F. E. NORTON & F. A. WILSON.

INDUCTION GENERATOR.

APPLICATION FILED DEC. 1, 1911.

1,084,594.

Patented Jan. 13, 1914.

3 SHEETS—SHEET 1.

Fig. 1.

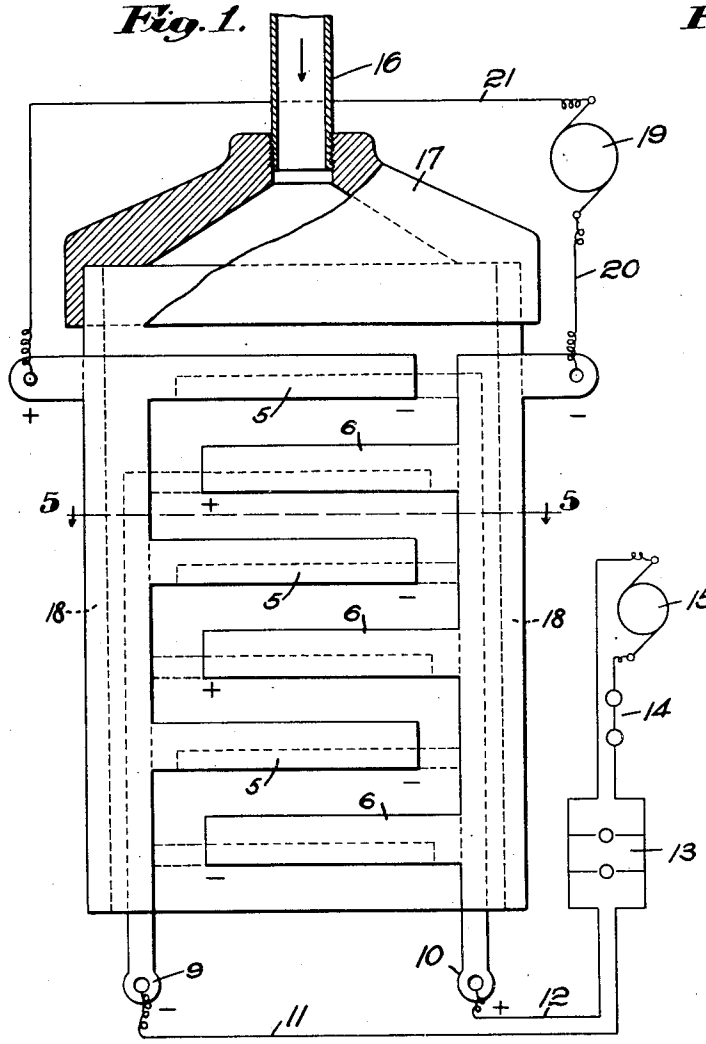


Fig. 2.

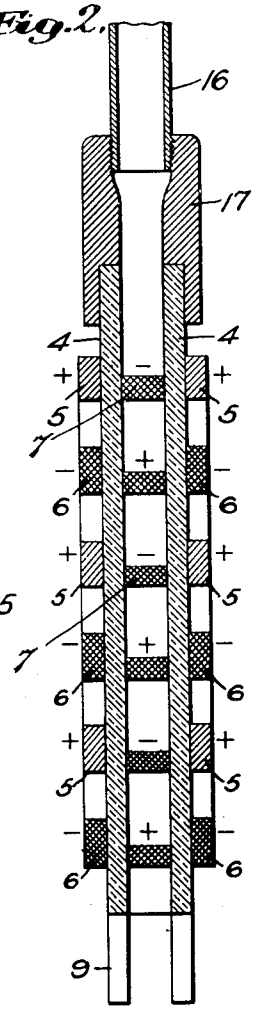
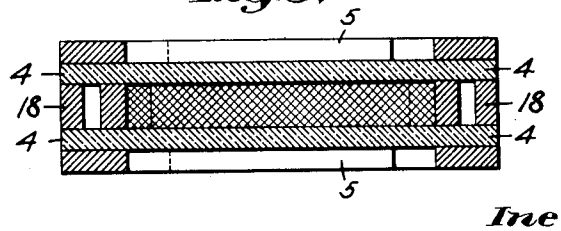


Fig. 3.



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3 SHEETS—SHEET 2.

Fig. 4.

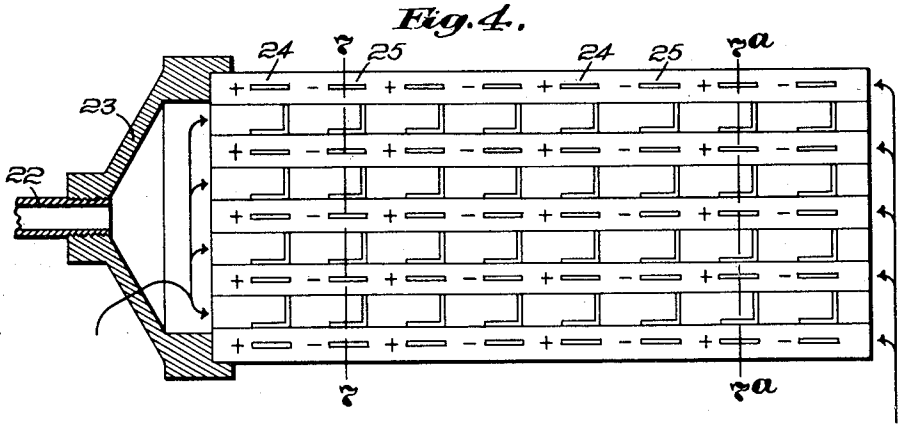


Fig. 5.

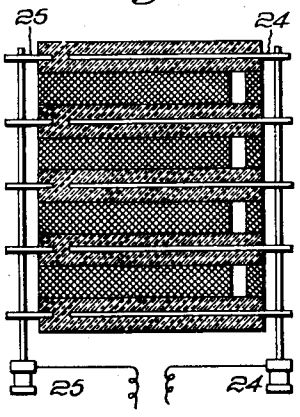
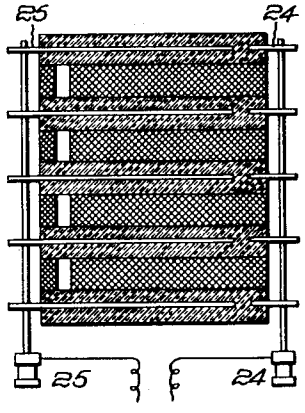


Fig. 5a.



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3 SHEETS—SHEET 3.

Fig. 6.

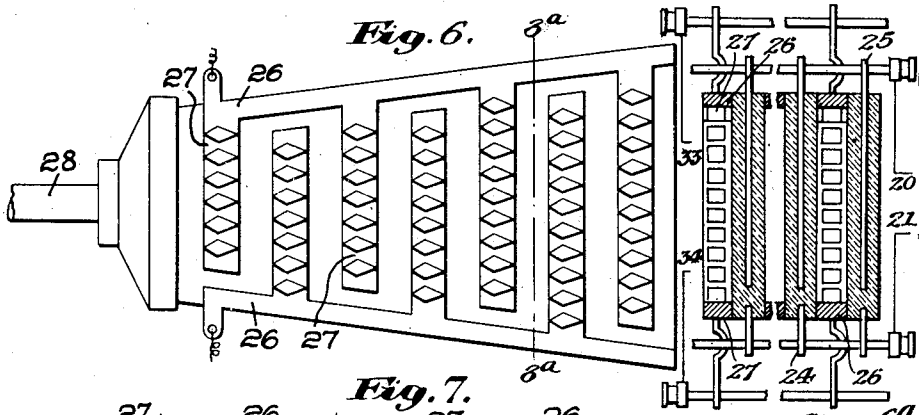


Fig. 6a.

Fig. 7.

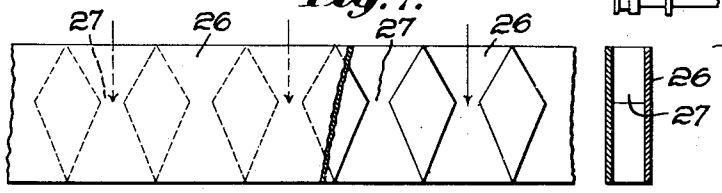
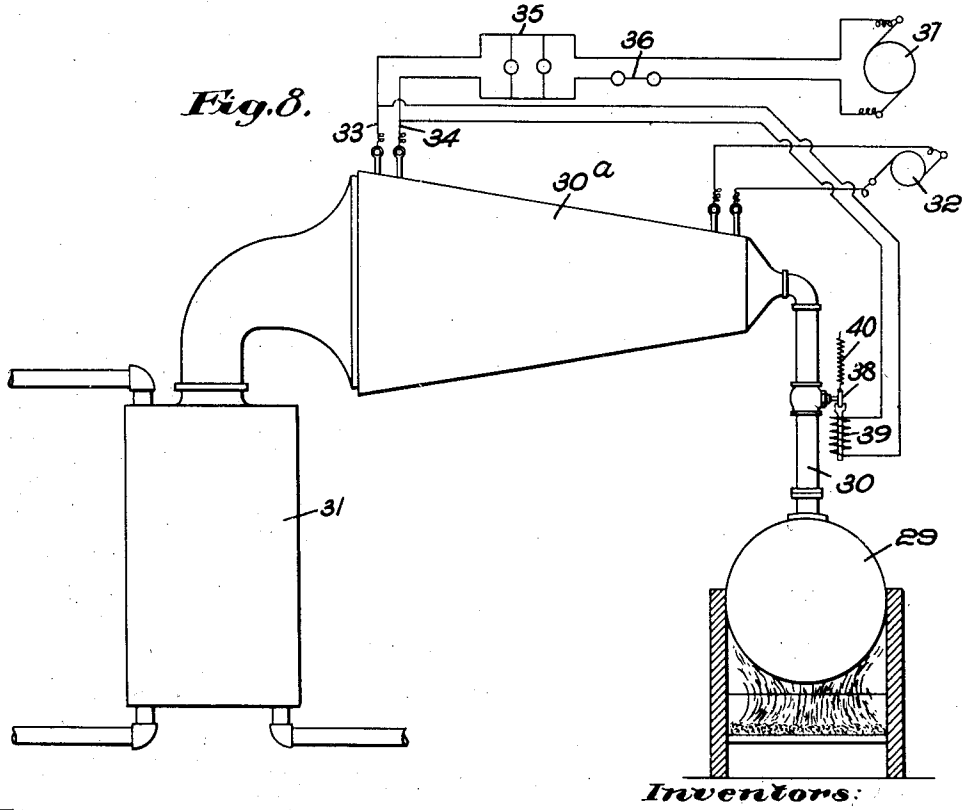


Fig. 8.



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UNITED STATES PATENT OFFICE.

FRED E. NORTON, OF LYNN, AND FRED A. WILSON, OF NAHANT, MASSACHUSETTS.

INDUCTION-GENERATOR.

1,084,594. Specification of Letters Patent. Patented Jan. 13, 1914.

Application filed December 1, 1911. Serial No. 663,184.

To all whom it may concern:

Be it known that we, FRED E. NORTON and FRED A. WILSON, both citizens of the United States, and residents, respectively, of Lynn and Nahant, in the county of Essex and State of Massachusetts, have invented an Improvement in Induction-Generators, of which the following description, in connection with the accompanying drawings, is a specification, like characters on the drawings representing like parts.

This invention relates to induction electric generators.

In order that the principles of the invention may be readily understood, we have disclosed a single form of apparatus for carrying the same into effect, wherein—

Figure 1 shows mainly in side elevation one element or portion of that form of apparatus preferably employed in the practice of our invention; Fig. 2 is a vertical section of the apparatus shown in Fig. 1; Fig. 3 is a transverse section thereof upon the line 3—3 of said figure and looking in the direction of the arrows thereon; Fig. 4 shows mainly in side elevation but partially in vertical section a modified form of our invention; Fig. 5 is a transverse section of that form of apparatus shown in Fig. 4 upon the line 7—7 of said figure; Fig. 5^a is a similar cross section upon the line 7^a—7^a of said figure; Fig. 6 shows in side elevation a modified form of the collecting elements; Fig. 6^a is a section taken upon the line 8^a—8^a of Fig. 6; Fig. 7 is a detail mainly in side elevation further illustrating the construction thereof; and Fig. 8 is a diagrammatic illustration of a generating plant for the purpose of our invention.

In order that the principles underlying our invention may be clearly understood, we shall first refer briefly to certain well known forms of apparatus from which as a rudimentary disclosure our invention has been developed.

It is well-known that if a pair of insulated spheres be charged, one positively and the other negatively, and a conductor be brought close to the positively charged sphere, so as to touch a terminal, the positive charge of said conductor repelled by the positively charged sphere, is imparted to said terminal. Similarly, movement of said conductor close to the negatively charged sphere results in imparting to a second terminal the negative charge of said conductor repelled by said negatively charged sphere. By the completion of a circuit through said terminals a positive charge of electricity flows from the first to the second, the negative charge going to the first terminal. Return movement of said conductor toward said positively charged sphere will carry with it a positive charge to said first terminal, and by moving said conductor alternately from one of said spheres to the other, alternately touching said terminals, a continuous supply of positive electricity may be taken from the first terminal which will flow toward the second terminal. The charges upon the said spheres are static charges, and excepting for imperfect insulation, no flow takes place from them. They are inductors and analogous to the permanent magnets of magneto-dynamo machines. There is, however, a tendency to force the charge away from the inductors, and a small amount of energy is required to maintain the charge.

The same principle of operation exists in the well known Thompson water dropping collector, wherein drops of water falling by gravity are substituted for the reciprocating conductor previously described. Said collector is usually composed of two or more pairs of inductors and collectors which may be cross connected and are excited reciprocally, needing no other excitation than a slight initial charge to one of them.

The apparatus embodying our invention is based upon the principles of certain simple induction generators, one of which is ometimes known as the Thompson water dropping collector or electrometer, and which is hereinbefore described in a multiplied form. According to our invention the parts are so multiplied and modified in form that the effectiveness of the inductors and the capacity of the collectors is so greatly increased that we are able to utilize the energy of a jet of saturated steam at high velocity.

By the novel form and arrangement of the parts, we are able to convert the kinetic energy of a steam jet moving at high velocity into electric energy at such a moderate

potential that it may be collected and used in a manner impossible in any apparatus heretofore known.

By means of inductors of practical form we exert a powerful inductive effect on the particles of steam or moisture carried therein and by the use of expanding nozzles we impart a high velocity to the steam and insure an efficient collection of the electricity.

In Figs. 1, 2 and 3, we have shown a single unit or element of one form of the apparatus. Therein are shown glass plates 4—4 or other suitable plates of any commonly used insulating material. 5—5 are metal (conducting) grid shaped plates mounted upon the glass plates 4—4 and constituting positive inductors. At 6—6 are represented corresponding metal plates constituting the negative inductors. We preferably employ wire gauze collectors for the negative side and similar collectors for the positive side, the former being indicated at 7—7 and the latter at 8—8. Terminals 9, 10 are connected to wires 11, 12 leading to lamps arranged in parallel at 13 or in series at 14 or to a motor at 15 as desired; or they may be connected to any apparatus requiring the use of electric power. Steam from any suitable source is admitted by pipe 16 and preferably passes into the expansion cap 17. The plates are supported in any suitable manner and may be properly spaced by strips 18 or the like, as indicated in Fig. 3. An exciter 19, as shown in Fig. 1, of any of the well-known forms of dynamo is connected to the grid shaped plates 5, 6 by wires 20, 21. Such exciter may be driven by any available source of power including the wires 11, 12. If now the supply of steam under pressure be admitted to the pipe 16, it expands in cap 17 and passes at high velocity between the inductors 5—5. These inductors are charged with a static charge from exciter 19 (for example) to a positive potential. The steam will have been partly condensed by expansion, and when the particles of water impinge on the collectors 7, they will acquire a negative charge and the positive electricity will be repelled toward and beyond the terminal 10. As the particles leave the collector 7, they will be attracted by inductor 5, and part of the velocity of the steam will be lost in driving them toward inductor 6, which, being negatively charged by exciter 19, will in turn repel them. There is thus a double resistance to the motion of the particle in approaching the collector 8. When the particle touches the collector 8, its negative charge is repelled by the inductors 6—6, and will flow toward the terminal 9. Thus, a positive charge is sent to the terminal 10 and a negative charge is sent to the terminal 9 for each pair of conductors passed by the particle. By having a large number of inductors and collectors, the velocity of the steam may be diminished gradually by comparatively small attractions and repulsions from the inductors. The collectors all being in parallel, the quantity of electricity may be indefinitely increased and its pressure correspondingly lowered, at the same time absorbing the energy of the steam.

It will be evident from the foregoing description that the inductors of alternately positive and negative sign are arranged in order, so as to permit or secure a continuous motion for the carrying body; that is, for the minute particles of water carried by the steam jets. The limitations of the previously known apparatus are removed by our invention and enormous quantities of electricity may be generated at comparatively low pressure.

We are aware that the use of a current of steam for generating electricity is not new. Sir William Armstrong constructed an apparatus to demonstrate that electricity could be developed from a jet of steam from an insulated boiler impinging upon a suitable insulated collector. The difficulty again appeared, however, that the quantity of electricity generated was small, the pressure enormous and the efficiency very low. So far as we are aware no further progress in this direction has been made other than that which the previously referred to laboratory experiments developed. Our apparatus herein disclosed, while it embodies these well known principles, is of great practical value and efficiency. The present methods of generating electricity depend upon an indirect method of using the expansive power of steam; inasmuch as the steam engine derives its power from the expansion of steam behind a piston, which drives a shaft carrying a magnet and through the well known magnetic-electric reactions generates a current. The steam turbine develops the energy of a jet of steam moving at high velocity to turn a shaft driving likewise a magnetic-electric dynamo.

In the practice of our invention, we utilize a jet of steam carrying minute particles of water passed through inductors and collectors subject to static repulsion and attraction in a manner fully analogous to the driving of copper wires through a magnetic field. In our apparatus the application of the energy of the steam is direct and no intermediate steps in transformations of energy take place. It is this direct application of an electric stress to the moving mass of steam or other suitable vapor that constitutes the efficient feature of our invention; to the end that a continuous and controllable supply of electricity may be made available. Obviously, the apparatus

may be made cheaply and its efficiency may be made to exceed any known form of heat engine, the friction losses being reduced to an almost negligible amount. Obviously the inductors and collectors may be of cylindrical form or disk shaped or of any other suitable form and construction. The apparatus may be made self-exciting as indicated, and any of the well-known means of controlling the pressure of excitation may be used. Any suitable form of exciting apparatus may be used, such for example as a static electric machine, a magneto, a battery or an ordinary dynamo. The excitation may be either continuous in one direction or alternating, and the resulting current will be correspondingly either continuous or alternating.

Our invention is not limited to the use of water vapor or steam, as any volatile liquid, whose vapor condenses to liquid during expansion may be employed, or even a non-conducting gas carrying particles of a conducting substance may be utilized. While gases such as air may be utilized, we prefer to use water vapor or steam.

The action of the collectors and inductors does not depend, in the practice of our invention, solely on the transfer of a quantity of electricity, as there is a further action due to the condensation of the vapor which may develop still further energy than that due to the transfer alone.

In Figs. 4, 5 and 5ª, we have represented a further form of apparatus embodying our invention, wherein the steam inlet pipe is indicated at 22, and the steam expansion cap at 23. The series of inductors 24, 25 are consolidated into preferably thin glass sheets which are so relatively positioned that the steam is developed into thin sheets, thus adding to the effectiveness of the inductors. In this form of apparatus the collectors are indicated at 25′ as being L-shaped and being of wire gauze or any other suitable metal having interstices for the passage of steam. This arrangement of cells and elements may be indefinitely multiplied either by end to end extension or by adding layers of cells. The number of elements may be very great, thus sub-dividing the work, so that each element only abstracts a very small quantity of energy. By placing the glass plates very closely together, the inductive effect is largely increased.

In Figs. 6, 6ª and 7, we have shown a modified form of collector 26, wherein the steam passages 27 receiving steam from the pipe 28 are so shaped that they in effect form nozzles. These nozzles may be so proportioned that at each step of the flow of the steam or other vapor just enough velocity is added to carry it to the next set of collectors. If desired, these passages may be constructed in the manner well known in ordinary steam turbines. By the employment of this form of our invention, the effect of friction, which may be considerable in the case of the form of collectors previously described, will be almost eliminated.

The form of collector previously described as of wire gauze allows the passage of steam through its interstices. This, while perfectly practical, affords more or less tortuous and restricted passages, and control of steam is not so easy as is desired. Therefore, for such wire gauze we have, in this form of the invention, substituted, as shown in said Figs. 6 and 7, metal grids having therein nozzle shaped openings or passages 27. The material still acts as collectors as previously described, and the holes or perforations permit the passage of steam. By properly shaping these holes in the manner commonly resorted to in the use of steam nozzles, the speed of flow is controlled in a desirable manner.

From Fig. 6, the casings have been removed and the collectors are exposed to view flatwise. The nozzle shaped apertures 27 are, in said figure, shown with the diamond shaped section of metal remaining between them. In said Fig. 6, the general form of the whole apparatus is represented as enlarging toward the outer end, a desirable feature of the apparatus to accommodate the increasing volume of the steam.

In Fig. 7, the nozzle shaped passages 27 are shown in one portion thereof as perforated grids. In said figure, the said nozzle-shaped openings are represented as rectangular in cross section with two sides parallel and two sides formed to control the flow of steam as described. This particular form of nozzle is not essential to the operation of the invention, but represents a possibility of economical manufacture.

Within the scope of the invention, any suitable form of nozzle may be employed, as the invention is not limited to any specific construction of the grids themselves.

In Fig. 8 we have indicated in a diagrammatic manner a generating plant for practising our invention. Therein the boiler is indicated at 29 which supplies steam through pipe 30 to the apparatus which is here represented as provided with a casing 30ª. The said apparatus consists of inductors and collectors preferably arranged as previously described and as shown in Figs. 4, 5 and 6ª, and one element thereof being shown in Figs. 1, 2 and 3. The steam passes from the said apparatus to a condenser 31 which may be of any well known type. The exciter 32 charges the inductor in the manner previously described and current is led from the collectors by wires 33 and 34 to lamps 35 arranged in parallel or lamps 36 arranged in series, or to a motor 37, as desired. A vertical section taken through the casing 30ª of Fig. 8 would be rectangular

and would correspond in structure to Figs. 5 or 5ª excepting that in Fig. 8 we have represented a casing 30ª which does not appear in Figs. 5 and 5ª.

In Fig. 8 the inductor connections are represented at the steam entrance end, corresponding in this respect to Fig. 1 and the collector terminals are indicated at the steam exit end, being similar in this respect to the arrangement shown in Fig. 1. Obviously, however, these terminals may be placed at any suitable point and in Fig. 6 the collector terminals are shown at the steam entrance end.

Figs. 6 and 8 show a type of apparatus enlarging toward the steam exit end, but obviously the apparatus may be of any other suitable shape.

The valve 38 in the steam pipe 30 is controlled by a solenoid 39 and spring 40 in such manner that the electric pressure may be kept constant. Any of the well-known devices for regulating steam engines or turbines may be employed for the purpose of controlling the steam supply; and either the electric pressure or quantity may be controlled as desired in any suitable manner.

Obviously any suitable materials may be employed for the purpose of our invention, and the mechanical arrangement of parts such as the inductors, collectors, exciters, etc. may be widely varied within the scope of our invention.

In order that the application of our invention may be appreciated, let us consider a channel (see Fig. 2 with its one channel or Fig. 4 with four channels) one foot square (thus containing one square foot of area) traversed by a current of steam at a velocity of three thousand feet per second. Associate one hundred of these channels measuring together one foot in height, and we are considering an apparatus containing one cubic foot of volume and one hundred square feet of surface exposed to the electrical action of our invention, and which may use ten pounds of steam per second. At a speed of flow of three thousand feet per second this would therefore give a condenser surface, to use a term associated with static machines, of three hundred thousand feet per second.

If one hundred series of inductors as above described are used, this would mean, therefore, that a condenser having thirty million square feet of surface is charged each second to the potential of the inductors. The energy due to ten pounds of steam per second at three thousand feet velocity per second is about twenty six hundred horse power. Comparisons may be made with static machines but these would be of little value. No known form of apparatus can produce the results shown by the above computation.

Having thus described one illustrative embodiment of our invention, we desire it to be understood that although specific terms are employed, they are used in a generic and descriptive sense and not for purposes of limitation, the scope of the invention being set forth in the following claims.

Claims:

1. An induction generator comprising in combination inductors, means for electrically charging the same, insulating walls separating said inductors and between which a channel is formed, collectors in said channel and inlet and outlet passages connected to said channel whereby a mass of vapor may move therethrough in co-active relation to but insulated from said inductors and in contact with said collectors thereby to transfer electricity to and from said collectors.

2. An induction generator comprising in combination insulated inductors, collectors, means to charge said inductors with electricity and means whereby a stream of vapor inductively charged by said inductors is caused to pass over said collectors.

3. An induction generator comprising in combination inductors, means for electrically charging the same, insulating walls separating said inductors, and forming a channel and collectors exposed in said channel.

4. An induction generator comprising in combination a plurality of sets of inductors, means for electrically charging the same, and insulating walls between which the inductors are positioned, said walls forming passages whereby a mass of vapor can be passed into co-active relation with said inductors.

5. An induction generator comprising in combination inductors, means for electrically charging the same, and insulating walls separating said inductors and forming a passage whereby a mass of vapor can be passed therethrough in coöperative relation with said inductors.

6. An induction generator comprising in combination inductors, means for electrically charging the same, insulating walls separating said inductors and between which a channel is formed, and inlet and outlet passages connected to the channel whereby a mass of vapor may move therethrough in co-active relation to said inductor.

7. An induction generator comprising in combination inductors, means for electrically charging the same, collectors positioned in proximity to said inductors and insulating walls separating said inductors and between which a channel is formed containing said collectors and inlet and outlet passages connected to said channel whereby a mass of vapor may move therethrough in coactive relation to said inductors and collectors.

8. An induction generator comprising in combination inductors, means for electrically charging the same, insulating walls

separating said inductors and between which a channel is formed, collectors positioned in said channel and having nozzle-shaped apertures and inlet and outlet passages connected to said channel whereby a mass of vapor may move therethrough in co-active relation to said collectors.

9. An induction generator comprising in combination inductors, means for electrically charging the same, insulating walls separating said inductors and between which a channel is formed, collectors in said channel and inlet and outlet passages connected to said channel whereby a mass of vapor may move therethrough subject to induction from said inductors.

In testimony whereof, we have signed our names to this specification, in the presence of two subscribing witnesses.

FRED E. NORTON.
FRED A. WILSON.

Witnesses:
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ROBERT H. KAMMLER.