No. 834,424. PATENTED OCT. 30, 1906.

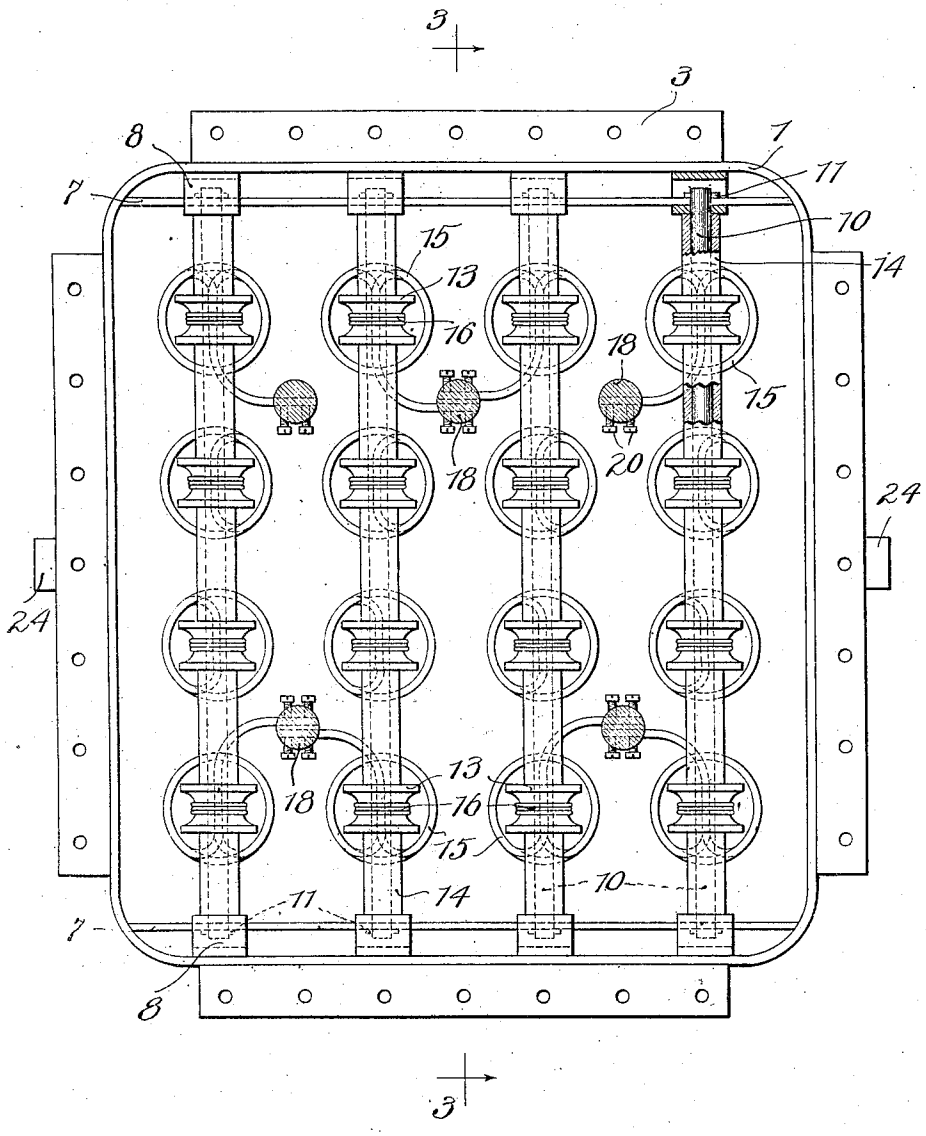
W. L. WATERS.

RESISTANCE DEVICE.

APPLICATION FILED APR. 28, 1905

3 SHEETS—SHEET 1.

Fig. 1.



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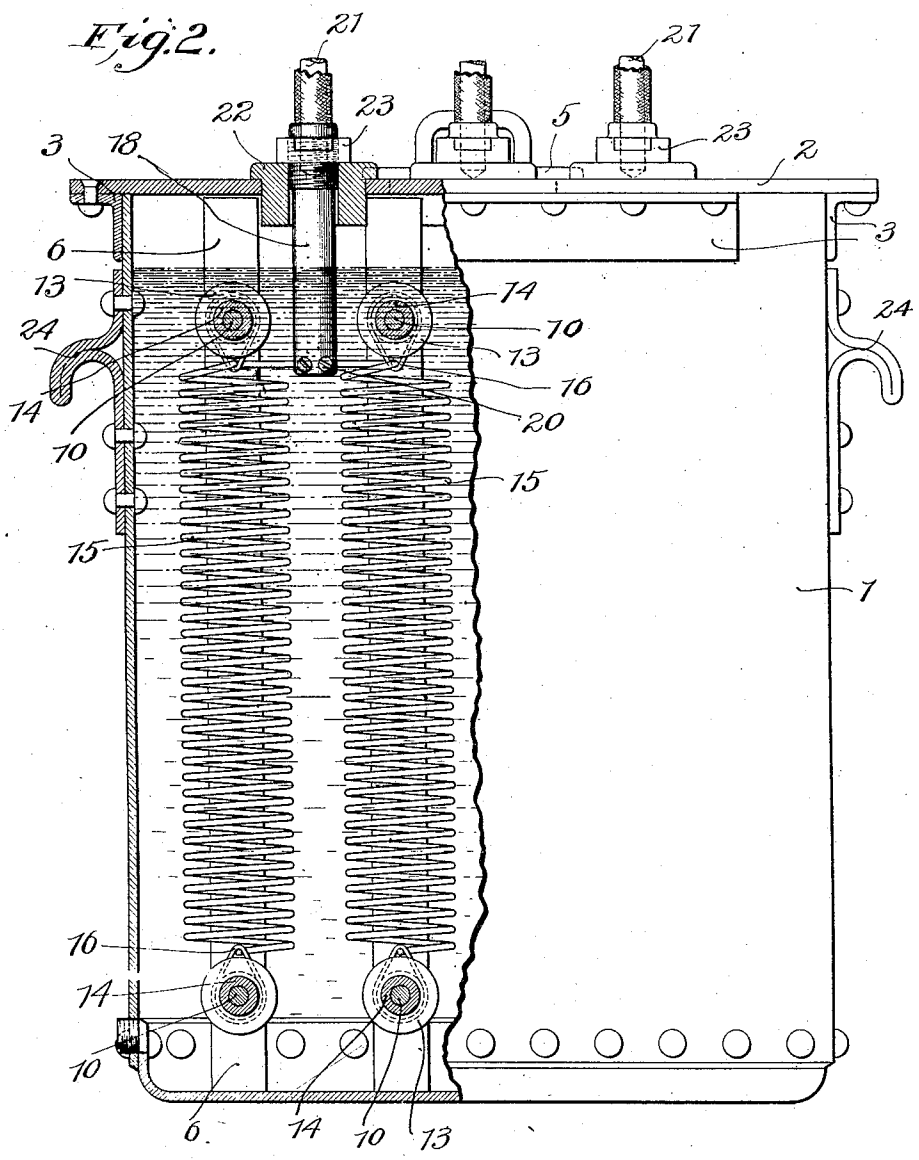
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3 SHEETS—SHEET 2.

Fig. 2.



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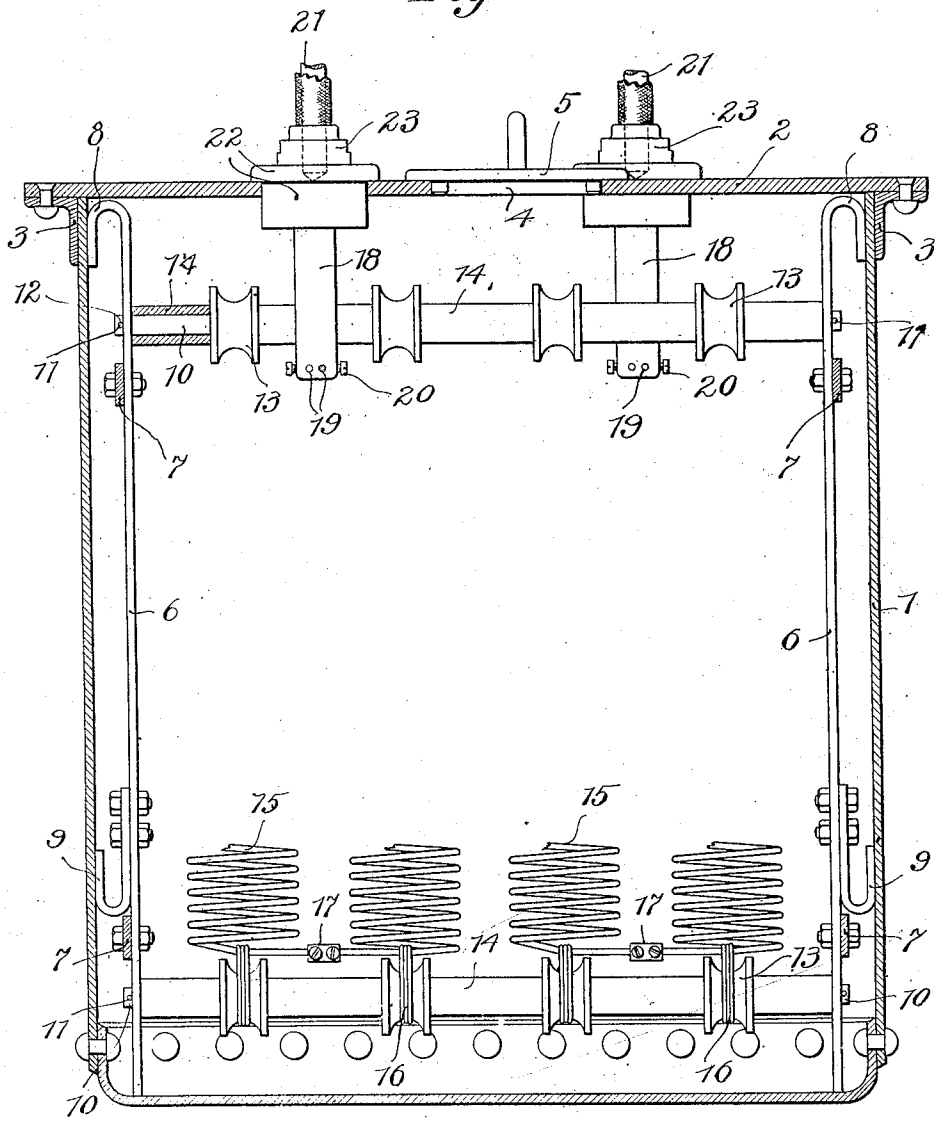
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3 SHEETS—SHEET 3.

Fig. 3.



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UNITED STATES PATENT OFFICE.

WILLIAM L. WATERS, OF MILWAUKEE, WISCONSIN, ASSIGNOR TO NATIONAL BRAKE & ELECTRIC COMPANY, OF MILWAUKEE, WISCONSIN, A CORPORATION OF WISCONSIN.

RESISTANCE DEVICE.

No. 834,424. Specification of Letters Patent. Patented Oct. 30, 1906.

Application filed April 28, 1905. Serial No. 257,837.

To all whom it may concern:

Be it known that I, WILLIAM L. WATERS, a citizen of the United States, residing at Milwaukee, in the county of Milwaukee and State of Wisconsin, have invented a certain new and useful Improvement in Resistance Devices, of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

My invention relates to resistances, and has for its object improved and more efficient means for cooling such resistances.

My invention is of great importance, for instance, in the operation of motor-generators and rotary converters when such machines are started from the direct-current side. In doing this the machine must be run to speed and then synchronized, and when synchronizing the speed must be adjusted very accurately. Where a machine of this kind is run from a traction-circuit, the voltage is very irregular and varies rapidly, and it is a very difficult matter to obtain the exact speed, it usually requiring quite a length of time. The sudden variation in voltage makes it impossible to obtain the correct speed by means of a shunt-rheostat, for instance, as the operation of a device of this kind is not rapid enough. Also, owing to the time it takes to acquire the correct speed, the coils of the shunt-rheostat would have to be in circuit for a length of time and would finally break down.

My invention therefore contemplates a resistance device specially designed for this class of work and which will carry a heavy current for a length of time sufficient for botaining the proper synchronizing speed.

My device consists of wire spirals or coils carried between porcelain insulators, which are again carried on an iron framework, the coil being immersed in a tank of oil.

My invention will be best understood when described with reference to the accompanying drawings, in which—

Figure 1 is a plan view of the device with the cover removed. Fig. 2 is an elevation view, part thereof being in section; and Fig. 3 is a longitudinal sectional view taken on line 3 3 of Fig. 1.

A tank 1 is provided with a cover 2, secured thereto by means of angle-irons 3, the cover being provided with hand-holes 4, having lids 5. The frame for supporting the resistance-coils may be lifted bodily from the tank and consists of similar side supporting members formed of vertical supporting-rods 6, secured together by transverse rods 7. The upper part 8 of each vertical supporting-rod is bent back on itself a distance, as shown, and a similar bent piece 9 is secured to each vertical rod near its lower end, the bend at the top of the rod and the bent piece secured thereto serving to maintain the rods out of direct engagement with the tank-walls. Between the corresponding vertical supporting-rods of the side members and near the top and bottom of the tank are rods or shafts 10, the ends of these rods projecting through openings in the vertical supports and secured in place by means of pins 11, passing through openings 12 through said ends. On each of the rods 10 are placed spools 13, of glass, porcelain, or other insulating material, and these spools are spaced appropriately by means of sleeves 14, also of glass, porcelain, or other insulating material, the spacing of the spools on corresponding upper and lower bars being preferably the same. Between each spool on an upper shaft and the spool directly below on the lower shaft are placed the resistance-coils 15. The application of these coils is best shown in Fig. 2, the end of each coil being engaged by a wire hanger 16, which may be ordinary wire coiled several times about the spool to form a loop through which the coil end may pass. In this manner the coils are entirely insulated, and the supporting-frame, therefore, is in no way secured to the tank or other parts, but can be lifted bodily therefrom and can be taken apart or assembled at the outside, which allows repairs or other changes to be made with rapidity and safety.

Ends of the coils may be suitably electrically connected together by means of connectors 17, while other ends thereof may connect with main terminal posts or lugs 18, these lugs being provided with openings 19 at their lower end, into which the coil ends may pass, and clamping-screws 20 for clamping the ends in position are provided. The upper end of each post or lug is drilled to receive a main conductor or cable 21. These lugs preferably pass upwardly through the

cover, and in order to be insulated therefrom bushings 22, of insulating material, are provided, and the upper part of the lugs may also be engaged by the threaded washer or nut 23 to be held in place. These terminal posts or lugs are connected, by means of the main conductors or cables, with switching mechanism and with the machine to be controlled in a manner well known in the art.

In order to more thoroughly insulate the coils and other parts from each other and also to keep the coils cool, the tank is filled with oil or other insulating fluid. A construction of this kind is practically fireproof and has a very large capacity for heat and can be kept in circuit until the oil reaches a very high temperature without damage resulting in any way, and I find that the temperature of the oil may reach 400° centigrade without harmful results. Hooks or hangers 24 may be secured to the sides of the tank from which it may be suspended. My invention, therefore, is of great importance where a resistance carrying heavy current must be maintained in circuit for any length of time.

I do not wish to be limited to the exact construction and arrangement of the parts herein shown, as changes may readily be made without departing from the spirit of the invention; but

I claim as new and desire to secure by Letters Patent—

1. In a device of the class described, the combination with a tank containing insulating fluid, of a supporting-frame adapted to be removably inserted in said tank, upper and lower supporting-rods for said frame, insulators carried by said rods, spacing members on said rods between said insulators, resistance-coils extending between said upper and lower bars and secured to said insulators, and main terminals extending from said tank and suitably connected with resistance-coils.

2. In a device of the class described, the combination with a tank containing insulating-oil, of a supporting-frame adapted to be bodily inserted in and removed from said tank, horizontal rods at the upper and lower end of said supporting-frame, spools of insulating material on said rods, insulating spacing-sleeves inserted in said rods between said spools, vertical resistance-coils held between said spools and suitably connected together, and main terminal lugs extending through the cover of said tank and suitably connected with resistance-coils.

3. In a device of the class described, the combination with a tank containing insulating-oil, of a supporting-frame adapted to be bodily slid into and out of said tank, vertical side members for said frame, horizontal rods extending between said side members at the top and bottom of the tank, supports of insulating material on said rods, vertical resistance-coils supported between said insulated supporting members and suitably connected together, and main terminals extending through the cover of the tank and suitably connected with resistance-coils.

4. In a device of the class described, the combination with a tank containing insulating-oil, of a supporting-frame adapted to be bodily slid from and into said tank, vertical side members for said supporting-frame, horizontal supporting-rods connected with said side members at the top and bottom of the tank, spools of insulating material surrounding said rods, spacing-bushings of insulating material between said spools, resistance members engaging and extending between corresponding spools, and main terminal lugs extending from said tank for connection with an external circuit and having connection with suitable resistance members.

5. In a device of the class described, the combination with a tank containing insulating-oil, of a supporting-frame within said tank, vertical side rods for said frame, transverse rods connecting said vertical rods together, horizontal rods at the top and bottom of the tank extending between opposite vertical rods, spools of insulating material on said rods, spacers of insulating material on said rods separating said spools, resistance members engaging and suspended between opposite supporting members, and means for connecting appropriate resistance members with an external circuit.

6. In a device of the class described, the combination with a tank filled with insulating-oil, of a supporting-frame therein, vertical side rods for said frame, transverse rods connected together, vertical rods at each side of the tank, horizontal rods at the top and bottom of the tank connected between opposite vertical side rods, spools of insulating material on said rods, spacing-bushings of insulating material on said rods between said spools, resistance members suspended between opposite spools on the upper and lower rods, and terminal lugs for connecting appropriate resistance members with an external circuit.

7. In a device of the class described, the combination with a tank filled with insulating-oil, of a supporting-frame adapted to be slid into and from said tank, side members for said frame composed of vertical rods connected together by transverse rods, horizontal rods at the top and bottom of said tank extending between opposite side rods, spools of insulating material on said horizontal rods, spacing-bushings of insulating material on said rods between said spools, resistance members suspended between the opposite spools on opposite upper and lower horizontal rods, a cover for said tank, and terminal lugs extending through said cover for engagement

with an exterior circuit and having connection with suitable resistance members.

8. In a device of the class described, the combination with resistance members, of a supporting-frame therefor, side members for said supporting-frame composed of vertical rods connected together by transverse rods, upper and lower horizontal supporting-shafts extending through the corresponding vertical rods of the side members of the frame, spools of insulating material on said horizontal shafts between which said resistance members are supported, and bushings of insulating material on said horizontal shafts for spacing said spools.

9. In a device of the class described, the combination with resistance members, of a supporting-frame therefor, vertical side members for said supporting-frame, horizontal supporting-shafts extending at their ends through openings in said side members and secured in place by means of pins, spools of insulating material on said horizontal shafts between which the resistance members are suspended, and bushings of insulating material on said shafts for spacing said spools.

10. In a device of the class described, the combination with resistance members in the form of wire spirals, of a supporting-frame therefor, side members for said supporting-frame composed of vertical rods connected together by transverse rods, horizontal supporting-rods at the upper and lower ends of said supporting-frame engaging corresponding vertical rods of the side members, spools of insulating material on said rods, said resistance members being suspended between opposite spools on the upper and lower horizontal supporting-rods, bushings of insulating material on said horizontal rods for spacing said spools, and main terminal lugs adapted for connection with an external circuit and with suitable resistance members.

11. In a device of the class described the combination with resistance members, of a supporting-frame therefor, said frame having side members connected together by horizontal supporting-rods, insulating supporting members on said rods between which said resistance members are suspended, and spacing members between said supporting members.

12. In a device of the class described the combination with resistance members, of a supporting-frame therefor, said frame having side members connected together by horizontal supporting-rods, spools of insulating material on said rods between which said resistance members are suspended, and spacing members on said rods between said spools.

13. In a device of the class described the combination with resistance members, of a supporting-frame therefor, said frame having side members connected together by horizontal supporting-rods, spools of insulating material on said rods between which said resistance members are suspended, and sleeves of insulating material on said rods separating said insulating supporting members.

In witness whereof I hereunto subscribe my name this 24th day of April, A. D. 1905.

WILLIAM L. WATERS.

Witnesses:
JOHN E. HUBEL,
J. F. DIXON, Jr.