M. H. GREENEWALT.

RHEOSTAT.

APPLICATION FILED DEC. 10, 1919.

1,357,773.

Patented Nov. 2, 1920.

2 SHEETS—SHEET 1.

Fig. 1.

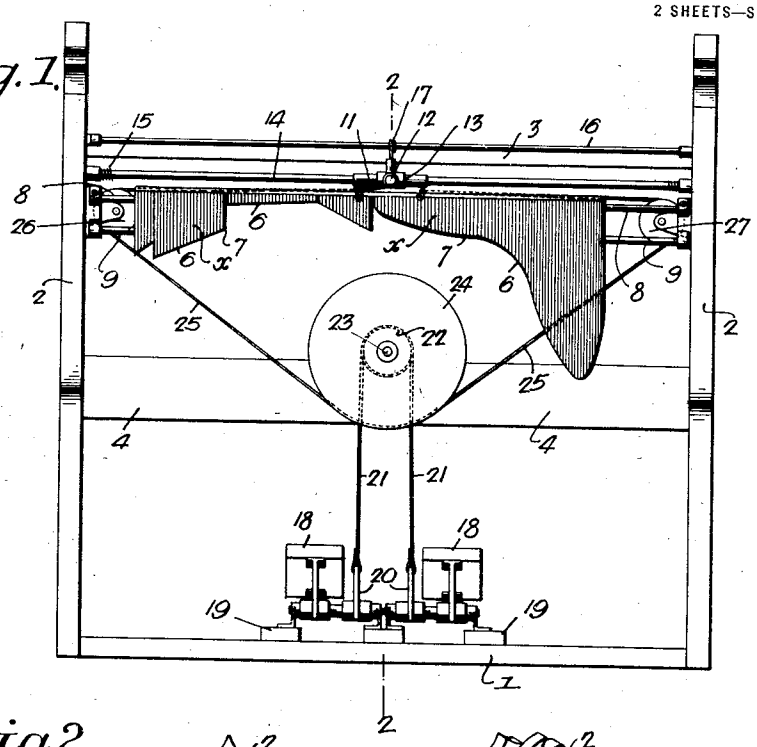


Fig. 2.

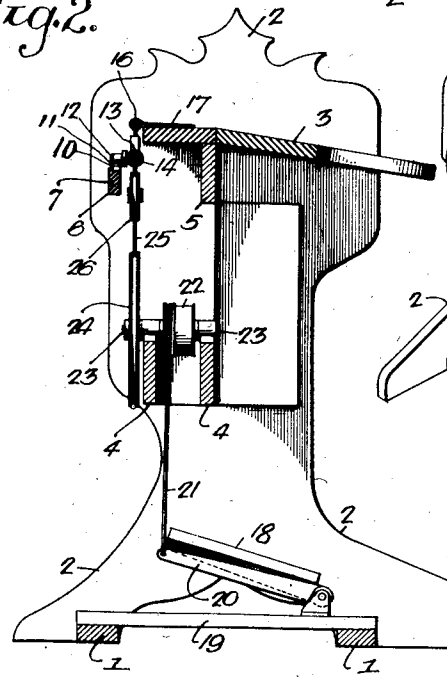
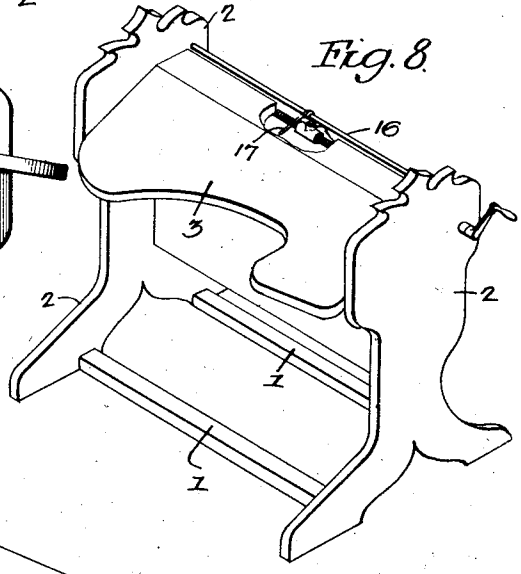


Fig. 8.



Inventor:—

Mary Hallock Greenewalt

by her Attorneys—

Howson & Howson

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2 SHEETS—SHEET 2.

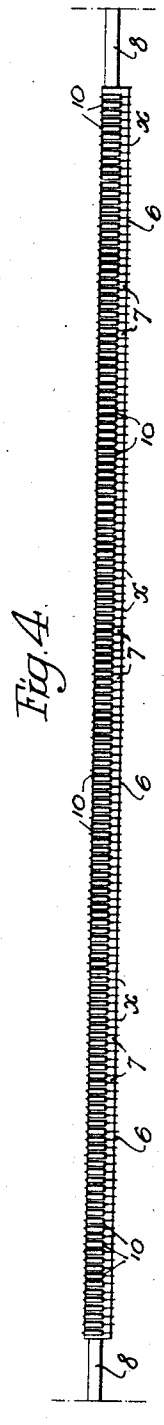

Fig. 4.

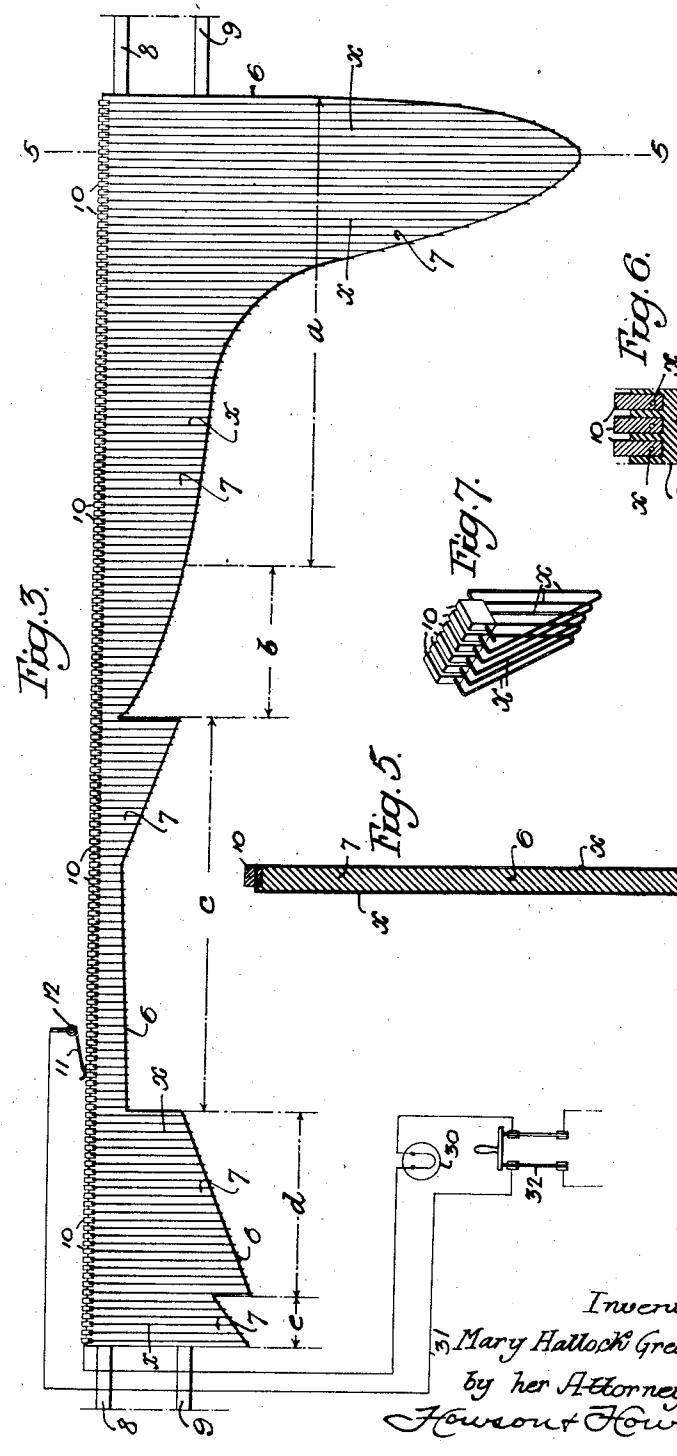

Fig. 3.

Fig. 6.

Fig. 7.

Fig. 5.

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UNITED STATES PATENT OFFICE.

MARY HALLOCK GREENEWALT, OF PHILADELPHIA, PENNSYLVANIA.

RHEOSTAT.

1,357,773. Specification of Letters Patent. Patented Nov. 2, 1920.

Application filed December 10, 1919. Serial No. 343,823.

To all whom it may concern:

Be it known that I, MARY HALLOCK GREENEWALT, a citizen of the United States, residing in Philadelphia, Pennsylvania, have invented Rheostats, of which the following is a specification.

It has been found that for a light capable of giving forth thirty two thousand six hundred and ninety seven milli-lamberts of brightness as many as two hundred and sixty seven perceptible gradations, and in a light having a capacity of nine hundred and eighty seven and ninety four hundredth milli-lamberts of brightness, as many as eighty-six perceptible gradations in the full intensity of the light emitted, may be produced by properly varying the intensity of said light from that value existing when the lamp is operated at its rated capacity or full candle power, to that value which is just sufficient to cause it to pass from a condition of absolute darkness to one in which it begins to give forth light; and one object of my invention is to provide means especially designed to vary the brightness of a lamp or the light it gives forth by amounts capable of causing the minimum perceptible variations in the intensity of such light between the limits of operation above-noted.

The invention further contemplates a rheostat including a resistance element of that form and construction which shall primarily accomplish the above ends; be compact and substantial of a commercially practicable design; relatively simple as regards the aggregate number and arrangement of its parts, and at the same time include a series of contact blocks and a movable contact member adapted for operation by human, mechanical or automatic power.

It is also desired to provide novel means for portably or permanently mounting a resistance element and its movable contact, together with a convenient mechanism whereby said contact may be actuated by the movement of any suitable part of an operator's body to vary the current flow in a light circuit, in such manner that the intensity of a lamp connected in such circuit shall be caused to vary by the least perceptible increments, between the limits of its full candle power and absolute darkness; the invention further contemplating the provision of means for indicating to the operator the relative intensity of the light emitted from the lamp when the movable contact member occupies any particular position.

Another object of my invention is to provide a novel foot operated mechanism for actuating the movable contact or slider of a rheostat primarily designed to vary the current in a light circuit, in such a manner that the intensity of the light emitted by a lamp in said circuit may be increased or decreased at will by the least perceptible increments, in the manner required, or in obedience to a light score such as forms the subject of my invention set forth in patent application Serial No. 318,393, filed August 18, 1919.

These objects and other advantageous ends I attain as hereinafter set forth, reference being had to the accompanying drawings, in which,

Figure 1 is a rear elevation of a light player table equipped with my invention.

Fig. 2 is a transverse vertical section on the line 2—2, Fig. 1.

Figs. 3 and 4 are respectively a side elevation and a plan, to some extent diagrammatic, illustrating the resistance element of my rheostat;

Fig. 5 is a transverse vertical section on the line 5—5 Fig. 3;

Fig. 6 is an enlarged fragmentary vertical section illustrating one means of mounting the contact members of the rheostat.

Fig. 7 is a diagrammatic perspective view illustrative of the detail construction of the resistance member, and

Fig. 8 is a perspective view illustrating my player table as equipped with hand operating means.

In Figs. 1 and 2 of the above drawings, 1—1 represent the base members and 2 the side members of a light player table which has a flat, slightly inclined top 3, and includes longitudinally extending bracing members 4—4 and 5. The first two of these consist of two parallel bars connecting the middle portions of the sides 2, and the last is a bar extending underneath the table top 3. Supported by any suitable means between the sides 2 to the rear and below the table top 3, is a resistance element 6, which preferably consists of a flat elongated and vertically mounted core of predetermined section and outline, hereafter described more particularly, carrying a winding of resistance wire *x*. This core, which is of insulating material, is supported upon a bar 8, extending between the sides 2 and is also

partially carried upon two other bars or rods 9 parallel with the bar 8 and projecting toward each other from said sides.

Mounted by, upon, or embedded in the flat top of the insulating core 7 is a series of equally spaced contact members 10 in the form of parallel metallic blocks or plates extending in a straight line between the sides 2 of the player table and forming what may be called a light scale keyboard.

In this case the contact blocks are of proper size and spacing to make their aggregate length such that a movable contact slidably coöperating with them is conveniently operated by hand or foot power provided by an operator positioned in front of the table, though obviously said contact may be automatically actuated by suitable means without departing from my invention.

The material constituting the resistance body, while possibly having its cross section varied in different zones of the resistance element consists in the present instance of a single length, and its sections are connected at intervals with or tapped to, the contact blocks or plates 10, which are spaced apart, and except for such connections, insulated from each other.

Said contact or slide 11 in the present instance has form of a spring strip carried by a pin or arm 12 projecting from a slide 13 guided on or held in place by a rod 14 supported between the sides 2 so as to operate in a line parallel with the general line of the contacts 10, and engage their sides or top faces.

At the ends of the rod 14 are mounted a pair of coil springs 15 designed to prevent the slide 13 from striking violently against said sides 2, and insure the noiseless action of the entire mechanism. In order to hold the slide with its contact 11 in the proper position relatively to an indicating scale, when the keyboard or contact surface of any rheostat is out of sight, I may extend from it a relatively stiff loop or turn of wire, and guide this upon a second rod 16 parallel with the rod 14, the loop having an end projected laterally, and immediately adjacent the flat portion of the sloping top of the table 3 to constitute an indicator 17, designed to coöperate with any desired scale and color indicator formed on said top and corresponding to the subdivisions of the rheostat.

For moving the slide 13 with its contact member 11, in the preferred form of my invention, I provide pedals 18 hinged or pivoted to a supporting structure 19 carried by the base member 1 of the table, and having arms 20 respectively connected to and movable with them. A flexible belt or cord 21 extends from the free end of one arm 20 around a drum 22 mounted on a spindle 23 carried by the bars 4 of the frame and from thence back to the second arm 20;—the arrangement being such that the depression of a pedal 18 through said cable 21 rotates the drum 22 in one direction and raises the other pedal, while the depression of this latter pedal in turn rotates the drum 22 in the opposite direction and elevates the first pedal. Though I have shown two pedals only, this motion may be divided among any number of pedals to give the foot muscles finer control. These pedals may be weighted or cushioned or in any manner so adjusted as to help the muscles to a less rigid more fluid and flexible control.

Fixed to the shaft 23 in the vertical plane including the guide bar 14, I mount a pulley wheel 24 and connect one end of a belt or cord 25 to one end of the slide 13, extending it from thence around a pulley 26 mounted at one side of the table, around the pulley 24, thence around a second guide pulley 27 adjacent the opposite side of the table, and so to the second end of the slide 13. The various parts are so proportioned and connected that the full depression of one of the pedals through its possible range of movement, will result in a movement of the slide 13 with its contact 11 from one end of the series of contact blocks 10 to the other, while the similar depression of the other pedal, will move said slide and contact for the same distance in the opposite direction. Obviously it is possible to thus move the contact 11 from any position upon the series of fixed contacts to any other position thereon, and that at a speed which may be varied at the will of the operator. The pedals may be multiplied and placed agreeably to the strength and sensitiveness of the foot muscles, and their capacity for lateral movement, to accomplish the ends above indicated and in the manner and time desired.

In connecting the apparatus, the block at one end of the series of contacts 10 is connected through a suitable conductor to the incandescent lamp 30 or to a series of lamps aggregating equal power, whose light is to be varied, while the movable contact 11 is connected through a second conductor 31 to one terminal of a double pole cutout switch 32, another of whose terminals is connected to said lamp, the contact being also connected to a suitable current source.

As is understood by those skilled in the art, it is possible to calculate or determine the current flow in an electric lamp necessary to cause the intensity of its light to be varied by the least visible increments, and while for a lamp of 1500 watts there may be two hundred and sixty-seven such least perceptible steps between the limits of full candle power and complete darkness, a 75 watt light may have as many as 86 perceptible differences to the eye.

The current flow necessary to cause these perceptible variations in the emitted light, will widely vary between the limits of that necessary to cause the lamp to begin to emit light and that required to operate the lamp at its full or normal rated candle power. The necessary difference of power for perception at the dark end of the light may be that to yield as low as thirty hundredths of a milli-lambert of illumination, while toward the middle range it may be fifty-eight and two tenths milli-lamberts, and at the brightest end of the light five hundred and forty milli-lamberts. For a 75 watt light, the difference in power may begin at thirty hundredths of a milli-lambert, while at another point it may be twelve, and at the extreme of its brightness it may be twenty-seven milli-lamberts. For lamps of other wattage, the curve of variations due to the varying perceptive possibility of the human eye, its varying visual acuity under different wave lengths through a succession of the least possible increments computed in connection with the dip or power curve of the lamp, will when combined give similarly varying factors.

It is also possible to calculate the resistance which must be placed in series with the lamp to cause the least perceptible variation in the intensity of its light at any particular point of what may be defined as the light scale, extending between the limits noted, and I have designed the resistance winding x on the core 7 and have connected it to the contact blocks 10, so that as the movable contact 11 passes from one of said blocks to that next adjacent, the proper amount of resistance is placed in circuit with the lamp to increase or diminish the intensity of its light by the least increment perceptible to the human eye. Obviously without departing from my invention, any desired form of resistance material may be suitably associated with the contact blocks as long as it is proportioned or divided in accordance with the factors obtained as described and such a body may be of proper capacity to suit it for operation with any required light or lights.

As shown in the drawings, the resistance wire x is arranged in a continuous coil, one or more of whose convolutions or sections is connected between each two adjacent blocks 10, and the length of this material thus included between any two adjacent contact blocks is that possessing such a resistance as will result in current flow through the lamp, necessary to cause the intensity of its light to be varied by the least perceptible increment at that particular part of the light scale.

While any desired means may be provided for making good electrical connection between the convolutions of the resistance wire x and the contact blocks, I have illustrated the latter as having perforations or passages through which said wire is passed, and I preferably sweat or solder said wire to each of the blocks where it passes into or out of the same. Provision is naturally made along the lower curve of the resistance core by means of holes or notches, pins or fastenings for preventing said wires from slipping or getting disordered especially along the curves and the changes therein made necesary by the dip of the light and the other factors herein mentioned.

Whereas more or less of the resistance material may be wound on small spools or otherwise disposed, this would not depart from the actual or implied curve created by the successive variations in resistance required by the dip of the light and other factors. While it is possible to employ a resistance wire x of constant cross section for the entire length of the resistance element, I find it to be more practical and otherwise advantageous to vary such cross section in different parts of the resistance element. In a typical case in which I use a fifteen hundred watt lamp 30 on a one hundred and ten volt circuit, I find it advantageous to employ in a zone a of the resistance element, approximately two hundred and five feet of #18 wire of a well known resistance material, dividing it into two hundred and five turns or lengths, of which two are connected between each adjacent pair of contact blocks 10. This wire is continuous with approximately fifteen feet of #17 wire arranged upon the core in fifty-six turns of which there are also two between each pair of adjacent contact blocks 10. Connected to this second zone b is a third zone c consisting of approximately forty-one feet of #16 wire arranged in one hundred and eighty-two turns of which there are likewise two connected between each pair of adjacent contact blocks. In a fourth zone d I employ approximately twenty-one feet of #15 wire arranged in thirty-three turns, and finally I provide a fifth zone e of about nineteen feet of #14 wire arranged in twenty-three turns, which like those of the zone d are singly connected between adjacent pairs of contact blocks 10.

With this construction, the core may be as deep as 14 inches at the low end of the light and but five-eighths of an inch square at the point of the light's highest efficiency.

It is to be noted that in each instance the lengths of the various sections of wire widely vary as indicated in Fig. 3, their orderly succession illustrating the approximate form of the supporting core upon which they should be wound or mounted within the space available, and in which they will safely perform their functions. The core itself preferably consists of a slab or

flat sheet of insulating material having a straight top enlarged or grooved for the reception of the fixed contacts 10 and having its lower edge conforming to the outline of the curve which illustrates the variation in the resistance necessary to cause such current flow in the lamp as will cause its emitted light to vary by the least perceptible increments as the contact 11 is moved over said fixed contacts.

The top of the table 3 adjacent the pointer or indicator 17 may be marked or graduated in any suitable manner, to provide a light scale or scales so that a performer operating the pedals 18 and observing said indicator may be able to tell at a glance the intensity of the light and color emitted by the lamp in circuit with the rheostat corresponding to any given position of the movable contact member 11.

From the above description it will be appreciated that by means of my rheostat it is possible for an operator to vary by orderly and equal increments the intensity of the light emitted by a lamp, which increments are the least which it is possible for the human eye to perceive, and to increase or decrease the intensity of such light by any desired number of such increments in the manner and in the time desired by the operator. It will further be noted that the lengths and therefore the resistances of the successive convolutions or bodies of the wire x are varied from one end to the other of the resistance element in such manner that at any point between the two limits defined by or dependent on the current necessary to operate the lamp at normal capacity and that necessary to cause its filament to begin to emit light, the movement of the contact 11 from one contact block 10 to the block next adjacent, will cause a minimum perceptible variation in the intensity of the emitted light. The core 7 may be made of such material as plaster of paris, soapstone, asbestos, vulcanized fiber, bakelite, or other material which may be conveniently cut, worked or shaped and reinforced to give it the section necessary for it to properly support the varying lengths of the resistance wire in the relative positions shown.

It is especially to be noted that a vital feature of my invention is the provision or employment of a body of resistance whose sections vary as to their resistance value in accordance with the variations in the curves constituting or illustrative of the resultant of the two factors which determine the differences of current flow in an electric lamp necessary to cause its emitted light to vary by the least perceptible increments. These factors are first,—the dip *i. e.* the curve characteristic of the lamp obtained by noting its behavior or decrease of resistance on decrease of voltage; second, the perceptive ability of the human eye. Moreover, the form or outline of the assembled resistance sections and in some cases of the core upon which it is mounted, is dependent on the above factors modified by the uniform spacing of the contacts.

Obviously without departing from my invention, the blocks 10 may be omitted and the top portions of the wire convolutions serve as the fixed contacts. As shown in Fig. 8 shaft 40 having threads of suitable pitch and number may be turned by the crank 41 or otherwise to move the slider or contact 11 longitudinally of the fixed contacts 10 or their equivalents, for which purpose said slider would have connected to it a nut 42 formed to coöperate with said shaft.

I claim:

1. A rheostat consisting of a body of resistance; a series of contacts connected to said resistance and dividing it into a series of unequal sections arranged to outline a curve illustrative of the resistance changes required to vary the light emitted by a lamp by the least perceptible increments; with a movable contact coöperating with said contacts.

2. A rheostat consisting of a body of resistance; a series of contacts connected to said resistance and dividing it into a series of unequal sections arranged to outline a curve illustrative of the resistance variations required to vary the light emitted by a lamp by the least appreciable increments; a movable contact coöperating with said fixed contacts; and foot actuated means for operating said movable contact.

3. A rheostat consisting of a supporting structure; a length of resistance wire; a series of fixed contacts connected to the wire so as to divide it into a series of sections having different resistances; a contact slidably engaging the contacts of said series; operating pedals; and means connecting said pedals with said slidable contact for adjusting at will its position relatively to the fixed contacts.

4. A rheostat consisting of a supporting structure; a length of resistance wire; a series of fixed contacts dividing the wire into a series of sections having different resistances; a core supporting said convolutions and having an outline approximately conforming to that of a curve illustrative of the resistance variations required to vary the light emitted by a lamp by the least perceptible increments between the limits of invisibility and normal candle power; with a movable contact coöperating with said fixed contacts.

5. A rheostat consisting of a body of resistance material; contacts connected to said body and dividing it into the number of sections required to vary the light of a lamp

by the least perceptible increments between the limits of invisibility and full candle power; a contact movable to coact with said contacts and foot actuated means for adjusting said movable contact in either direction to any desired extent upon the fixed contacts.

6. The combination in a rheostat of a supporting structure; a core of insulating material mounted thereon and approximating the outline of a curve, illustrative of the resistance variations required to vary the current flowing through an incandescent lamp in such manner as to vary the light emitted thereby by the least appreciable increments; a continuous length of wire wound on said core; a series of contacts connected to said wire and arranged at substantially uniform distances apart; a movable contact mounted to coöperate with said fixed contacts; and foot actuated mechanism for adjusting the position of the movable contact at will.

7. The combination of a supporting structure; a series of uniformly spaced contacts; a body of resistance wire connected to said contacts and extending therefrom in a series of sections having the resistances required to vary the current flowing to an incandescent lamp by the amounts necessary to cause the light emitted to be varied by the least perceptible increments; a core of insulating material carried by said structure and immovably supporting said sections; and a movable contact coöperating with the fixed contacts.

8. The combination of a table including a top; a laterally extending series of contacts; resistance material connected to said contacts; a movable contact coöperative with said fixed contacts; with foot actuated means for adjusting the movable contact, consisting of a plurality of pedals; a pulley connected to be rotated thereby; and a flexible member operatively associated with said pulley and connected to said movable contact.

9. The combination of a supporting structure; a series of fixed contacts supported thereby in a substantially horizontal line; a guide adjacent said contacts; a slide operative on said guide; a movable contact connected to said slide and in engagement with the fixed contacts; a pulley; a flexible member associated with said pulley and connected to the slide; with pedals flexibly connected to turn the pulley in either direction at will.

10. The combination in a current varying device of a movable current varying member; with pedals connected to respectively move said member in opposite directions.

11. The combination with a lamp of a rheostat including a series of uniformly spaced contacts; a movable contact coacting therewith; with a series of resistance sections respectively connected to the series of contacts and arranged to define a curve dependent for its outline on the uniform spacing of said contacts, the dip of a lamp, and the curve efficiency of the human eye.

12. The combination of an incandescent electric lamp and a rheostat in circuit therewith including means for varying the light emitted by said lamp by definite steps to cause it to change by the least perceptible increments.

In witness whereof I affix my signature.

MARY HALLOCK GREENEWALT.