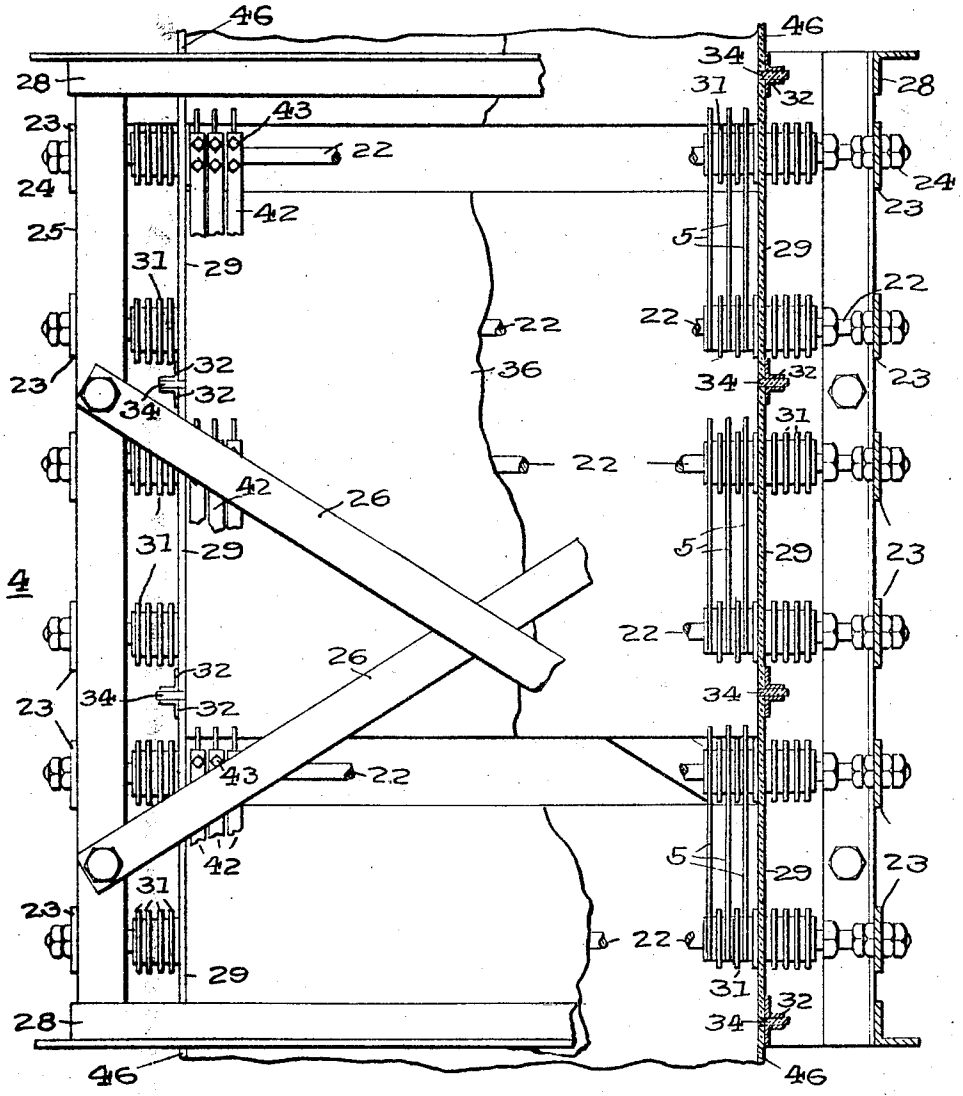
Dec. 1, 1925. 1,563,363

L. J. HIBBARD

RESISTOR

Filed July 22, 1921 3 Sheets-Sheet 1

Fig. 1.



WITNESSES:

R. S. Harrison

H. C. Lowe

INVENTOR

Lloyd J. Hibbard,

BY

Merle G. Carr

ATTORNEY

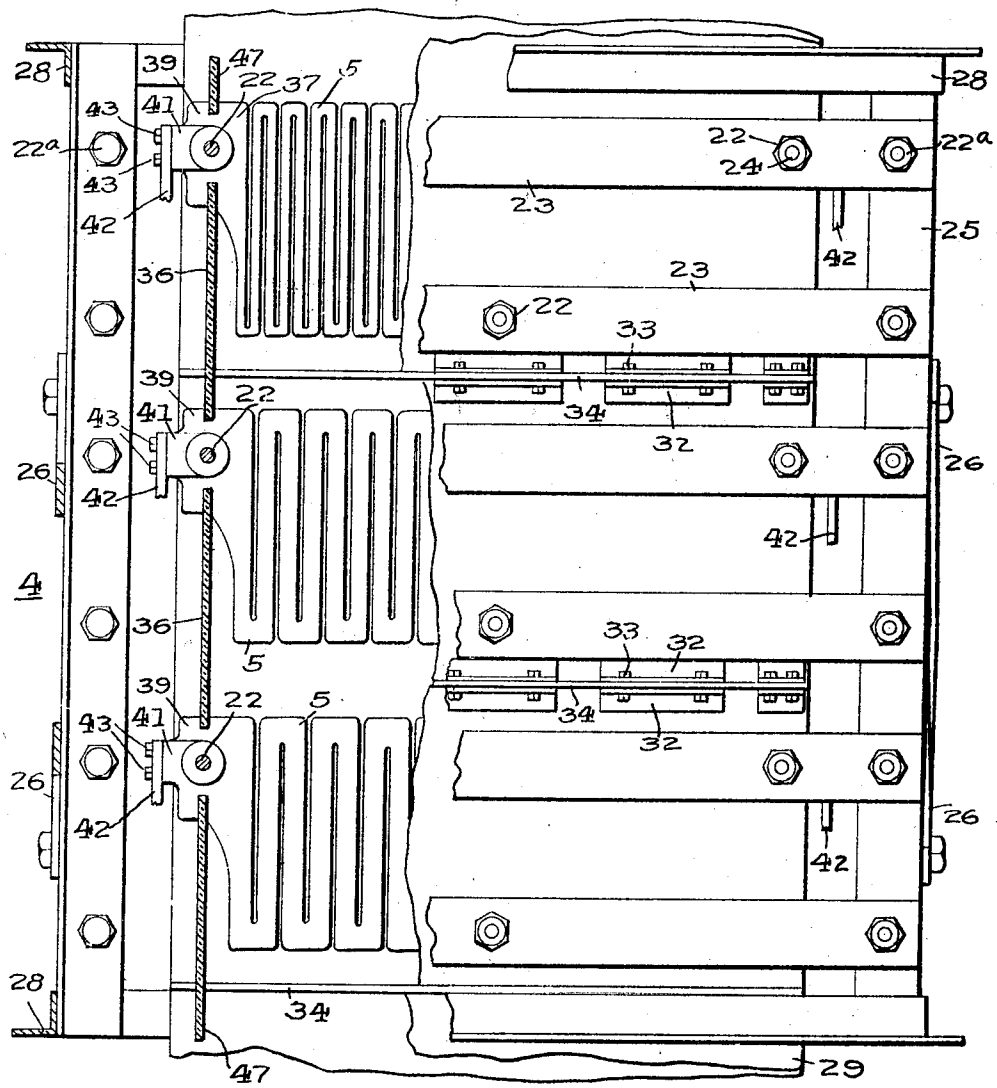
Dec. 1, 1925. 1,563,363

L. J. HIBBARD

RESISTOR

Filed July 22, 1921 3 Sheets-Sheet 2

Fig. 2.



WITNESSES:

R. S. Harrison

H. C. Lowe

INVENTOR

Lloyd J. Hibbard.

BY

Wesley G. Carr

ATTORNEY

Dec. 1, 1925. 1,563,363

L. J. HIBBARD

RESISTOR

Filed July 22, 1921 3 Sheets-Sheet 3

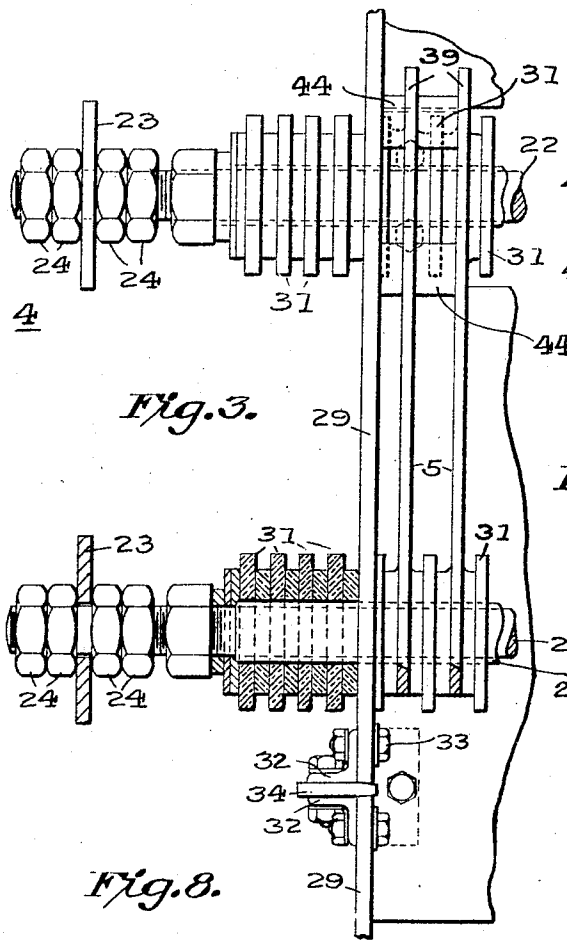


Fig. 3.

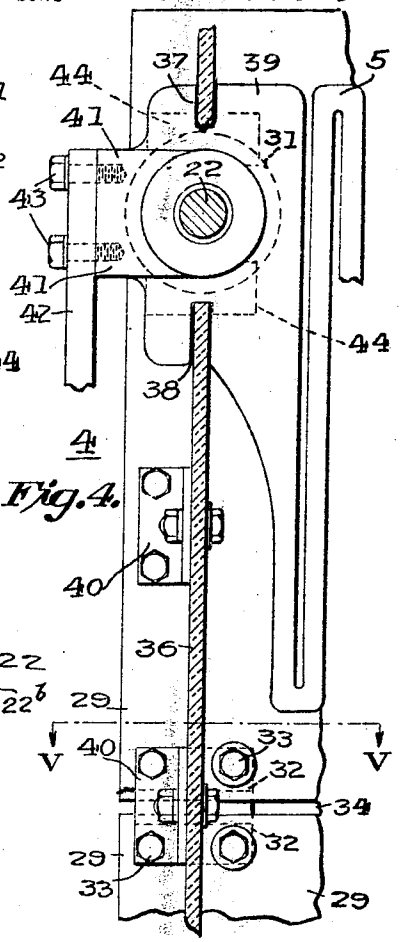
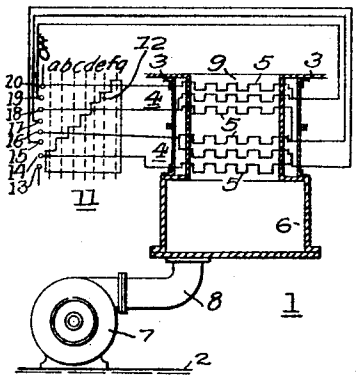


Fig. 4.

Fig. 8.

Fig. 5.



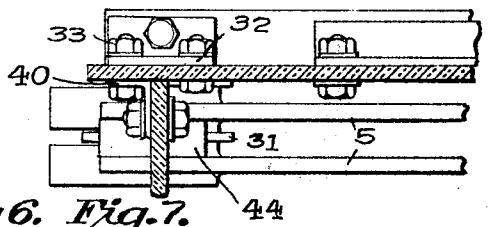
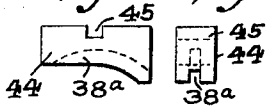


Fig 6. Fig. 7.



WITNESSES:

R. B. Harrison

H. C. Lowe

INVENTOR

Lloyd J. Hibbard.

BY

Merle L. Barr

ATTORNEY

Patented Dec. 1, 1925. 1,563,363

UNITED STATES PATENT OFFICE.

LLOYD J. HIBBARD, OF EDGEWOOD, PENNSYLVANIA, ASSIGNOR TO WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY, A CORPORATION OF PENNSYLVANIA.

RESISTOR.

Application filed July 22, 1921. Serial No. 486,869.

To all whom it may concern:

Be it known that I, LLOYD J. HIBBARD, a citizen of the United States, and a resident of Edgewood, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Resistors, of which the following is a specification.

My invention relates to resistance devices and it has particular relation to resistors employed in control systems for governing the operation of dynamo-electric machines that are located where the space allotted to the control system is relatively limited; for example, underneath the floor of a railway vehicle.

One object of my invention is to provide an improved resistor that will be relatively simple in construction and advantageous and economical in operation.

Another object of my invention is to provide an improved method for cooling resistors.

A further object of my invention is to provide resistor units of the minimum thickness and the maximum surface consistent with mechanical strength and with the ohmic value desired.

Another object of my invention is to prevent overheating of parts of a plurality of grid resistors, thereby causing what is termed "hot spots", while securing as high a temperature rise of the resistors as is consistent with their mechanical strength and with the temperature limits of the insulating material.

A further object of my invention is to so design the resistors that they may be stacked or arranged in any number of sections in a manner corresponding to sectional bookcases.

Briefly speaking, my invention consists in providing resistor units having side walls that are so designed that air can circulate only in a vertical direction past the resistors, and in also providing a blower for circulating air through a compartment adjacent to the resistors and thence past them. The purpose of the compartment is to permit the air pressure to become uniformly distributed over the surfaces of the resistors, thereby preventing certain portions of the resistors from becoming excessively heated.

For a better understanding of my invention, reference may be made to the accompanying drawings,

Figure 1 of which is a view, partly in section and partly in end elevation, of a resistor unit constructed in accordance with my invention;

Fig. 2 is a view, partly in section and partly in side elevation, of the resistor unit shown in Fig. 1;

Figs. 3 to 7, inclusive, are detail views illustrating certain features of my invention; and

Fig. 8 is a view, partly in cross section and partly in side elevation, of a plurality of resistors constructed in accordance with my invention, a controller for connecting said resistors in a control system and a blower device for supplying a cooling fluid to said resistors.

Referring particularly to Fig. 8, my invention is illustrated as applied to a locomotive 1 having a floor 2 and a roof 3. The locomotive is provided with a plurality of resistor units 4 which are superimposed. Each of the resistor units 4 comprises a plurality of grid resistors 5 which are mounted therein in a manner hereinafter more fully described.

A compartment 6, which is positioned below the resistor units 4, is mechanically connected to a blower 7 by a suitable conveyor 8. By employing the compartment 6, the air, or other fluid circulated by the blower 7, is uniformly distributed over the surfaces of the grid resistors 5 and thence, through the opening 9 in the roof 3 of the locomotive, to the outer air.

The grid resistors 5 may be connected in a control system by a controller 11 having an "off" position and a plurality of operating positions *a* to *g*, inclusive. The controller 11 is provided with a suitably configured contact segment 12 and a plurality of control fingers 13 to 20, inclusive.

Upon the controller 11 being actuated to position *a*, all of the resistors 5 are connected in series relation in the control system. When the controller 11 is actuated to position *b*, the lowest row of grid resistors 5 is shunted. Upon the controller 11 being actuated to position *c*, the second row of grid resistors 5 is shunted. Thus, the successive rows of grid resistors 5, beginning

with the bottom row 5 are shunted as the controller 11 is actuated to successive positions, until all the resistors 5 are short-circuited by contact segment 12 when the controller 11 occupies position *g*.

By shunting the rows of resistors successively from the bottom upward, those of the resistors 5 which carry current the longest are nearest the opening 9 in the roof 3 of the locomotive whereby the heat carried from them does not tend to heat the other resistors. By reason of this advantageous arrangement, the minimum possible total heating of the resistor units 4 is ensured.

The method of constructing the resistance units 4 may be better understood by referring to Figs. 1 to 7, inclusive, of the drawings.

In Figs. 1 and 2 of the drawings, the resistors 4 severally comprise a plurality of grid resistors 5 mounted upon a plurality of horizontal rods 22 from which they are insulated by means of any suitable insulating material, such as sheet asbestos 22*b*. The rods 22 are mounted upon a plurality of horizontal members, such, for example, as steel bars or strips 23, being maintained in position by means of nuts 24. The horizontal members 23 have their ends secured to a plurality of vertical members, such, for example, as bars 25, by a plurality of rods 22*a*. Suitable diagonal members, such, for example, as bars 26, are secured to the vertical members 25 for rendering the resistor units 4 more rigid.

A plurality of angle bars 28 are attached to the top and bottom of the vertical members 25 for permitting one resistor unit 4 to be superimposed upon another and to make each resistor unit 4 more rigid.

Near the intersections of the rods 22 with the horizontal members 23, a plurality of flat insulating side members or sheets 29 are provided. Each of the side members 29 is so positioned upon three of the rods 22 that it tends to serve as a spacing member during the assembly of the grid resistors 5, as well as to subsequently confine the cooling fluid that circulates past the resistors 5.

Each grid resistor 5 is separated from the adjacent grid resistor 5 by an annular insulating member 31, which is mounted upon the corresponding rod 22. (See Figs. 3 and 4 of the drawings.)

Each of the side members 29 has attached to its upper or lower edge, or both, angle bars 32, which are secured thereto by means of bolts 33. An asbestos board 34 is positioned between the adjacent side members 29 by the angle bars 32 and bolts 33. The purpose of the asbestos boards 34 is to make the resistor units 4 air tight by filling the gap between adjacent side members 29.

A plurality of side members 36 are positioned on the sides of the resistor units 5 that are at right angles to the side members 29, by slidably mounting the members 36 in grooves 37 and 38 of the enlarged end portions 39 of the grid resistors 5. A plurality of clip angle pieces 40 are provided for securing the side members 29 and 36 the one to the other.

The end portions 39 of the grid resistors 5 are relatively flat and serve to conduct a portion of the heat from the resistors 5. A projecting portion or lug 41, constituting a part of the end portion 39, is provided for electrically connecting an L-shaped terminal member 42 thereto by means of tap bolts 43.

Referring particularly to Figs. 6 and 7 of the drawing, filler blocks 44 are provided to prevent escape of air between adjacent end portions 39 of the grids 5 and the side members 36. Each of the blocks 44 has a vertical groove 45 in its upper surface that corresponds to the grooves 37 and 38 of the end portions 39 of the resistor 5 and a groove 38*a*, in the opposite surface of the block 44, which adapts it to be fitted upon the insulating members 31 that are positioned between the enlarged portions 39 of the resistors 5. The curved portion of each of the blocks 44 conforms to the shape of the enlarged portion 39 of a grid 5.

When one resistor unit 4 is mounted upon another, a plurality of side members 46 are provided for filling the gap between the side members 29 of the upper and lower resistor units 4, and a plurality of side members 47, which are of slightly greater length than the side members 36 and correspond thereto, are employed for filling the gap between the side members 36 of adjacent resistor units 4.

It is apparent that, by my invention, substantially air-tight walls are provided for the resistor units 4 by means of the side members 29 and 36 and the co-operating members adjacent thereto and that air or other fluid may pass over the grid resistors 5 only in a vertical direction. If it were not for the side walls of the resistor units, the air would be deflected by the lower grid resistors and their supporting members and the upper resistor units would receive only a relatively small amount of the circulating air. This condition would cause portions of the grid resistors to become so heated as to lessen their mechanical strength sufficiently to permit them to sag.

Furthermore, it is desirable that air travel over the surfaces of the resistors at as high velocity as possible, thereby tending to much more rapidly cool resistors than if the air traveled at relatively low velocity.

While I have shown my invention in a preferred form, it is apparent that minor changes may be made, for example, in the arrangement of the side walls and the shape

of the resistor units and grids without departing from the spirit of my invention. I desire, therefore, to be limited only by the scope of the appended claims.

I claim as my invention:

1. The combination with a plurality of resistors and means for stacking said resistors, of means for comprising a plurality of vertical walls for enclosing said resistors, and means for circulating a cooling fluid around said resistors.

2. The combination with a plurality of resistors, each of said resistors having an end portion provided with slots, and means for mounting said resistors in side-by-side relation in parallel rows, of a side member adapted to be positioned between rows of said resistors by means of said slots.

3. The combination with a plurality of resistors each of said resistors having an enlarged end portion provided with a plurality of slots, of means comprising a plurality of rods for mounting said resistors in side-by-side relation, a frame for supporting said rods in parallel relation and a plurality of relatively flat members adapted to be positioned near the ends of said resistors by said slots.

4. The combination with a plurality of resistors, each of said units being provided with a relatively large end portion having a plurality of slots, of means for arranging said resistors in parallel rows, said rows being placed one above another, a plurality of side members adapted to be slidably positioned between said rows of resistors by means of said slots in said resistors, and a plurality of relatively small filling members positioned between said resistors and said side members.

5. The combination with a plurality of resistors, of means for mounting said resistors one above another and for substantially enclosing said resistors, means for supplying a cooling fluid through said means to said resistors and means for shunting said resistors in sequence beginning with the lowest resistor.

6. The method of cooling a plurality of resistors that are superimposed one upon another which comprises providing means for surrounding said resistors by a plurality of walls, circulating a cooling fluid between said walls and then shunting said resistors in a predetermined sequence beginning with the lowest resistor and concluding with the top resistor.

7. In a resistor, in combination, a plurality of resistors units, side members carried by each resistor unit, disposed to provide a passage and means for supporting each resistor unit, said supporting means of each unit being adapted for attachment to other units to provide a multiple unit resistor.

8. In a resistor, in combination, a plurality of resistor units, side members carried by each resistor unit, disposed to provide a passage and means for supporting each resistor unit, said supporting means of each unit being adapted for attachment to other units to provide a multiple unit resistor, the side members carried by the different resistor units being disposed for alinement when a plurality of units are assembled thereby to form a continuous passage.

In testimony whereof, I have hereunto subscribed my name this 12th day of July, 1921.

LLOYD J. HIBBARD.