(No Model.)

J. J. WOOD.

DYNAMO ELECTRIC MACHINE.

No. 302,460. Patented July 22, 1884.

Fig. 1.

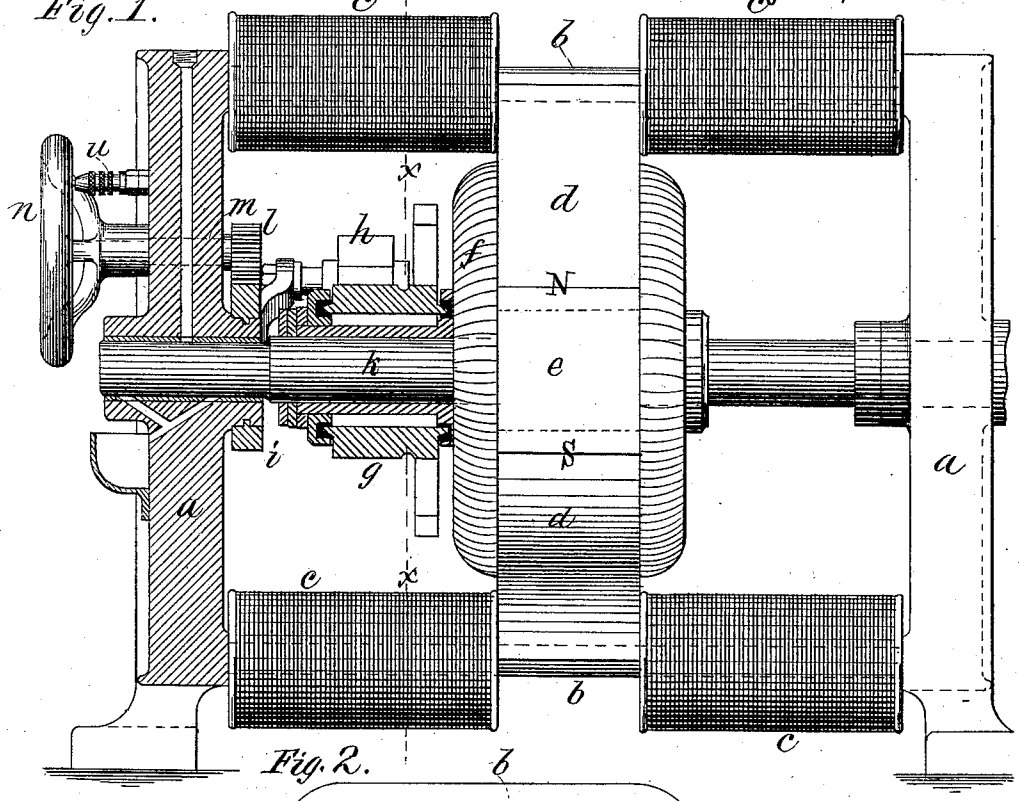


Fig. 2.

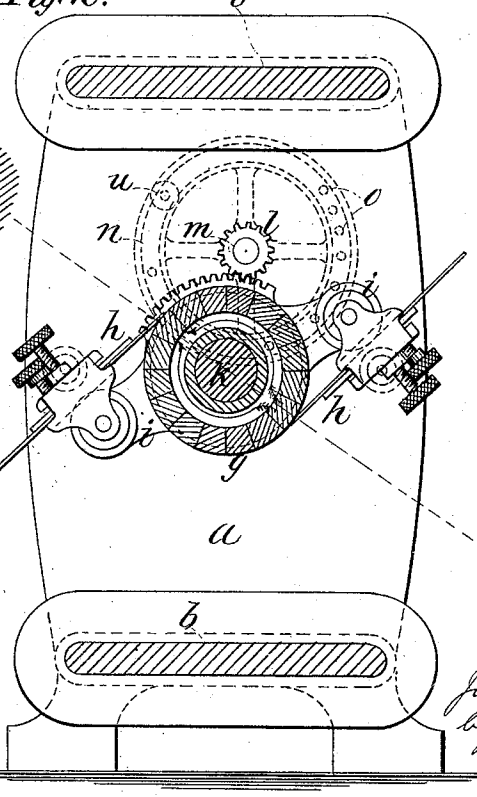


Fig. 4.

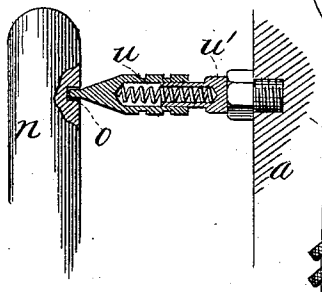
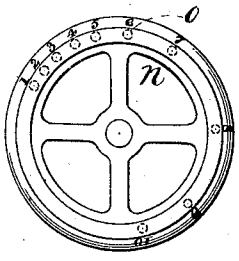


Fig. 3.



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UNITED STATES PATENT OFFICE.

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DYNAMO-ELECTRIC MACHINE.

SPECIFICATION forming part of Letters Patent No. 302,460, dated July 22, 1884.

Application filed March 24, 1882. (No model.) Patented in England May 27, 1882, No. 2,526; in France September 7, 1882; in Canada October 2, 1882, and in Germany May 21, 1883, No. 21,955.

To all whom it may concern:

Be it known that I, JAMES J. WOOD, of Brooklyn, in the county of Kings and State of New York, have invented certain new and useful Improvements in Electric Generators, of which the following is a specification.

My improvement applies more especially to the Gramme type of generator, or any other dynamo or magneto machine in which the coils or sections of the armature are connected in what is known as a "close circuit;" and my invention lies in an improved form of current-regulator, whereby the force of the current produced by the machine may be increased or decreased, as may be required, to suit the kind or amount of work which is to be performed by the machine—for instance, in electric lighting—whereby the current may be reduced to suit one lamp or increased to suit any additional number of lights up to the maximum number capable of being maintained by the machine.

To this end the main feature of my invention may be stated to consist in the combination, with a Gramme or equivalent form of armature and a movable brush-holder adapted to move the brushes on the commutator from the point of greatest effect toward the minimum position, of a manipulating or adjusting device operatively engaged with the brush-holder and with a catch or lock, and provided with fixed definite points of graduation and engagement, whereby the brushes can be set and held at certain indicated and fixed positions corresponding to distinct changes of current suited for one or more lights without trouble or calculation on the part of the operator.

My invention also consists in the special construction of the parts, as hereinafter fully set forth.

In the annexed drawings, Figure 1 presents a side elevation, partly in section, of my improved form of Gramme dynamo-electric generator provided with my improved current-regulator. Fig. 2 is a cross-section on line *x x*, looking to the left. Fig. 3 represents an end view of the hand-wheel of the current-regulator, showing the fixed definite graduations and points of engagement corresponding to current changes suited for any number of lights from one to ten. Fig. 4 is a fragmentary detail illustrating the catch for holding the hand-wheel or manipulating device of the regulator at the desired adjustments or graduations.

In Figs. 1 and 2, *a a* indicate the side frame or sustaining standards of the machine, which are joined at top and bottom by the wrought-iron webs or plates *b b*, which form the core of the field-magnets *c c*. *d d* are the pole-pieces of the field-magnets, which project from the middle of the cores *b b*, as usual, and are formed into nearly semicircular shape, to encircle nearly one-half of the armature, the separated but approaching ends of the pole-pieces being joined by brass plates *e*, as usual. *f* is the armature, which revolves in the usual manner between the encircling-poles, and is mounted on the shaft *k*, which is journaled in the standards *a*, and provided with the commutator *g*, with which the coils of the armature connect in the well-known manner of Gramme armatures or closed-circuit armatures. *h h* indicate the collecting and transmitting brushes, which bear upon the commutator in the usual manner, and project from a movable arm or yoke, *i*, which is mounted upon the bearing at the commutator end of the armature-shaft, and is capable of radial adjustment thereon, as usual. The manner of and means for the adjustment of this yoke or brush-holder in this case is, however, novel, and constitutes my present invention, as will hereinafter appear.

I do not show or describe the manner of constructing the armature or of connecting the coils or sections thereof with the sections of the commutator, this being, as before stated, on the Gramme or close-circuit principle, which is well known to experts or electricians, and in itself forms no part of my present invention, and it is therefore not thought necessary to here specify the same. I would call attention, however, to the well-known fact that in this class of armatures which revolve between the two opposite poles the currents always flow in a constant direction in each half of the armature, the currents from the several coils all tending to flow from one dia-

metrical point in the armature around each half to the opposite diametrical point, as indicated by arrows in Fig. 2, so that if the brushes bear upon the commutator at these diametrical points they will convey the full maximum current of the machine. These maximum points will be at opposite ends of a diametrical line passing through the armature between the opposite poles of the magnet and coincident with the diagonally-opposite corners of the opposite pole-pieces. Hence, if the brushes rest upon the commutator so as to tap the armature at this position, as shown in Fig. 2, they will convey the full effective current of the armature, as before stated; but if the brushes be moved to a different radial position from this the force of the current conveyed by the brushes will be reduced by reason of a partial mutual counteraction of the currents from each half of the armature, and this reduction will continue as the brushes approach a position at right angles to the aforesaid maximum position, where the effect will be *nil*, due to the complete counteraction of the two currents in the armature at this point. In practice the current will become inappreciable some time before the brushes reach the theoretically minimum position; but the effective range through which the brushes may be moved will vary in different machines according to individual peculiarities. Thus in some machines in which the field of magnetic force is concentrated abruptly near the ends or corners of the pole-pieces the range will be less, while in other machines in which the magnetic force is more diffused along the pole-pieces the range will be greater. In machines, however, of the same plan of construction and of the same size the conditions of the magnetic field will of course be the same in each individual machine.

Now, according to my improvements in adjusting the brushes and regulating the current of the machine, I provide the brush-holder or yoke *i* with a segment of gear-teeth, as shown best in Fig. 2, into which is meshed a pinion, *l*, which is fixed on the inner end of a short shaft, *m*, which passes through one of the standards *a*, and on the outer end of which is fixed a hand-wheel, *n*, (see Fig. 1,) by turning which one way or the other the yoke and brushes may be adjusted to any desired position on the commutator, as will be readily understood from Figs. 1 and 2. The hand-wheel *n* is formed with a long hub, as seen in Fig. 1, by which the rim sets well out from the side or standard of the machine to admit the convenient grasp of the hand; and the inner side of the rim is perforated or notched with series of indentations, any one of which may be engaged with the point of a spring-bolt, *u*, which projects from the side frame of the machine, as shown in Figs. 1, 2, and 3, and in detail in Fig. 4, so as to thus hold the wheel firmly at any of the several positions corresponding with the said notches to which the wheel may be turned, as will be understood. These notches, as will now be readily observed, constitute points of graduation corresponding to fixed definite changes in the position of the brushes on the commutator, and representing definite variations in the force of the current suited for a greater or less amount of work, and, as shown in Fig. 3, the rim of the hand-wheel is graduated or marked with numbers or other indications corresponding in position with the engaging-notches, and showing the value of each adjustment. Thus in the present generator, which is designed for arc lighting, the graduations on the hand-wheel represent a range of adjustment for from one to ten lamps; hence, if the hand-wheel is turned so that the 10 figure and notch is coincident with the spring-bolt *u*, the brushes will be set to their maximum position, and will convey the full maximum current of the machine sufficient to properly maintain the maximum number of ten lamps. If any less number of lamps is desired, the wheel can be turned till the notch and number corresponding to the desired number of lamps is coincident with the bolt, and the current will be thus properly adjusted for such number, and so on down to the lowest number, and the parts will at the same time be firmly held at the desired adjustment as long as required, as will be readily understood; hence by this means it is not necessary to run the full number of lights and use a maximum amount of power when only a small number of lights may be required, and for which a smaller amount of power would suffice; but by this regulating device the operator or user of the machine is enabled, without the necessity of any skill or calculation, to adapt the machine in a certain and simple manner for any desired duty, where it will give only the amount or number of lights desired and use only a corresponding amount of power, which has heretofore been very desirable in the arc system of electric lighting.

It will be noted on reference to Fig. 3 that the graduations of the different numbers of lights are not at regular but at irregular intervals, the intervals at the minimum end of the scale for a small number of lights being quite short or close together, but much longer at the maximum end for the large number of lights, while the intervals increase rapidly in length from each end toward the middle of the scale. These graduations will vary somewhat in machines of different construction, according to their individual peculiarities, as before mentioned, but will always have the irregular character above noted.

The graduations for all machines of any particular kind and size are formed as follows: The machine is set in motion and put in circuit with one lamp or an equivalent resistance, and the brushes are then adjusted by moving the hand-wheel *n* (the rim of which is of course as yet left blank) until the current emitted is sufficient to maintain an arc or light

of normal or standard power in the one lamp. When this result is reached, the point on the rim of the wheel which coincides with the bolt *u* is marked by a prick-punch or scribe, and this constitutes the graduation or adjustment for one lamp. Two lamps are then switched into circuit and the hand-wheel turned so as to advance the brushes farther toward the maximum position until the current is increased sufficiently to produce a standard arc in both lamps, when the position thus formed is marked on the wheel, as before, and the graduation for each additional lamp up to the maximum number is thus found one after the other in the same way, after which the indentations *o* are bored at the points marked, and the figures representing the value of the graduations are stamped on the front over the indentations, as shown in Fig. 3. When the correct graduations are thus found by actual test for one machine of a certain construction and size, the same graduations will of course suit for every other machine of the same nature. In this way the adjustments of each machine for any number of lights are rendered perfectly accurate, and the operator has only to set the regulator, as its graduations indicate for the corresponding number of lights, which is of course done in a very quick and easy manner, and requires no skill or special care, thus embodying a most important improvement in generators for electric lighting or other distributed electrical work.

I do not of course wish to be understood as inferring any claim of novelty in the principle of adjusting the angular position of the brushes on the commutator of a Gramme armature for the purpose of regulating the force of the current emitted thereby, as this principle is of course well known, and is at present employed in several ways. Thus it is common to make the brush-holder movable about the commutator, and provided with a set-screw whereby it can be held at different angular positions, and in one of such instances regular circumferential or angular graduations were provided, whereby the brushes might be set at angles of different degrees. Again, in certain systems of incandescent electric lighting it has been common to automatically shift the position of the brushes by an automatic magnetic regulating device, so as to regulate the current in the general light-circuit. It will be readily noted, however, that my improvement is distinct from any of these instances, in that I present a regulating device for manually shifting the position of the brushes, provided with fixed definite points of graduation or engagement, representing fixed definite changes of current corresponding to certain varying numbers of lights or other definite changes of duty, so that the unskilled operator can instantly and easily adjust the machine for the desired duty without need of calculation or danger of error, and without waste of power or overproduction of current, which latter is an important element of safety in operating light-circuits.

It may also be noted that the special construction of my regulator presents advantages in safety, simplicity, and efficiency, for as the manipulating device or hand-wheel *n* is placed on the outside of the machine, remote from the brush-holder, it is very conveniently reached and operated by the hand, and there is no liability of receiving a shock in so doing, whereas were the manipulating device placed within the machine near the brush-holder or commutator it would be in a less convenient position, and the operator would be sometimes likely, in a moment of inadvertence, to touch a positive and negative part at the same time in proceeding to make the adjustment, and thus receive a shock, which is completely obviated by my arrangement.

It may be further noted by referring to Figs. 1, 2, and 3 that the indicating and adjusting wheel *n* is so geared with the brush-holder that its graduated rim, which serves as the indicator to the position of the brushes on the commutator, has a multiplying relation to the said brushes, so that a slight movement of the brush is multiplied into a large movement at the rim of the hand-wheel. Now, when the brushes are near their minimum position, a very slight movement thereof will represent a considerable change of current, as will be noted by referring to Fig. 3, in which the graduations at the minimum end of the scale are quite close together, while they become farther and farther apart toward the maximum end of the scale; hence without some multiplying-gearing of the indicator with the brush-holder the adjustments at the minimum end could not be easily made, and would not be conspicuous.

It will be readily understood that while I prefer the special manipulating and engaging devices shown, yet any other suitable manipulating and engaging devices might be substituted without departing from the main feature of my invention. For instance, a hand lever or screw might be used in place of the hand-wheel, either on the outside or inside of the machine, and many other slight modifications might be adopted without departing from the principal feature.

The special construction of the catch-bolt *u* is shown best in Fig. 4. The movable bolt part *u* has the form of a knarled sleeve, and slides over a hollow stud, *u'*, screwed onto the side frame of the machine. A spring inclosed within the hollow of the sleeve and stud bears at one end against the stud and at the opposite end upon the sleeve, tending constantly to press the solid point of the sleeve into engagement with the notches in the rim of the wheel. By pressing the sleeve back the point of the sleeve may be disengaged from one notch, the wheel turned round to the desired

point, and the sleeve, or both, allowed to spring into engagement with the desired notch, thereby holding the wheel positively in the desired position, as will be understood.

What I claim is—

1. The combination, in an electric generator of the Gramme or close-circuit type, of a regulating device for manually shifting the position of the commutator-brushes, with a scale over which the same is adjusted, graduated into irregular degrees representing distinct successive numbers of lamps or their equivalents, and a fastening device for retaining the brush-holder at any of said degrees, whereby the operator can adjust the machine to different indicated stages suited to any number of lamps within the scope of the machine without requiring experiment or calculation, substantially as herein set forth.

2. The combination, in an electric generator of the described kind, with a movable brush-holder, of an indicator geared with the brush-holder in a multiplying ratio, said indicator being provided with a graduated scale, graduated into degrees representing successive numbers of lamps or their equivalents, and with means for holding the said brush-holder and indicator at any of the said graduations, whereby a slight movement of the brush-holder when near the minimum point is multiplied and made conspicuous on the scale, and whereby the operator can readily adjust the position of the brushes to support any desired number of lamps without requiring calculation or experiment, substantially as herein set forth.

3. The combination, in an electric generator, with a movable brush-holder arranged within the frame-work of the machine, of a manipulating or operating device operatively engaged with the brush-holder, with its manipulating or grasping portion arranged on the exterior of the machine, and a catch or retaining device for holding the said manipulator in the different positions to which it may be set, substantially as herein shown and described.

4. The combination, in an electric generator, of the movable toothed brush-holder *i*, pinion *l*, shaft *k*, and hand-wheel *n*, with a catch to hold said hand-wheel in different positions.

5. In an electric generator, the hand-wheel *n*, provided with engaging points or notches on its rim, and a fixed spring bolt or catch to engage therewith, in combination with a movable brush-holder and an operative connection between the same and the hand-wheel, substantially as and for the purpose set forth.

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