to the motor **27-28**, which in this manner can be rotated at the speed needed to attain the desired frequency. Both terminals of the alternator are connected through the inductive resistance **43**, with the poles **44, 45** of the primary winding of a step-up transformer, whose secondary winding **46, 47**, connected to capacitor **48**, will finally produce the high-voltage alternating currents needed to charge the capacitor. However, the use of this motor and alternator is not essential in this process as the same results could be attained if the primary **44, 45** of the transformer, were connected through an ordinary interrupter to the discharging battery.

The terminals **49, 50** of capacitor **48** are connected through an arc lamp of the Poulsen type **51, 52**, or through an adequate spark-gap with the rectifiers **33, 34, 35** and **36**, and with the battery under charge (**3 & 4** in this case). Extending into the arc chamber are the poles of a strong electromagnet, the coils of which are in series with the arc, so that their excitation current is the arc current.

Connected in this manner, the strong magnetic field which exists between the poles of the magnets, acts on the arc, and owing to this action, combined with the influence of the voltage developed by the secondary of the transformer **46, 47**, it happens that this action and influence being about equal in value, are each of them alternately greater than the other, so that the voltage across the arc automatically rises and falls. Therefore, when the action of the magnetic field is greater than the voltage produced by the secondary winding of the transformer has not enough power to pass across the arc and so the capacitor **48** is charged to a higher voltage. But, an instant later the action decreases in value and the capacitor discharges again across the arc.

On the other hand, owing to the oscillatory nature of the circuit (which is arranged with proper values of capacity, inductance and resistance), the charging and discharging of the capacitor can occur several million times per second if desired, and in this manner, a current of a great number of amperes can be obtained through the oscillating circuit, even with a small amount of electricity stored in the capacitor.

In the same manner, one gallon of water could produce a flow of one thousand gallons per second through a pipe if such a pipe were connected with two different vessels and the gallon of water could be forced through the pipe by a piston which could transfer that gallon of water from one vessel to the other one thousand times per second. Obviously, what can be easily performed with electricity is not so feasible with water.

In other words, the small amount of electrical power taken by the DC motor **27, 28**, appears (with a small loss) at the alternator **42**, and that power is delivered to the transformer primary **44, 45**. Again, the inductive action of this transformer produces at the secondary **46, 47**, a similar amount of power (diminished slightly due to the efficiency of the transformer), and finally, the capacitor is charged with a small amount of electricity which is then converted into oscillitatory energy. Obviously, if such electric power, instead of being stored by the capacitor, had simply been rectified and used to charge one of the batteries, such power would produce only a very small effect on the battery and the entire discharge of one battery would never cause the complete charge of the second battery.

Contrary to that, if that same power is stored in capacitor **48**, and that capacitor is properly connected to an oscillatory circuit in which one of the batteries can be joined, and furthermore, if by means of a rectifier, the high-frequency currents produced in such an oscillatory circuit are forced to pass from the positive to the negative pole through the battery, it is obvious to state that it is always possible to secure by these means, the number of amperes required to charge the battery in the available time. That is to say, with a small number of coulombs stored in capacitor **48**, it is possible to produce in the oscillatory circuit, a great number of amperes, if that same small number of coulombs are forced to pass and repass through the circuit, thousands or millions of times per second, just as was explained in the water analogy.

On the other hand, the values of the above named quantities: capacity, resistance, inductance and voltage can be varied within very wide limits, and therefore it is always possible to attain the required conditions in each case, in order to produce a given number of oscillations per second: The capacity of the capacitor can be adjusted to a certain value by increasing or reducing the inter-meshed surface area of its plates. The resistance of the circuit can be adjusted to the required value by varying the length of the arc in the Poulsen lamp, or varying the number of lamps connected in series or parallel in the circuit. The inductance of the circuit can be varied by winding part of the circuit on an insulating frame, in such a manner as to obtain the number of turns required to produce the