(No Model.)

3 Sheets—Sheet 1.

S. L. TRIPPE.

ELECTRIC LIGHTING SYSTEM.

No. 555,192.

Patented Feb. 25, 1896.

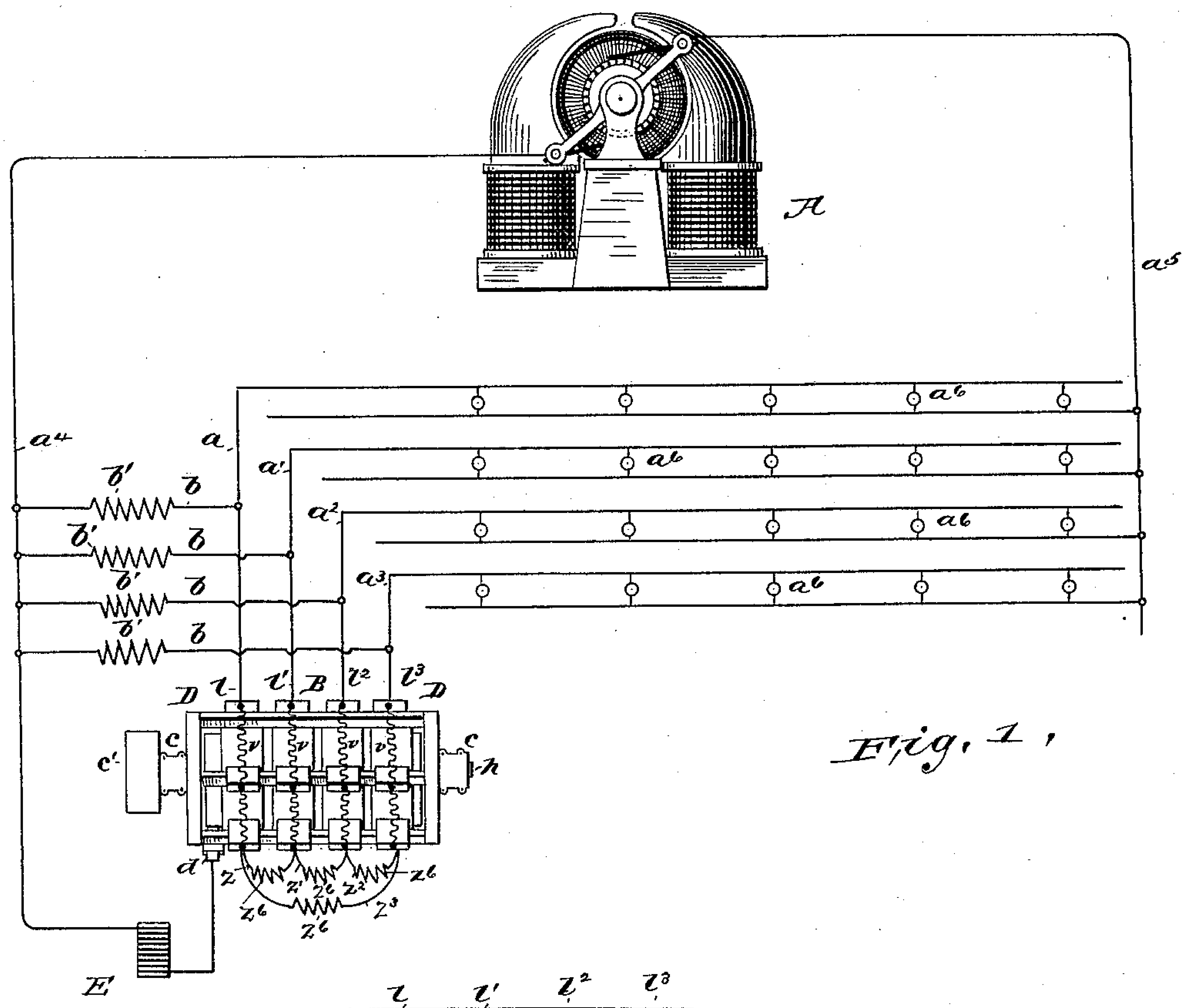

Fig. 1.

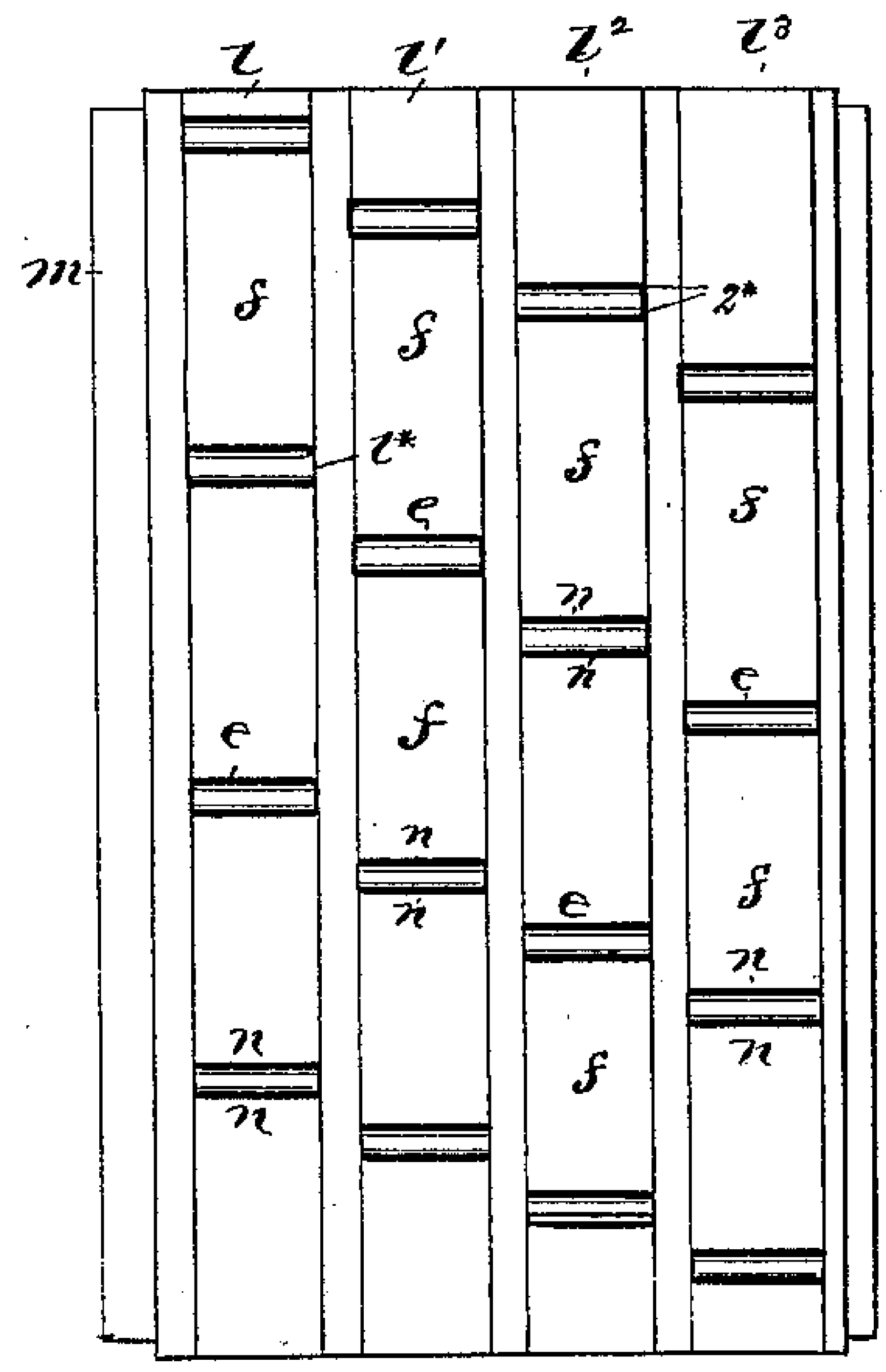

Fig. 7.

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(No Model.)

3 Sheets—Sheet 2.

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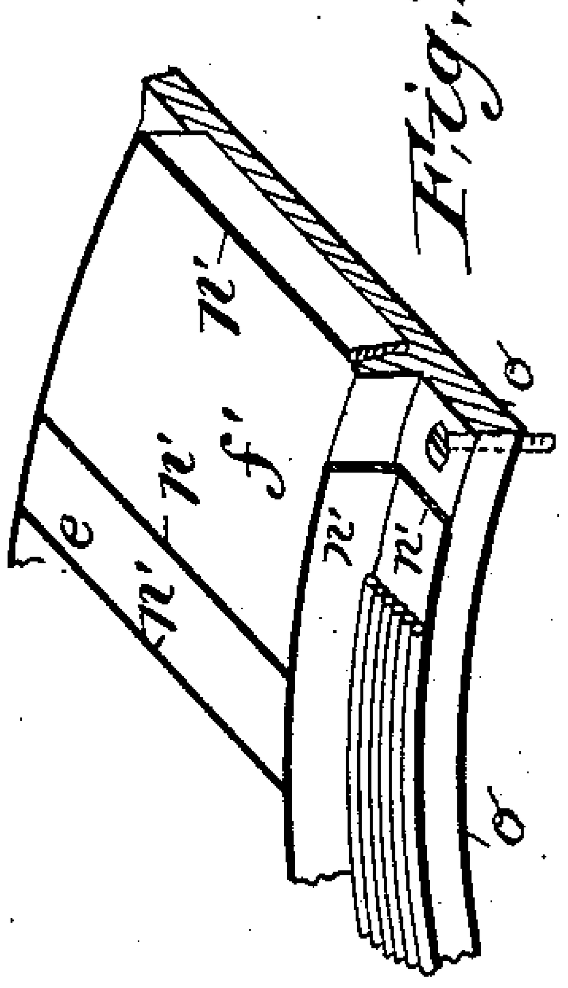

Fig. 9.

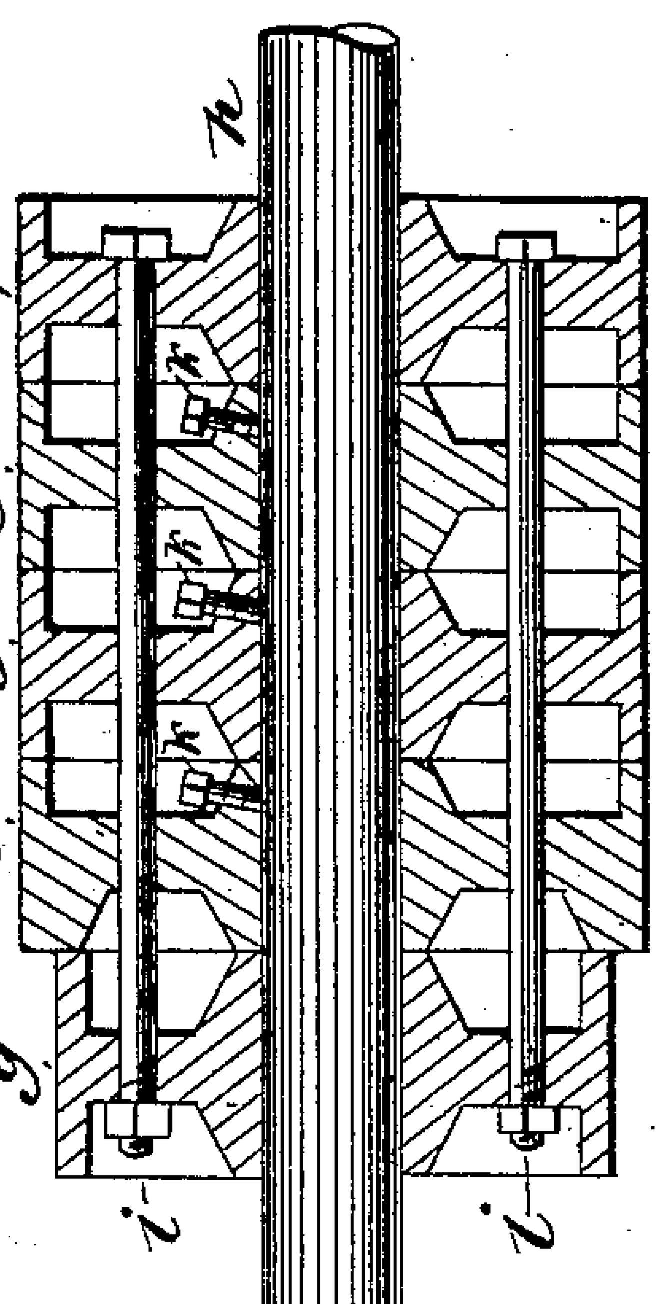

Fig. 5.

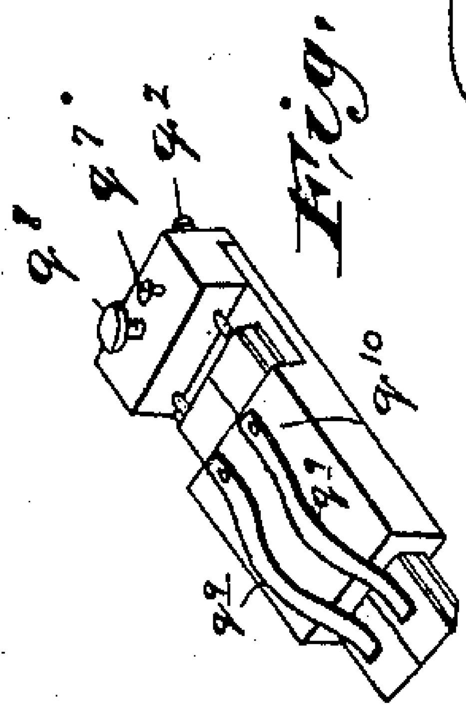

Fig. 8.

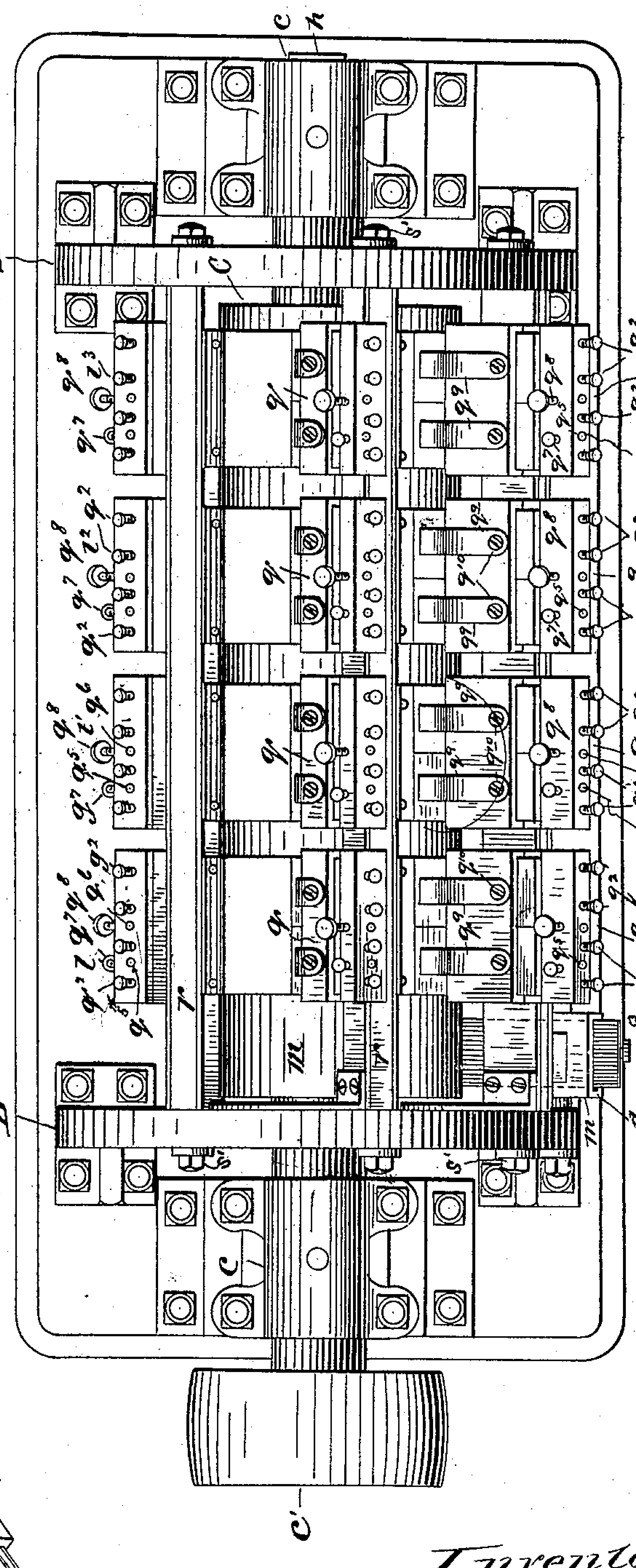

Fig. 2.

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(No Model.)

3 Sheets—Sheet 3.

S. L. TRIPPE.

ELECTRIC LIGHTING SYSTEM.

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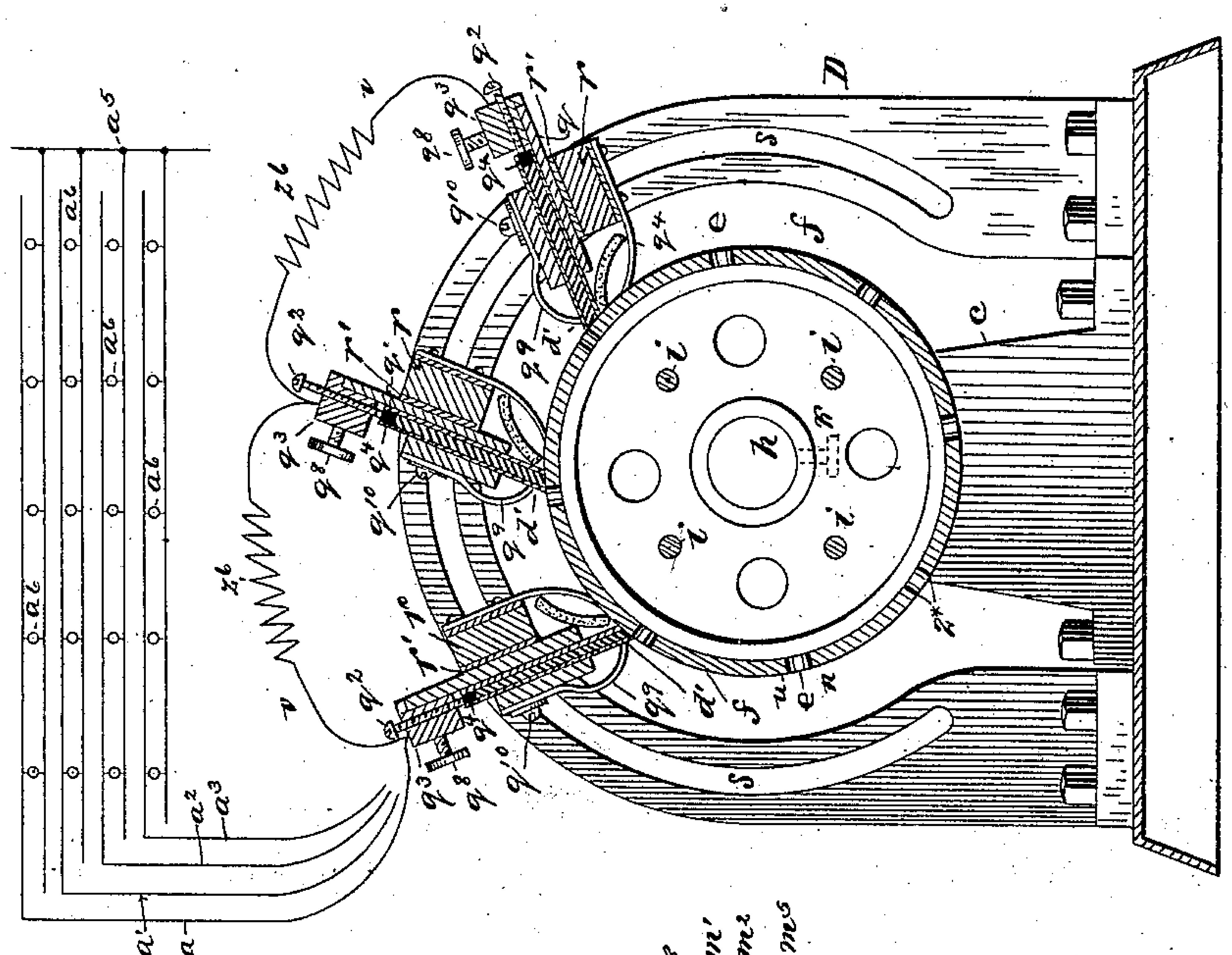

Fig. 4.

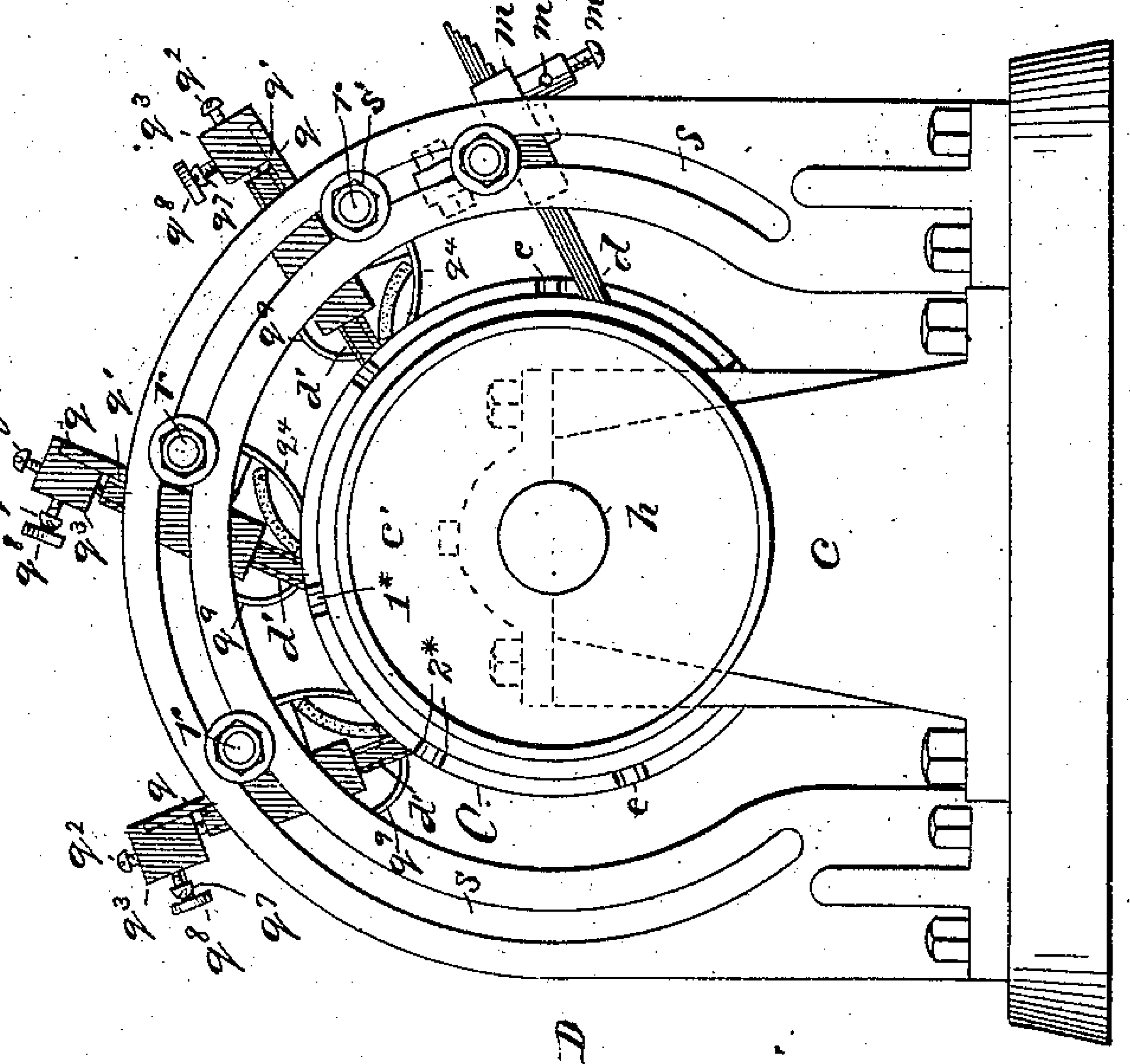

Fig. 3.

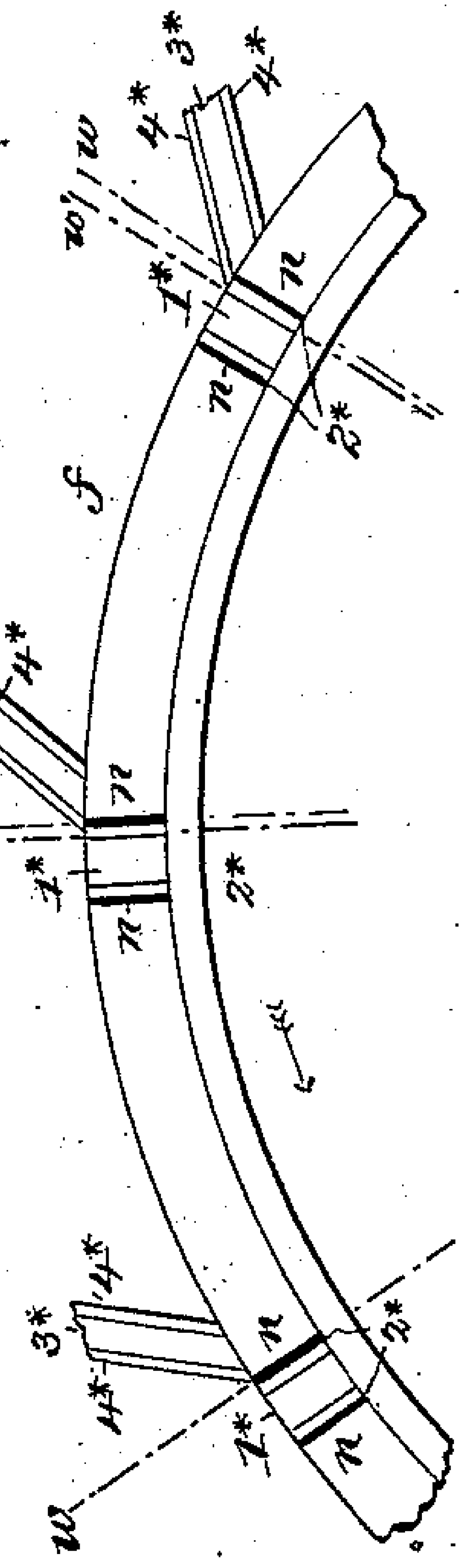

Fig. 6

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Inventor;
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UNITED STATES PATENT OFFICE.

SYLVANUS LANDER TRIPPE, OF NEW YORK, N. Y.

ELECTRIC-LIGHTING SYSTEM.

SPECIFICATION forming part of Letters Patent No. 555,192, dated February 25, 1896.

Application filed June 21, 1893. Renewed July 31, 1895. Serial No. 557,770. (No model.)

To all whom it may concern:

Be it known that I, SYLVANUS LANDER TRIPPE, a citizen of the United States, and a resident of New York, county of New York, and State of New York, have invented certain new and useful Improvements in Electric Lighting, of which the following is a specification.

My invention, while relating to electric lighting generally, has reference more particularly to that system of electric lighting in which the current is transferred from one to two or more circuits through which it is caused to successively pass in continuous repetition so long as the system is in operation.

In the system of electric lighting thus specified I have found by experiment that while the several lamps in the different circuits can be made to produce a satisfactory light by a much less expenditure of current in the lamp itself than what is required in either the continuous system or in what is known as the "alternating" system, the induced current caused by the closing of the circuits, as the current is transferred from one circuit to another, acts as a resistance to the outward flow of the current in a direct wound or in a separately-excited dynamo, while in a shunt-wound machine it acts to reduce the output of current and partially demagnetize the field, so that with either form of dynamo the engine or other form of motor is required to exert nearly as much power to supply the lamps as is required to supply the lamps in the ordinary continuous or alternating systems.

The object of my invention is to overcome this defect and to provide a system of electric lighting which, while comparatively inexpensive, shall at the same time reduce the cost of producing lights to the minimum.

To these ends the invention consists, first, in an improvement in the means for overcoming or rather obviating the increase of power that is required to produce a given amount of current in those systems of electric lighting in which a plurality of circuits are alternately opened and closed, and, second, in various constructions and combinations of parts entering into my improved system of electric lighting, all as will hereinafter more fully appear.

Referring to the accompanying drawings, which show certain embodiments of my invention, Figure 1 is a diagrammatic view of a dynamo and four electric circuits, with a device for transferring the current and a series of shunts, both constructed and arranged in accordance with my invention, applied in connection therewith; Fig. 2, a plan view of a current-transferring device of my improved construction; Fig. 3, an end view thereof looking from the right in Fig. 2; Fig. 4, a transverse vertical section of such transferring device, taken in the plane $x\,x$ of Fig. 2; Fig. 5, a longitudinal sectional view of the cylinder of the transferring device taken axially of the same; Fig. 6, a sectional detail of portions of such cylinder and of the brushes co-operating therewith, showing the arrangement of the latter with respect to the former; Fig. 7, a plan view of the surface of the cylinder of the current-transferring device developed upon a plane; Fig. 8, a perspective detail of one of the brushes, and Fig. 9 a perspective detail showing a slightly-modified construction of non-conducting segment upon the cylinder of the current-transferring device.

In all the views like letters and figures of reference are employed to designate corresponding parts.

A indicates a source of electric energy and a, a', a^2, and a^3 four electric circuits which receive their currents from the source of energy through a conductor a^4, and return them thereto either by grounding their other terminals or by connecting them to a return-conductor a^5, which extends back to the same. The source of energy may be either a dynamo, a primary battery, or a storage-battery, as may be preferred. When a dynamo is employed, any of the well-known forms may be adopted. I prefer, however, to make use of those forms in which the field-magnets are excited by separate means, as such magnets are not then affected by the induced currents set up in and traveling back along the several circuits as they are successively closed, and the evil effects of the induced currents are confined to the increased resistance in the supply-wire.

In each of the several circuits a, a', a^2, and a^3 I have shown a number of lamps a^6, which are connected in multiple arcs, and the number in each is preferably, though not necessarily, the same as that of the others in the several circuits.

The current issuing from the source of energy A and traveling outward along the conductor a^4, instead of passing through the several circuits $a\ a'\ a^2\ a^3$ of the series simultaneously, is interrupted at the point where it enters such circuits, and is transferred from one to another in succession throughout the series and then back to the first in continuous repetition, and so on. The means for effecting the interruption and transfer of this current may be of various forms. I prefer, however, to make use of a rotating device B, which is located in the several circuits, as shown, for instance, in Fig. 1, and serves both as a switch and transformer for the current as it comes from the source of energy. The construction of this device which I have found the most desirable in practice is best shown in Fig. 2, and consists of a cylinder C, which is provided around and along its periphery with a series of conducting and non-conducting segments *e f*, respectively, arranged in alternation and in spiral lines, as illustrated more clearly in Fig. 6. As thus constructed, this cylinder is mounted in suitable bearings *c c*, so as to be capable of rotation therein by power applied to the pulley c', and co-operates with a series of brushes $d\ d'$, the brushes d' of which series are connected with the several circuits, while the brush *d* of such series is connected with the conductor a^4, leading from the dynamo or other source of energy.

In the formation of the cylinder C any of the usual well-known materials possessing a high degree of electrical conductivity may be employed. I prefer, however, to make use of soft cast-iron for the purpose, and in its construction to build it up from a series of disks $g\ g'\ g^2\ g^3\ g^4$ of that material which are arranged side by side upon its supporting-shaft *h* and secured together by bolts *i i* passing transversely through them, as illustrated in Figs. 4 and 5. The bolts *i i* when employed are, as is well understood, provided with the usual heads and nuts whereby to force the disks closely together and hold them in that relation, and in addition to these bolts the disks, some or all, are or may be provided with setscrews *k* passing through their hubs and contacting at their inner ends with the shaft *h*, whereby to hold such disks firmly thereto, but these, as well as the bolts, while affording a convenient means for securing the disks together and holding them firmly to the shaft are not essential to my invention and may be omitted and other equivalent devices employed in lieu thereof when found convenient or desirable.

To the surface of the cylinder C are secured by screws or otherwise the conducting-segments *e* and non-conducting-segments *f*.

The conducting-segments *e* may be constructed of any of the well-known materials which permit of the ready flow of the electric current therethrough—such, for instance, as brass, copper, iron, or other equivalent substances—it only being essential that the material employed be such as to withstand whatever wear that may be entailed upon it by the brushes and permit of the flow of the current with as little resistance as is possible. In the exemplification of the invention shown in the drawings they are constructed of different materials having different degrees of conductivity. When thus constructed the best results have been accomplished by making their middle or central portions of brass and their edges of German silver, since the resistance offered thereby to the flow of the current when the edges of the segments are brought under and carried away from the brushes tends to prevent the objectionable sparking which usually results where a circuit carrying a considerable volume and tension of current is closed and broken, while the central or middle portions of the segments, which are made of brass, permit of the ready flow of the current therethrough without offering any considerable resistance thereto. The construction of these conducting-segments *e* are best shown in Figs. 3, 4, and 6, 1* indicating the central portion of brass, and 2* the German-silver strips secured to both edges of the same. In some cases I have united the German-silver strips to the brass strip by solder, and in others I have left them separate. I prefer, however, to unite them by solder, but either course may be pursued and the parts operate with efficiency. As thus constructed, the segments *e* are disposed around the periphery of the cylinder C in zones $l\ l'\ l^2\ l^3$, &c., four being shown in the present instance, with the segments of each zone following one another at equidistances around the same.

The segments of the several zones instead of being arranged in longitudinal lines along the surface of the cylinder or at random are so placed thereon that the segments *e* of the zones l' are slightly in rear of those on the zone *l*, the segments *e* on the zone l^2 slightly in rear of those on the zone l', and the segments *e* on the zone l^3 slightly in rear of the segments on the zone l^2, and so on, the series of segments *e* on the several zones thus assuming practically spiral lines along the cylinder, with the space between the rear edges of the segments of one zone and the forward edges of the segments of the adjoining zones, traveling back in a direction opposite to that in which the cylinder is rotated, substantially that of the width of the surface of the brush that bears upon it. The segments *e* of the several zones $l\ l'\ l^2\ l^3$, &c., being thus secured to the surface of the cylinder C, are all in electrical connection, as they are with the continuous conducting-surface *m*, which receives the current from the dynamo or other source of supply and transmits it to the cylinder and through it to the several segments *e* thereon.

The non-conducting segments *f* may be made from any of the well-known non-conducting materials that will withstand the wear incident to the brushes bearing thereon, or from the same material as either the cylinder itself or the conducting-segments *e*, in which last two-mentioned cases it becomes necessary to insulate them from the cylinder and from the conducting-segments that are in close relationship thereto. In Figs. 2 to 6, inclusive, these segments are shown as made from non-conducting material, vulcanized fiber and lignum vitæ being the material from which I have heretofore constructed them. When these materials or their equivalents are employed, I preferably fashion them in the form of segments of an annulus of the proper diameter and secure them, by screws or otherwise, to the surface of the cylinder C intermediate of and so as to alternate with the conducting-segments *e*, with strips of mica *n* interposed between their edges and the edges of the conducting-segments with which they adjoin to prevent the burning of or damage to the former edges by sparking should any take place at those points. In Fig. 9, on the other hand, I have illustrated such non-conducting segments as made from the same material as the cylinder itself or from the same material as the middle portions on the conducting-segments *e*. When thus constructed, the material employed is likewise formed in the shape of segments *f'* of an annulus of the proper diameter and secured to the surface of the cylinder C by screws or other equivalent means, with insulating material *o n'* interposed between their inner sides and the periphery of the cylinder and between their respective edges and the edges of the segments *e* adjacent thereto. Either of the forms of non-conducting segments thus described may be adopted that is preferred, and when applied to the cylinder C they form, with the conducting-segments *e*, a practically smooth surface around the entire periphery thereof.

The brushes *d'*, which co-operate with the conducting-segments *e*, may be made of copper, carbon, or any of the usual materials that are availed of for that purpose. In the embodiment of the invention illustrated in the drawings copper and German silver have been selected. When these materials are employed, I find it advantageous to make the middle or interior portion 3* of the brush of copper, and the front and back portions 4* thereof of German silver. These materials, when so used, are preferably superposed the one upon the other, as shown, for instance, in Figs 2 to 5, inclusive, and are so proportioned that the surface of the brush that bears upon the cylinder is of substantially the same thickness as the width of the conducting-segments *e*, with the middle or copper portion 3* and the German-silver portions 4* of substantially the same thickness as the middle or brass portion 1* and the German-silver portions 2* of such segments, respectively. By thus constructing the brushes of two metals having different degree of conductivity, with the metal having the greatest resistance on the front and back, the flow of electric current, which is comparatively free when the copper and brass portions of the brushes and conducting-segments respectively are in contact, is resisted by the German silver on the two, when the front edges of the segments are brought under the brushes, and their rear edges leave the same as they are carried forward by the rotation of the cylinder C, and the sparking that would ordinarily result on these occasions thereby mitigated, if not altogether obviated.

For supporting the brushes *d'*, however constructed, I employ the holders *q*, which are provided with suitable seats *q'*, in which such brushes rest, and are adjusted toward and from the cylinder C by screws q^2 passing through the upturned portions q^3 of such holders. In some cases these screws may engage directly with the ends of the brushes. I prefer, however, to interpose between their inner ends and the ends of the brushes adjacent thereto springs q^4, which may be made either of metal, rubber, or other resilient material, whereby to insure a bearing at all times between them and the cylinder C. (See Fig. 4.) In addition to the parts thus described these holders are provided with sockets or connections q^5 q^6 for reception of conducting-wires which may be held therein by screws q^7 q^8, respectively, and also provided, when desired, with springs q^9, which, secured to the face of the holder by screws q^{10}, (see Fig. 8,) bear with their free ends upon the brushes near the points where they contact with the cylinder for preventing them from trembling and breaking contact with the cylinder when the latter is in operation. As thus constructed, the brushes *d'* and their holders *q* are arranged opposite the several zones l l' l^2 l^3, &c., and are held in these positions by bars *r*, to which they are secured, as shown in Figs. 2, 3, 4, and 7, being insulated therefrom by the interposed non-conducting material *r'*. For supporting these bars and holding them rigidly in place I make use of the brackets D, which are secured to the base-plate or other convenient part of the machine a short distance outside the ends of the cylinder C, and are each provided with a slot *s* of curvilinear form, extending around its upper portion in concentricity to the axis of said cylinder, and receives the ends of such bars *r*, which are secured therein by nuts *s'* screwed upon such ends.

When the transferring device is used in connection with light currents, a single brush *d'* opposite each of the several zones of conducting-segments *e* will suffice, and these will preferably be arranged with their inner ends in a line parallel to the axis of the cylinder C. When, on the other hand, it is employed in connection with heavier currents a plurality of these brushes, arranged one behind the other opposite each of the zones of segments and connected together by suitable conductors, will be found desirable if not absolutely essential. In the drawings I have shown three of these brushes thus arranged, the inner end of each of the corresponding brushes in the several groups of threes throughout the series being disposed in a line parallel to the axis of the cylinder C, as is the case with the several brushes when only a single brush opposite each of the zones is employed, or as will be the case when a duplication, a quadruplication or more thereof is adopted.

The several brushes d' being arranged along the cylinder C, as above specified, their disposition around the same when a plurality opposite each zone of segments are employed will preferably, though not necessarily, be such that when the foremost brush of one group is brought into contact with one conducting-segment e on the cylinder C, the next brush of that group behind it will be brought into contact with the next succeeding segment e on the same zone, and so on throughout the group, each additional brush employed being arranged to contact with the next succeeding segment to that with which the next preceding brush of the group is brought. As thus arranged, the several brushes d' of each group are connected by suitable conductors v, which, secured at their ends in the sockets q^5 by screws q^7, extend from one brush to the other, as shown more clearly in Figs. 1 to 4. By thus providing for the employment of either a single brush d', or a plurality of such brushes opposite each of the zones of segments on the cylinder C, I am enabled not only to graduate the cross-section of the brushes to the particular volume of current to be transmitted—whether light or heavy—but also at the same time to so divide up the amount that is to delivered by each of the zones of segments e to its respective brushes that the portion received by each brush shall be so relatively small as to reduce the sparking at the point of contact of the brush with the segments to the minimum, if not obviate it altogether. In order, however, to further overcome the sparking at the instant of making and breaking contact between the brushes d' and the segments e, when a plurality of such brushes opposite each of the zones of segments is made use of the several brushes of each of the groups, while disposed one behind the other so as to contact with successive segments e in the same zone, have the distance between them such that when the foremost one has left a segment e the next succeeding brush slightly overlaps its segment, and, when a third brush is employed, that brush overlaps its segment still more. This arrangement of the brushes d' is best shown in Fig. 5, where the broken lines w show the adjoining edges of the conducting-segments e and the non-conducting segments f, and the broken lines w' the extreme front ends of the several brushes in the group. From this illustration it will be seen that the foremost brush of the group, or the one to the left in that figure, has just left the conducting-segment e, while the next brush to the right overlaps its conducting-segment some little distance, and the brush to the extreme right overlaps its segment e still more, the distance at which these last two-mentioned brushes overlap their respective segment e being indicated by the distance between the two broken lines w w' at the points where they respectively intersect the periphery of the segments.

The several brushes of the groups being arranged and connected as above described, and the extreme forward end of each of the corresponding brushes in the several groups being disposed in a line parallel to the axis of the cylinder, as before explained, with the spaces between the rear edges of the conducting-segments e of one zone and the front edges of the conducting-segments of the next zone being substantially that of the thickness of the brushes d', it follows that immediately the foremost brush d' of one group leaves a conducting-segment e of its respective zone the foremost brush of the next group beside it engages with a conducting-segment e of its respective zone, and the current that ceased to flow through the former brush when it left its conducting-segment begins to flow through the latter brush. The result of this transfer of current from one brush to another would be to cause a sparking at both the points of making and breaking contact, especially where heavy currents were being carried, if it were not for the fact that, although the foremost brush in the group had left its conducting-segment e, the two brushes behind it in the same group are still in contact with their respective conducting-segments and still allow of some of the current passing therethrough, so that until these brushes leave their segments, which they do in succession, the current is allowed to flow through some of the brushes of two adjacent zones of segments at the same time, and thereby effects a more gradual transfer of current from one group of brushes to another than would be the case if the brushes in rear of the foremost one of each group were omitted. Not only is the transfer of the current from one group of brushes to another thus gradually effected by the arrangement of such brushes with respect to the conducting-segments on the cylinder, but the German-silver strips on the edges of the brushes and the conducting-segments, respectively, having as they do an increased degree of resistance over what is possessed by the interior portions of the segments and brushes, also aid in making the transfer of the current more gradual by the increased resistance they afford to its flow.

The same result as that last specified may also be accomplished when a single brush d' is employed opposite each zone of conducting-segments by simply making the brushes of a slightly greater thickness than the spaces between the rear edges of the conducting-segments e of one zone and the front edges of the conducting-segments e of the next zone, the brushes at the time of transferring the current from one brush to the other being thereby both in contact with their respective segments.

The contact of the brushes with the segments that are about to be broken, when a plurality of such brushes are employed opposite each of the zones of segments, or the brush with the segments when only a single brush opposite each zone is made use of, only continues until the current begins to flow easily through the contact just made, when it gradually ceases to flow through the former in consequence of the brushes in that group parting company with their respective segments e.

To still further aid in preventing the sparking when the transfer of the current from the brush or brushes of one zone of segments to the brush or brushes of another zone of segments is effected, the brushes d' of the several zones of segments, in addition to being connected to the several circuits $a\ a'\ a^2\ a^3$, &c., respectively, are connected together by the conductors $z\ z'\ z^2\ z^3$. The connection of the brushes to the circuits $a\ a'\ a^2\ a^3$, &c., is effected by securing the wires of the latter in the sockets q^6 of the holders of the former by screws q^8, while the connection of the brushes of one zone of segments to the brushes of another zone is accomplished by securing the ends of the conductors $z\ z'\ z^2\ z^3$ in the sockets q^5, with the conductors v, by the screws q^7. In making this connection between the brushes of the several zones of segments the conductor z will preferably extend between the brushes of the zones of segments l and l', the conductor z' between the brushes of the zones of segments $l'\ l^2$, the conductor z^2 between the brushes of the zones of segments l^2 and l^3, and the conductor z^3 between the brushes of the zones of segments l^3 and l, as shown more especially in Figs. 1 and 2. By thus connecting the brushes of the several zones of segments the tension and strain on the circuits formed and broken is more nearly equalized and the transfer of such current from one circuit to another is made with less shock and consequent sparking than has heretofore been possible with the constructions hitherto in use. In some cases, especially where light currents are availed of, the conductors $z\ z'\ z^2\ z^3$ may be employed without resistances; but where heavier currents are employed I find it convenient to interpose resistances z^6, which may be in the shape of lamps or other materials possessing the proper degree of resisting properties.

The brush d, by means of which the current is supplied to the cylinder C, may be of any of the well-known forms and materials usually employed in dynamos and electric motors, and is held in contact with the continuous conducting-surface m of the cylinder by a holder m', which is secured to one of the brackets D or other convenient part of the machine. This brush-holder is provided with a socket m^2 for reception of the conductor a^4, which is held therein by a suitable screw m^5, all as is common with dynamos and other electrical machines.

The several parts being constructed and arranged as above explained and the cylinder C rotated, a current of electricity supplied by the conductor a^4 will be repeatedly transferred from one to another of the brushes of the several zones $l\ l'\ l^2\ l^3$, &c., and back to the first, in succession, as long as such cylinder is in rotation. As a result of this operation, a series of pulsations of current is caused to pass successively through the several circuits $a\ a'\ a^2\ a^3$, &c., and through the lamps a^6 therein, which pulsations, if repeated with sufficient frequency, will maintain the lights in the several circuits in a constant and uniform glow so long as the cylinder is in operation without any breaks or interruptions in them.

The current coming from the dynamo or other source of supply being thus divided up among the several circuits in the manner specified, I am enabled to supply a far greater number of lamps from a given amount of current than has been possible with the continuous or alternating systems heretofore in use; but while this is the case as regards an increase in the number of lamps that may be supplied, the power required to produce the current is also increased to a considerable degree. The cause of this increased consumption of power may be thus explained: With a transferring device, and with circuits and brushes arranged as above described, the actual contact of the brush with the conducting-segment in the closing-circuit is made prior to the actual break in the preceding circuit, and that as the induced current produced by the making of contact is in a direction opposite to that of the current in the closing-circuit, upon which its entire force is spent, it requires at each contact an expenditure of power at the engine or other motor to overcome it. These induced currents constantly recurring react as a steady force upon the dynamo or other source of current, and thereby to that extent increase the power necessary to produce a given amount of current. I have discovered, however, that by carrying over a shunt from the main supply or other current to the several circuits direct, whereby the current traveling thereover avoids the reduction of voltage caused by the action of the transferring device, I am able to overcome or neutralize this objectional result by a very small expenditure of current and thereby reduce the power required to supply the given current to the minimum. The particular arrangement or parts by means of which this increase of power is obviated is best illustrated in Fig. 1, and consists of the shunts b, which extend across directly from the main supply-conductor a^4 to the several circuits $a\ a'\ a^2\ a^3$. In some cases these shunts are unprovided with any resistances other than what is possessed by the conductors themselves. I prefer, however, to interpose a suitable resistance b' in each, which may be an ordinary rheostat, a coil of German-silver wire, or a number of lamps. When the lamps are employed they will preferably be arranged in multiple arcs, and the number made use of will be dependent upon the length of the several lamp-circuits in use.

The cylinder C, being made up from a number of soft cast-iron disks $g\ g'\ g^2\ g^3\ g^4$, arranged side by side and bolted together, as before explained, while affording an exceedingly cheap and convenient form of construction, likewise serves as a reservoir for the current and acts as a sort of cushion thereto as the same is transferred from one circuit to another. In most cases its capacity for that service will be sufficient without other assistance. When, however, it is not adequate for that purpose I sometimes find it advantageous to interpose in the main supply-conductor a^1, intermediate the shunts and the transferring device, an electromagnet E, around which such conductor is coiled, as shown in Fig. 1.

Instead of carrying the shunts b over from the main supply-conductor a^1 to the several light-circuits, I may, if I so desire, carry it over from a separate dynamo or other source of current.

Although in the foregoing I have described the best means contemplated by me for carrying my invention into practice, I wish it distinctly understood that I do not limit myself strictly thereto, since it is obvious that I may modify the same in various ways without departing from the spirit thereof—as, for instance, instead of making the current-transferring device in the form of a cylinder I may, if I so desire, make it in the form of a disk, with the conducting and non-conducting segments secured to the face thereof. Again, although I have described my invention as applied to electric lighting, it is obvious that certain of the features are applicable to other forms of electric apparatus, and where capable of being applied thereto I intend so to apply them.

Having now described my invention and shown certain of the ways in which it is or may be carried into effect, what I claim as new, and desire to secure by Letters Patent of the United States, is—

1. The combination, with a dynamo or other source of electric current, and a plurality of circuits, of a transferring device for changing the current from one circuit to another, and a series of shunts for neutralizing the induced current by allowing a portion of the supply-current to pass directly to the first-mentioned circuits without being transformed by passing through the transferring device, substantially as described.

2. The combination, with a dynamo or other source of electric current, and a plurality of circuits, of a transferring device for changing the current from one circuit to another, a series of shunts for allowing a portion of the current passing directly to the first-mentioned circuits without passing through the transferring device, and resistances interposed in such shunts, substantially as described.

3. The combination, with a dynamo or other source of electric current, and a plurality of circuits of electric lamps, of a transferring device for changing the current from one circuit to another, and a series of shunts interposed between the main supply-conductor and the circuits for allowing a portion of the current passing directly to such circuits without passing through the transferring devices, and resistances interposed in the shunts, substantially as described.

4. The combination, with a dynamo or other source of electric current, and a plurality of lamp-circuits, of a transferring device for changing the current from one circuit to another, a series of shunts for allowing a portion of the current passing directly to the first-mentioned currents without passing through the transferring device, and an electromagnet interposed in the main supply-conductor, substantially as described.

5. The combination, with a rotating cylinder provided with a series of zones of conducting-segments arranged along the same in spiral lines, of a plurality of brushes arranged opposite each zone of segments, conductors for connecting the brushes of each zone together, and a plurality of circuits to which the brushes of the several zones are respectively connected, substantially as described.

6. The combination, with a rotating cylinder provided with a series of zones of conducting-segments arranged along the same in spiral lines, of a plurality of brushes arranged opposite each zone of segments with the distance between the brushes of each zone slightly less than that between successive conducting-segments of such zone, conductors for connecting the brushes of each zone and the brushes of the different zones, and a plurality of circuits to which the brushes of the different zones are respectively connected, substantially as described.

7. A cylinder for a transferring device for electric currents made up from a series of soft cast-iron disks arranged side by side and secured together, and provided upon its periphery with a series of conducting-segments arranged in zones and disposed in spiral lines around the same, and with a series of non-conducting spaces between such segments, substantially as described.

In testimony whereof I have hereunto set my hand this 16th day of June, 1893.

SYLVANUS LANDER TRIPPE.

Witnesses:

WM. E. TREFCER,

W. C. HAUFF.