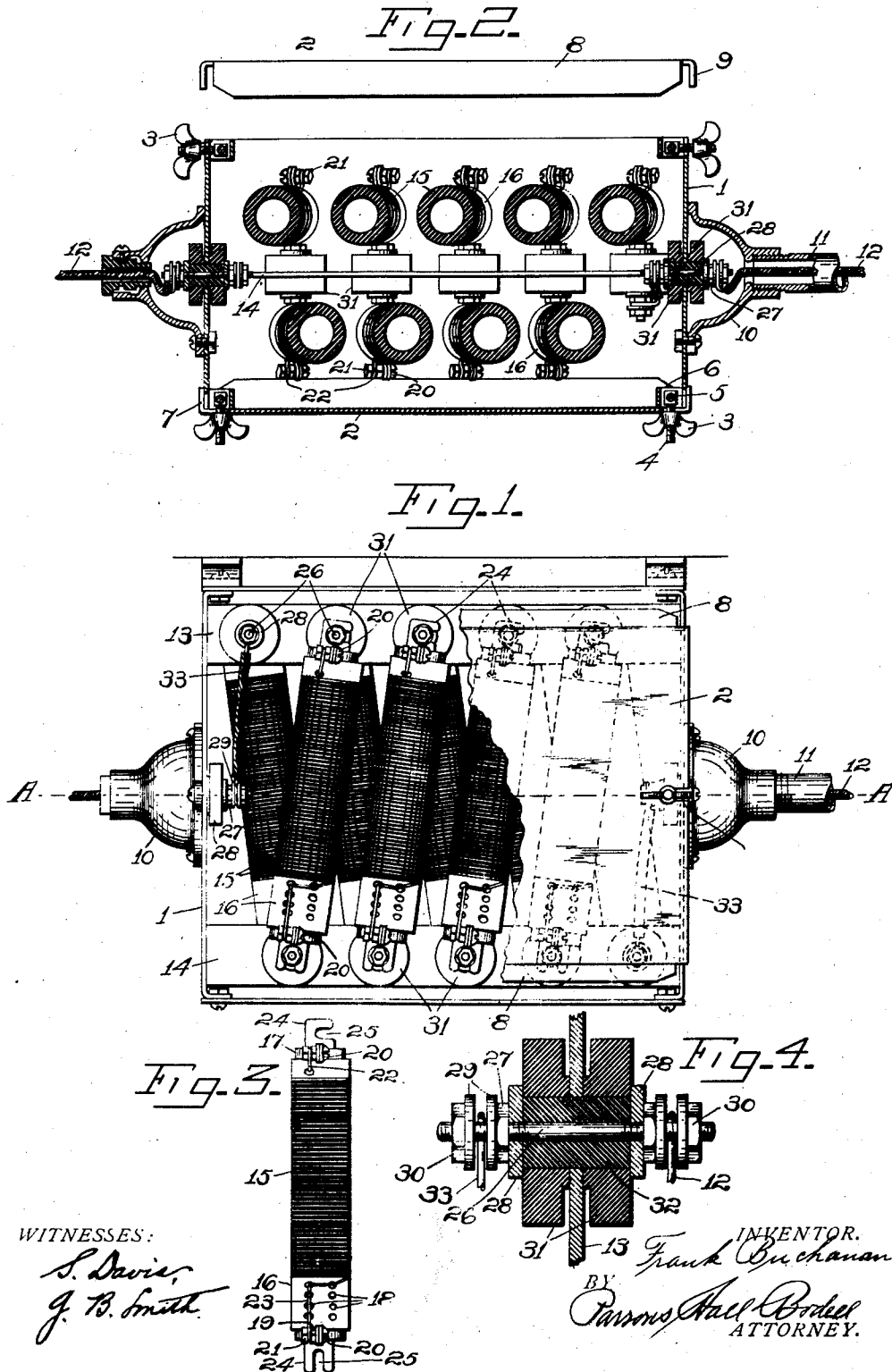


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ELECTRICAL RESISTANCE.
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Patented Dec. 17, 1912.



WITNESSES:

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ELECTRICAL RESISTANCE.

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Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, FRANK BUCHANAN, of Syracuse, in the county of Onondaga and State of New York, have invented a certain new and useful Electrical Resistance, of which the following is a specification.

This invention has for its object the production of an electrical resistance which is particularly simple in construction, and highly efficient in use; and it consists in the combinations and constructions hereinafter set forth and claimed.

In describing this invention reference is had to the accompanying drawing in which like characters designate corresponding parts in all the views.

Figure 1 is a side elevation, partly broken away, of one form of my resistance. Fig. 2 is a transverse sectional view on line "A—A," Fig. 1, one side of the case or box being shown as displaced. Fig. 3 is a detail view of one of the resistance units. Fig. 4 is an enlarged sectional view of one of the supporting and electrical connections.

My electrical resistance comprises, generally, a plurality of resistance units, each being detachably supported independently of the others and being detachably connected electrically to the others so that any one thereof may be readily removed and replaced, the units being supported within a suitable case or box.

In the illustrated embodiment of my invention, the units are connected together at their opposite ends and include terminal clips which form part of the means serving to electrically connect each unit with the adjoining units and to also mechanically support the units. Preferably the means electrically connecting adjoining units also serves to mechanically connect the units to suitable supporting means.

1 is the case or box, preferably having removable sides 2 which are held in position by suitable means as wing nuts 3 turning on screws 4 which are pivoted at 5 to lugs 6 supported by the end walls of the case or box, the screws being movable on their pivots in slots 7 in the side walls 2, into and out of effective position. The screws and wing nuts 3 are shown in operative position at the bottom of Fig. 2 and as out of operative position at the top thereof.

The side walls 2, are here shown as formed

with inturned flanges 8 at their upper and lower edges which extend into the box and with flanges 9 at their sides which overlap the end walls. The side walls terminate short of the top and bottom of the case, as seen in Fig. 1, forming ventilating spaces at the top and bottom, and the resistance units are preferably arranged in upright positions so that the heat from each unit can pass upwardly through the ventilating space at the top without coming in contact with any of the other units.

10 are fittings secured to the end walls of the case by means of which conduits, as 11, inclosing the electric circuit wires 12, may be connected to the resistance box.

13, 14 are supporting means for the resistance units, the supporting means being here shown as bars arranged near the top and bottom of the box and extending lengthwise thereof.

15 are the resistance units arranged in series and detachably supported independently of each other, each unit comprising terminal clips at its opposite ends for detachable connection with the clips of the adjoining units, the terminal clips not only coacting with connecting means, presently described to electrically connect each unit in circuit with the next units, but also coacting with said means to mechanically connect the unit to the supporting means 13, 14, the clips of adjoining units having portions opposed to each other and preferably extending on opposite sides of the bars, and the opposed portions being electrically connected by means passing transversely through the opposing portions of the clips and the interposed supporting bars.

As here shown the resistance units are arranged in a double row on opposite sides of the supporting bars 13, 14 and the units of each row are serially connected alternately with the units of the other row, the units of the rows inclining in opposite directions out of the vertical, and thus adjoining units incline in opposite directions.

In the illustrated embodiment of my invention, each resistance unit comprises a spool 16 of insulation, a wire resistance coil wound around the spool and terminal clips 17. Preferably each of the spools is formed with a plurality of peripheral transverse holes 18 arranged in a series lengthwise of the spool, these holes being for the purpose

of attaching the end of the last coil to the spool, and if the unit is to be of minimum resistance, the last coil terminates at the hole farthest removed from the end of the spool, and the end of such coil is looped through the hole to prevent unwinding of the coil. If the unit is to be of greater resistance, the last coil may terminate in any one of the remaining holes. Each terminal clip includes clamping means in the form of a split ring for engaging a reduced end portion of the spool, the sections of the ring being drawn together by a nut and bolt 19, 20, the bolt having an extra nut 21 thereon which coacts with the nut 19 and bolt 20 to form a binding device to which one end as 22 or 23 of the coil is connected. Each terminal clip also includes a lug 24 arranged at an angle to the clamping ring and formed with an open ended slot 25 for the purpose to be presently described, the slot of the clip at one end as the lower end of the unit, opening through the end of the lug and that of the upper end of the unit, opening through the side of the lug. The arrangement of the lugs 24 facilitates the placing and attaching of the unit in position and the engagement thereof with the connecting means by which the units are secured to the bars 13, 14 and are electrically connected together.

26 is a connecting member between the opposing lugs 24 of adjoining units, said member extending transversely through such opposing lugs 24 and the interposed bar 13 or 14 and having nuts 27 on its opposite end portions which turn against washers 28 bearing directly against insulation means to be presently described.

29 are a pair of washers on each projecting end of the member 26, one member 29 of each pair bearing against the contiguous nut 27.

30 are nuts turning on the member 26 against the outermost washers of each pair 29 for pressing said washers against and clamping the interposed lugs 24 tightly in position.

The insulating means previously referred to for the connecting member 26 comprises a pair of disks 31 arranged on opposite sides of the bar 13 or 14 and mounted concentric with the corresponding connecting member 26 on a bushing 32 on said member 26, the bushing extending the full width of both disks and the washers 28 bearing against the end faces of the bushing and the disks.

A connecting member 26 and associated parts are mounted on each end wall of the case 1 for connecting the incoming and outgoing wires to the first and last resistance units 15. Said members 26 on the end walls are connected to the first and last units 15 respectively by conductors 33. This arrangement of the connecting member with its insulation is particularly advantageous

in that the connecting member is thoroughly insulated and protected from water which might otherwise percolate between the disks to the connecting member and cause disintegration of the connecting member. In this resistance, if the coil of one unit should become broken or burned out, a repair can be easily made by removing the sides 2 of the case, thus exposing all of the units so that the defective unit can be readily seen, removing the defective unit by loosening the outer nuts 29 at the upper and lower ends of such unit, swinging the upper end of the unit laterally out of engagement with the corresponding connecting member about the lower connecting member as a pivot and when the upper lug 24 has been disengaged from its connecting member, lifting the unit to disconnect the lower lug 24 from its connecting member. The reverse of this operation takes place in inserting a new unit. Although the units are here shown as arranged in upright positions, obviously they may be arranged in any other position.

What I claim is:

1. An electrical resistance comprising supporting means, a plurality of conducting supporting members carried by said means independently of each other and electrically disconnected from each other, corresponding portions of the members projecting laterally from the supporting means, and a plurality of separable resistance units including a terminal in electrical connection with the conductor of the resistance unit and detachably engaging the projecting portion of one of the supporting members, each supporting member electrically connecting and supporting a pair of the terminals, and said terminals being engaged with the projecting portions of the supporting members and detached therefrom independently of each other and without manipulation of said supporting means, substantially as and for the purpose described.

2. An electrical resistance comprising supporting means, a plurality of conducting supporting members carried by said means independently of each other and electrically disconnected from each other, corresponding portions of the members projecting laterally from the supporting means, a plurality of separable resistance units including a terminal in electrical connection with the conductor of the resistance unit and detachably engaging the projecting portion of one of the supporting members, each supporting member electrically connecting and supporting a pair of the terminals, and said terminals being engaged with the projecting portions of the supporting members and detached therefrom without manipulation of said supporting means, and means mounted on said projecting portions and movable endwise thereof for clamping the terminals

in position thereon, substantially as and for the purpose specified.

3. An electrical resistance comprising supporting means, a plurality of conducting supporting members carried by said means independently of each other and electrically disconnected from each other, corresponding portions of the members projecting laterally from the supporting means, a plurality of separable resistance units including a terminal in electrical connection with the conductor of the resistance unit and detachably engaging the projecting portion of one of the supporting members, each supporting member electrically connecting and supporting a pair of the terminals, and said terminals being engaged with the projecting portions of the supporting members and detached therefrom without manipulation of the supporting means, insulating means at the bases of said projecting portions, said means projecting laterally from the supporting means, and means on the projecting portions of the supporting members for clamping the terminals in position thereon against the insulating means, substantially as and for the purpose set forth.

4. An electrical resistance comprising supporting means, a plurality of conductors carried by said means independently of each other and electrically disconnected from each other, both ends of the conductors projecting laterally from the supporting means, and a plurality of separable resistance units including a terminal in electrical connection with the conductor of the resistance unit, a terminal of one resistance unit detachably engaging the projecting end of one of said plurality of conductors, and a terminal of another resistance unit detachably engaging the other projecting end of said conductor, said terminals being engaged with and removable from the projecting ends of the first-mentioned conductors independently of each other and without manipulation of the supporting means for said conductors, substantially as and for the purpose described.

5. An electrical resistance comprising supporting means, a plurality of conductors carried by said means independently of each other and electrically disconnected from each other, both ends of the conductors projecting laterally from the supporting means, a plurality of separable resistance units including a terminal in electrical connection with the conductor of the resistance unit, a terminal of one resistance unit detachably engaging the projecting end of one of said plurality of conductors, and a terminal of another resistance unit detachably engaging the other projecting end of said conductor, said terminals being engaged with and removable from the projecting ends of the first-mentioned conductors without manip-

ulation of the supporting means for said conductors, and means mounted on the projecting ends of the first-mentioned conductors and movable endwise thereof for clamping the terminals in position, substantially as and for the purpose set forth.

6. An electrical resistance comprising supporting means, a plurality of conductors carried by said means independently of each other and electrically disconnected from each other, both ends of the conductors projecting laterally from the supporting means, a plurality of separable resistance units including a terminal in electrical connection with the conductor of the resistance unit, a terminal of one resistance unit detachably engaging the projecting end of one of said plurality of conductors, and a terminal of another resistance unit detachably engaging the other projecting end of said conductor, said terminals being engaged with and removable from the projecting ends of the first-mentioned conductors without manipulation of the supporting means for said conductors, insulating means arranged at the bases of said projecting ends and projecting laterally from the supporting means, and means on the projecting ends of the first-mentioned conductors for clamping the terminals in position thereon against the insulating means, substantially as and for the purpose set forth.

7. An electrical resistance comprising supporting means, a plurality of conductors carried by said means independently of each other and electrically disconnected from each other, both ends of the conductors projecting laterally from the supporting means, a plurality of separable resistance units including a terminal in electrical connection with the conductor of the resistance unit, a terminal of one resistance unit detachably engaging the projecting end of one of said plurality of conductors, and a terminal of another resistance unit detachably engaging the other projecting end of said conductor, said terminals being engaged with and removable from the projecting ends of the first-mentioned conductors without manipulation of the supporting means for said conductors, insulating sleeves surrounding the first-mentioned conductors and extending through the supporting means and projecting laterally from opposite sides thereof, and means mounted on the projecting ends of the first-mentioned conductors and movable endwise thereof for clamping the terminals in position thereon against the insulating sleeves, substantially as and for the purpose described.

8. An electrical resistance comprising supporting means, resistance units each comprising a terminal, the terminals of adjoining units extending on opposite sides of the supporting means, and parts projecting lat-

erally from opposite sides of the supporting means, a part projecting from one side of the supporting means being electrically connected to a part projecting from the opposite side thereof, two electrically connected parts projecting from opposite sides of the supporting means being free to be engaged with the terminals of adjoining resistance units and serving to detachably support and electrically connect said terminals of adjoining resistance units, substantially as and for the purpose set forth.

9. An electrical resistance comprising a plurality of resistance units electrically connected, supporting means for the units, a plurality of said units each comprising a terminal clip for electrically connecting a unit in circuit with the next unit and mechanically connecting the unit to the supporting means, the clips of adjoining units extending on opposite sides of the supporting means, and fastening means including a member extending transversely through the supporting means and the clips and having projecting ends free from the supporting means to permit the ready attachment and detachment of the clips, said member serving to mechanically and electrically connect the clips, substantially as and for the purpose described.

10. An electrical resistance comprising a plurality of resistance units, supporting means for the units, each unit comprising a spool, wire coiled about the spool, and a terminal clip at one end of the spool, the clip having means mechanically supporting the spool and electrically connected with the wire coiled about said spool, the clips of adjoining units extending on opposite sides of the supporting means, and means for mechanically connecting the clips to the supporting means and electrically connecting said clips including a member extending transversely through the supporting means, substantially as and for the purpose specified.

11. An electrical resistance comprising a plurality of resistance units electrically connected, a plurality of said units each comprising a spool, wire coiled about the spool, and a terminal clip, the clip having means detachably engaging the spool and also detachably engaging the coiled wire, and a supporting member detachably engaging the clips of adjoining units for supporting said units, said member forming an electrical connection between the clips to connect the adjoining units in series, substantially as and for the purpose described.

12. An electrical resistance comprising a plurality of resistance units, each unit comprising a spool, wire coiled about the spool, and a terminal clip at each end of the spool, each clip having means for mechanically engaging and supporting one end of the spool

and a binding device for one end of the wire coil, the clips of adjoining units being arranged in positions opposed to each other, and fastening means including a member extending transversely through the opposing portions of the clips for mechanically and electrically connecting the clips of adjoining units, substantially as and for the purpose set forth.

13. An electrical resistance comprising a plurality of resistance units, supporting means for opposite ends of the units, each unit comprising a spool, wire coiled about the spool, and a terminal clip at each end of the spool, each clip having means engaging one end of the spool to support the same, and means for electrical connection to one end of the coil, the clips of adjoining units extending on opposite sides of the supporting means, and fastening means including a member extending transversely through the supporting means and the clips for mechanically connecting the clips to the supporting means and electrically connecting the clips of the adjoining units, substantially as and for the purpose described.

14. An electrical resistance comprising a plurality of units arranged in a double row, supporting means for opposite ends of the units, each unit having terminal clips at its opposite ends for connection with the supporting means respectively, the clips of the units of one row being arranged on one side of the supporting means and those of the other row being arranged on the other side of the supporting means, and means extending transversely through and projecting from the supporting means for electrically connecting the clips of adjoining units and mechanically connecting the clips to the supporting means, substantially as and for the purpose described.

15. An electrical resistance unit comprising a spool, wire coiled about the spool, and terminal clips at opposite ends of the spool said clips having means for clamping the spool and thereby securing the clips to the spool, and means for attaching the spool to supporting means, the clamping means of the terminals also having binding devices associated therewith to which the ends of the coils are connected, substantially as and for the purpose set forth.

16. An electrical resistance unit comprising a spool, wire coiled about the spool, and binding devices at opposite ends of the spool for opposite ends of the wire, the spool being formed with a series of transverse peripheral holes located different distances from one end thereof in any one of which the coiling of the wire may be terminated, substantially as and for the purpose described.

17. The combination of a supporting means having a transverse opening, an in-

5 sulating bushing extending through the opening, insulating disks mounted on opposite ends of the bushing on opposite sides of the supporting means, a metal connecting member extending through the bushing and projecting beyond opposite ends of the same, nuts turning on the connecting member and bearing against the ends of the bushing, and additional clamping members 10 on opposite ends of the connecting member by means of which electrical devices may be secured to the connecting member, substantially as and for the purpose specified.

15 18. A resistance unit comprising a spool, wire coiled about the spool, and terminals including clamping devices for engaging opposite ends of the spool, each clamping device comprising a split collar, and a screw for drawing opposite portions of the split 20 collar together, the screw having means co-acting therewith and constituting the bind-

ing device for one end of the wire, substantially as and for the purpose set forth.

19. In combination, a casing including spaced apart bars, resistance units arranged 25 in a double row on opposite sides of said bars, connecting members held in the bars and projecting on opposite sides thereof, the projecting portions of the connecting members being free from said bars, and 30 means for detachably connecting the ends of said units to the projecting portion of the connecting members.

In testimony whereof, I have hereunto signed my name in the presence of two at- 35 testing witnesses, at Syracuse, in the county of Onondaga, in the State of New York, this 12th day of March, 1912.

FRANK BUCHANAN.

Witnesses:

L. M. DAVIS,
S. DAVIS.