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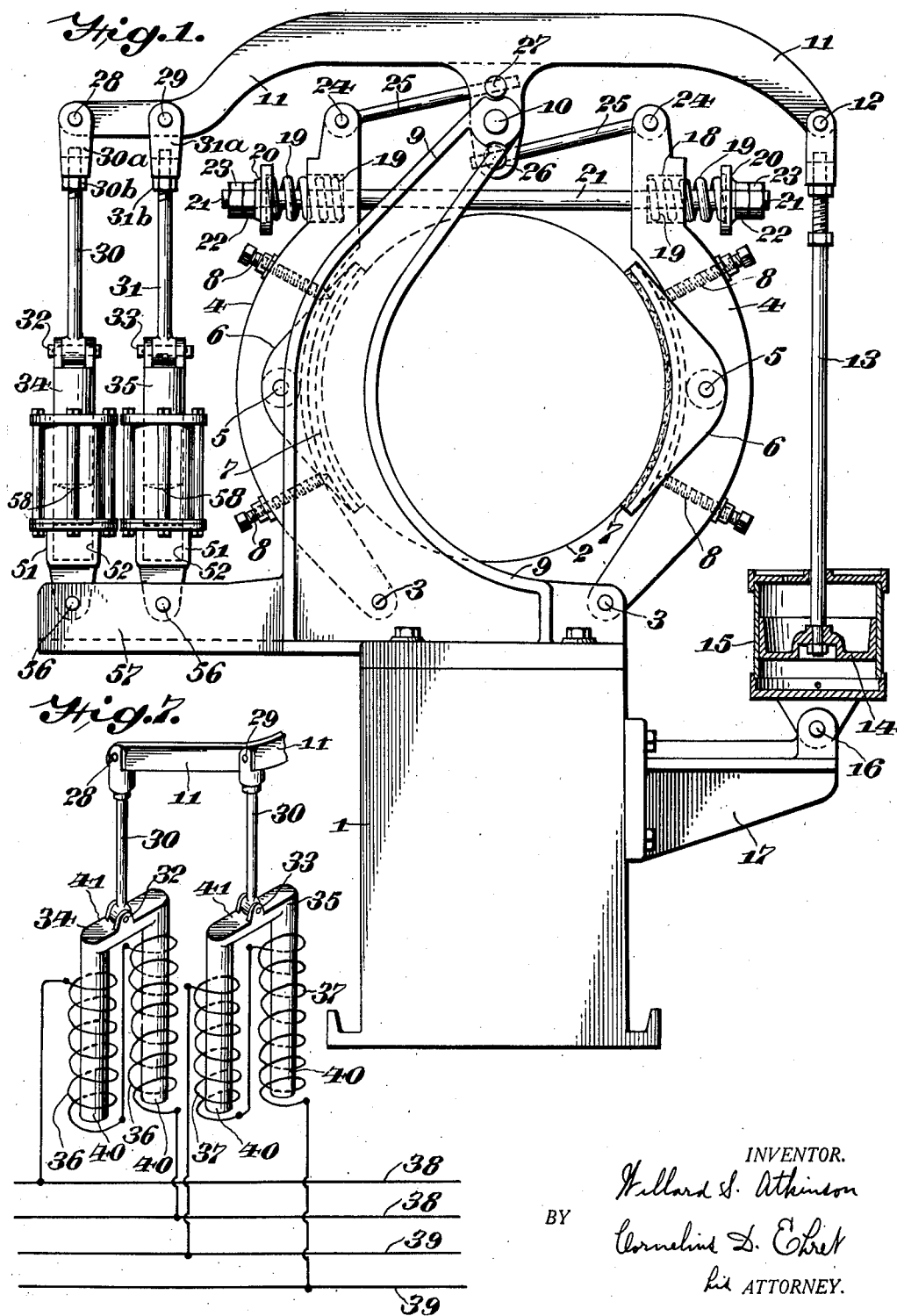
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W. S. ATKINSON

BRAKE MECHANISM AND MAGNET SYSTEM THEREFOR

Filed Dec. 14, 1923

2 Sheets-Sheet 1



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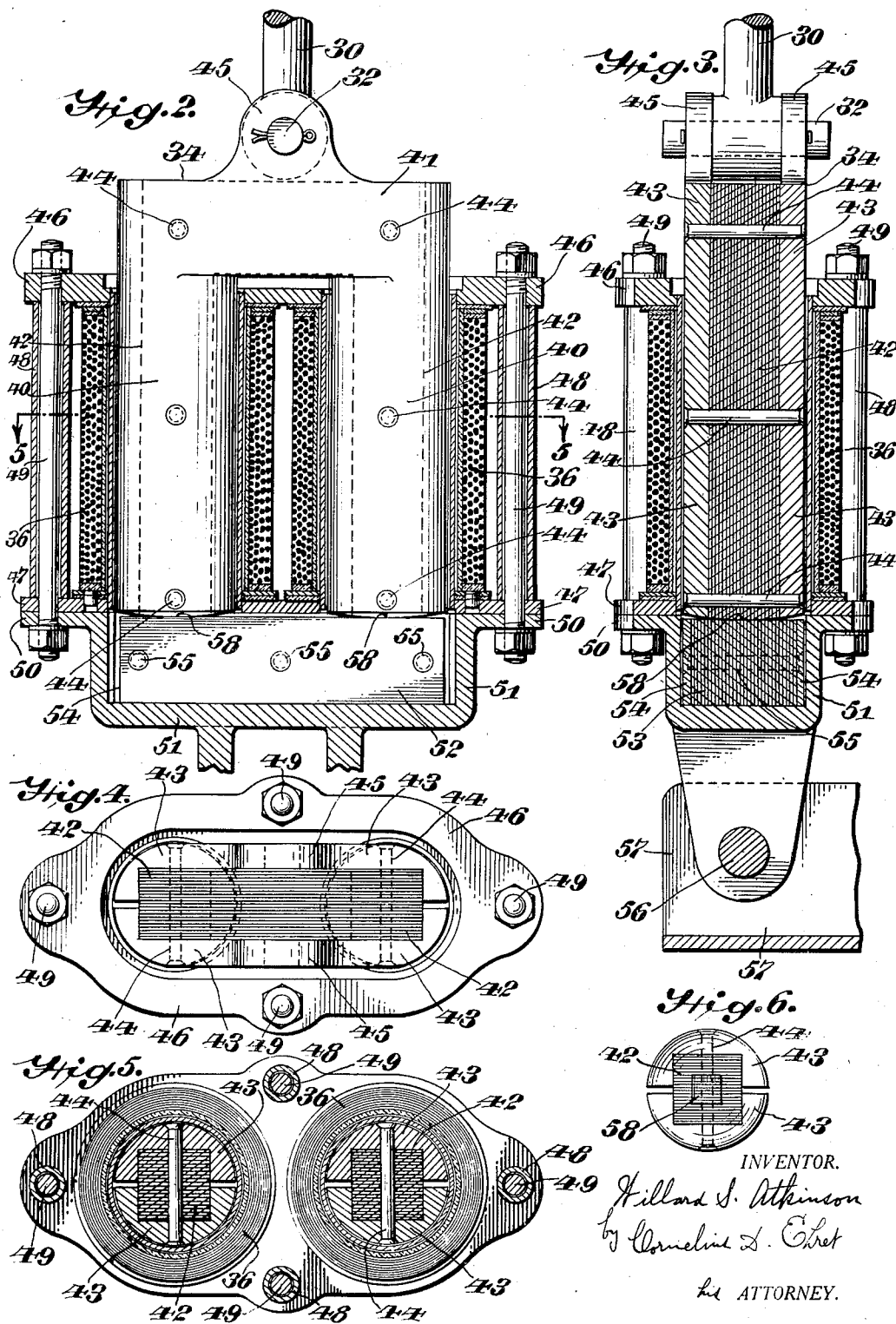
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BRAKE MECHANISM AND MAGNET SYSTEM THEREFOR

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2 Sheets-Sheet 2



UNITED STATES PATENT OFFICE.

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BRAKE MECHANISM AND MAGNET SYSTEM THEREFOR.

Application filed December 14, 1923. Serial No. 680,610.

To all whom it may concern:

Be it known that I, WILLARD S. ATKINSON, a citizen of the United States, residing in Ashland, county of Camden, State of New Jersey, have invented certain new and useful Improvements in Brake Mechanism and Magnet Systems Therefor, of which the following is a specification.

My invention relates to brake mechanisms, more particularly those utilized in elevator systems, and relates also to a magnet system for controlling the brake mechanism.

In accordance with my invention, the brake mechanism is controlled by a magnet system comprising two or more electromagnets energized independently of each other from a two or more phase alternating current circuit to effect uniformity or consistency of action of the magnet system upon the brake mechanism, to avoid chattering, and to ensure approximately constant brake-controlling force throughout a considerable range of movement of the movable magnet elements.

Further in accordance with my invention, there is provided in an alternating or fluctuating current magnet, in which relatively movable members of the magnetic circuit come into engagement or contact with each other, a restricted area of engagement or contact, materially less than either of the areas at the adjacent ends or portions of the co-acting members and materially greater than a point.

My invention resides in features herein-after described and claimed.

For an illustration of one of the various forms my invention may take, reference is to be had to the accompanying drawings, in which:

Fig. 1 is a side elevational view, partly in vertical section, of braking mechanism embodying my invention.

Fig. 2 is a vertical sectional view, partly in elevation, of one of the electro-magnets.

Fig. 3 is a vertical sectional view, partly in elevation, taken at right angles to Fig. 2.

Fig. 4 is a top plan view of part of the structure of Fig. 2.

Fig. 5 is a horizontal sectional view, partly in plan, taken on the line 5—5 of Fig. 2.

Fig. 6 is a bottom plan view of one of the magnet core members.

Fig. 7 is a fragmentary view of the movable magnet cores and a diagrammatic view of the circuit connections of the magnet windings.

Referring to the drawing, 1 is a base or support of any suitable character, for example, for an electric motor which operates the cable-winding mechanism of an elevator or elevator system. 2 indicates the cylindrical brake drum or pulley, generally secured upon the armature or rotor shaft of the motor. Pivoted to the base 1 at 3, 3 are the levers 4, 4, to each of which is pivoted at 5 a brake shoe 6, preferably provided with a brake lining 7 engaging the brake drum 2. Each brake shoe 6 may be adjusted as to its angular position with respect to its lever 4 by the adjustable set screws 8. Carried by the base 1 is the bracket 9, to which there is pivoted at 10 the brake control or operating lever 11, which has pivoted thereto at 12 the piston rod 13 carrying at its end the plunger or piston 14 movable within the cylinder 15 pivoted at 16 to a bracket 17. The piston 14 and cylinder 15 constitute a dash pot which retards movement of the lever 11, and all parts attached thereto, in either direction or in both directions.

Each of the lever arms 4 is provided with a recess or pocket 18, in which is disposed the helical spring 19 engaging at its opposite end the floating abutment 20. Both abutments 20 are adjustably secured upon the floating rod or abutment-connecting member 21 by the nuts 22 threaded and adjustable upon the rod 21 and locked in adjusted position by the lock nuts 23. Pivoted to each of the lever arms 4 at 24 is a link or rod 25, the rods 25 being pivoted, respectively, at 26 and 27 to the lever 11 on opposite sides of its pivot 10.

With the parts in the position indicated in Fig. 1, the brake is set, since the springs 19 are thrusting inwardly upon the lever arms 4, thereby thrusting the brake shoes against the drum 2. The brakes are equalized or the brake shoes are pressed with substantially equal forces against the drum 2, because the floating abutments 20, which take the reaction of the thrusts of the springs 19 upon the lever arms 4, are connected to each other, as by the rod 21.

Upon exertion of a downward pull upon the arm 11 to the left of its pivot 10, causing

in effect counterclockwise rotation of the lever 11 about its pivot 10, the links 25, 25 thrust against the inner ends of the arms 4, forcing both outwardly away from the drum 2, thereby lifting the brake shoes from engagement with the drum. And upon release of the force so exerted upon the lever 11, the springs 19, previously under compression, expand, thrusting the upper ends of the levers 4 inwardly, causing the brake shoes to re-engage the drum 2.

Pivoted to the lever 11 at 28 and 29 are the rods 30 and 31, pivoted, respectively, at 32 and 33 to the movable core structures 34 and 35, respectively, of two independent single phase alternating current magnets whose windings 36 and 37 are connected, respectively, to different phases of a two-phase alternating current supply system of which the conductors 38, 38 supply current of one phase while the conductors 39, 39 supply the current of the second phase, generally in quadrature with or dephased ninety degrees from the current traversing the conductors 38.

Inasmuch as the independent electro-magnets are or may be similar to each other, a description of the construction of one will suffice for both.

Referring to Figs. 2 to 5 inclusive, the movable core structure is, by way of example, and preferably, U-shaped, comprising the plungers or limbs 40, 40 and the yoke 41. The core structure proper comprises superposed laminæ of iron, mild steel or other suitable core material. The stack of superposed U-shaped laminæ 42 is confined between the cheek members 43, secured to each other by the rivets or equivalent members 44, the members 43 more or less completely enclosing the laminæ 42, as indicated in section in Fig. 5. The cheek members 43 carry at their upper ends the pivot-supporting lugs 45, whereby pivotal connection is made with the aforesaid rod 30.

The limbs 40 are disposed within the magnet windings or coils 36, disposed between the plates 46 and 47, spaced from each other by the spacer tubes or bushings 48, through which extend the bolts 49, which extend also through the flange 50 at the upper end of the cup-shaped member 51, the members 46 and 47 being held at fixed distance from each other, and between them are confined the coils 36, 36; and there is simultaneously held in fixed position to the magnet coils the member 51, in which lies, unrestrained, the relatively fixed member 52 of the magnetic circuit. The fixed member or keeper 52 comprises a bundle or stack of laminæ 53 held between cheek members 54, secured to each other by rivets or equivalent members 55. The member 52 has a longitudinal extent sufficient to bridge the free ends of the movable core structure, as indicated in Fig. 2.

The member 51 and the parts attached thereto are pivoted at 56 to the bracket 57, which may be attached to the bracket 9 or base 1, or any other suitable fixed support.

As indicated in Figs. 2, 3 and 6, the ends of the limbs 40 are not straight or flat, but are rounded or tapered in virtue of the fact that the end surfaces are those of spheres, cones, pyramids or equivalent. Each of the limbs 40 is flattened, as indicated at 58, whereby the area of engagement or contact between the limbs 42 and the keeper or fixed member 52 of the magnetic circuit is materially greater than a point and materially less than the areas of the ends of the limbs 42.

In the example of my invention illustrated, the movable core structure may rock or pivot upon the pivot 32, which is normal to the pivots 28 and 56 and which is also normal to the longitudinal extent of the yoke 41 of the U-shaped movable core.

While in Fig. 7 the windings 36 and 37 are shown permanently connected to the supply conductors 38 and 39, it will be understood that switching mechanism will intervene between the conductors and these windings for closing and opening their circuits at desired times. In an elevator system this switching mechanism is under the control of a control lever or cable manipulated by the operator upon the car.

The operation is as follows:

With the parts in the position indicated in Fig. 1, the movable core structures are in their elevated positions with the brake shoes 6 set in engagement with the brake drum 2 by the springs 19. Upon energization of the windings 36 and 37, by closing the aforesaid switching mechanism, the cores will be pulled downwardly due to the attractive effect caused by the current traversing the windings and existing between the movable core structure and the relatively fixed keeper or stationary member 52 of the magnetic circuit, the attraction being continued until the limbs 40 engage the keeper or member 52. The fully attracted position is indicated in Figs. 2 and 3, and in attaining that position the magnetic attractions of the two magnets have overcome the opposition of springs 19, by tilting the lever 11 in counterclockwise direction, thereby lifting the brake shoes from the drum 2. Upon rupture of the circuit of the windings 36 and 37, the springs 19 restore the parts to the position indicated in Fig. 1.

By utilization of independent single phase magnets energized from different phases of a polyphase system, the pull upon the lever 11 is never zero during energization of the windings 36 and 37, because the energizing currents are in quadrature with each other.

My magnet system comprising independent single phase magnets connected in dif-

ferent phases of a polyphase system has practical advantages not heretofore available either with one single phase magnet or a polyphase magnet comprising a plurality of magnet windings connected in different phases of a polyphase circuit and co-acting with a common magnetic circuit or parts of magnetic circuits having a common flux path.

In the case of employment of one single phase magnet, even when provided with a shading coil or equivalent, the pull is periodically zero or substantially zero, and in the intervals between zero or minimum pulls the attraction rises to a maximum and again falls to zero or minimum. In practice the result has been that when the movable core structure has reached the limit of its movement and is in engagement or contact with the stationary member of the magnetic circuit, there results chattering and humming, the chattering being due to the fact that the brake-applying spring is under its maximum tension, therefore opposing its greatest force to the magnetic attraction, and since the magnetic attraction passes through zero magnitude the spring begins to return the brake towards drum-engaging position, but soon thereafter the magnetic attraction reaches sufficient magnitude to again compress the spring. This cycle of operations is repeated, causing chattering.

Nevertheless, a single phase electro-magnet has advantages over a polyphase magnet in that with the movable core structure retracted or at the uppermost limit of its movement the inductance of the magnet winding is small or at its minimum, and the magnetizing current is at its maximum. The resultant magnetic attraction draws the core towards the fixed member of the magnetic circuit, and as the core proceeds into the magnet winding the inductance increases and the magnetizing current decreases, but because of shortened air gap in the magnetic circuit the attractive force or effective pull exerted by the magnet remains roughly the same or constant throughout the travel of the core. On the contrary, in a polyphase magnet, because the magnet windings are mutually inductively related, they inductively affect each other, through their common magnetic circuit, with the result that with the changes in inductance, and therefore of magnetizing currents traversing the polyphase windings, there are set up in the different phase circuits reactions, causing inconsistent and erratic action of the polyphase magnet as a whole, and there is an appreciably greater departure of magnitude of the magnetic pull from substantial or approximate constancy throughout the range of movement of the core.

Furthermore, due to the reactions between the windings of the polyphase magnet, or due

to other causes, the polyphase magnet itself is frequently subject to chattering.

Nevertheless, the polyphase magnet has the advantage that its effective pull is never zero, but the pull exerted upon the brake-lifting lever is due to the interaction of de-phased magnetizing currents, and the pull which fluctuates between finite values greater than zero corresponds with a magnetic attraction varying in magnitude between finite limits other than zero, while in accordance with my invention, employing the independent single phase magnets, each effects its own magnetic pull upon the brake-controlling mechanism, and the pulls effected by the magnet windings are for the first time combined mechanically external to the magnets themselves, while in a polyphase magnet the pulls due to the several phases are combined within the magnetic circuit itself, and a single fluctuating pull is applied to the brake mechanism.

By employment of a plurality of independent single phase magnets the aforesaid advantages of both single and polyphase magnets are retained, since the pull upon the lever 11 is never zero, and for the further reason that the attraction of each of the movable core members is orderly, uniform and consistent, and exerts through a considerable range of movement a substantially or approximately constant attraction.

Chattering is avoided as aforesaid by employing on at least one, and either one, of the relatively movable magnetic elements a surface which is curved, tapered or the like, with a restricted area of engagement or contact. Where the movable core and fixed magnetic member engage over a large surface, the residual magnetism is often of sufficient intensity to hold the parts attracted in engagement with each other even after the exciting current is discontinued, preventing entirely or at least preventing prompt resetting of the brake shoes by the spring mechanism. On the other hand, where the area of engagement or contact between the relatively movable magnetic elements is greatly restricted, as in the case of a point or extremely small area, chattering occurs because the residual magnetism acting through the greatly restricted area is unable to overcome the opposing force of the spring until the current has risen to a value substantially greater than zero. However, in accordance with my invention, where the area is much greater than that of a point or the like and much less than the area of either of the opposing faces, the residual magnetism operative through the restricted area of contact is sufficiently small to permit the springs with certainty to reset the brakes upon discontinuance of current; and yet the area of engagement or contact is sufficiently large that the residual magnetism acting there-

through is sufficient to hold the core structure in fully attracted position over the instant of zero or minimum current in the magnet winding. In other words, the area of engagement or contact is a compromise between full surface contact and minute surface contact, with the result that both undesired effects, failure to release and chattering, are overcome.

My independent single phase magnet structures independently operating upon the brake-control mechanism have been in practical and commercial use, where they effect the advantages of both the single phase and polyphase magnets and avoid or overcome disadvantages of both.

As stated, each of the keepers or relatively fixed elements 52 of the magnetic circuit simply lies free in the member 51, so that it may slightly move, if necessary, to come into contact with both poles of the movable core structure.

Furthermore, to cause both movable core structures to come into contact at both poles with the members 52 at the same time, either or both of the rods 30 and 31 may be adjusted as to effective length, as by its threading into the member 30^a or 31^a, the rods being provided with the lock nuts 30^b and 31^b.

The flat surface 58 may be of any suitable shape, as circular, elliptical, polygonal, etc., but, as indicated in Fig. 6, may be a square whose diameter may be of the order of one-half inch when the diameter of the movable core structure or plunger is of the order of two inches, this relation being given, however, merely by way of example, and is not by way of limitation of my invention.

What I claim is:

1. The combination with an elevator brake mechanism comprising a brake drum, braking means co-acting therewith, and a control lever, of a plurality of single phase electro-magnets whose magnetic-circuits are substantially independent and each comprising relatively movable core elements and a winding, means for connecting the windings of the different magnets with different conductors of a polyphase circuit, whereby the currents traversing said windings are dephased with respect to each other, and means for connecting the movable core elements of the different magnets with said control lever.

2. The combination with an elevator brake mechanism comprising a brake drum, braking means co-acting therewith, and a control lever, of a plurality of single phase electro-magnets each comprising a movable U-shaped plunger, a co-acting stationary core element loosely mounted to effect engagement with the ends of the limbs of said U-shaped plunger, and an exciting winding, said windings traversed, respectively, by currents which are dephased with respect

to each other, and means for connecting said U-shaped plungers with said control lever.

3. The combination with an elevator brake mechanism comprising a brake drum, braking means co-acting therewith, and a control lever, of a plurality of independent single phase electro-magnets whose magnetic circuits are substantially independent and each comprising relatively movable core elements and a winding, the windings of the different magnets traversed, respectively, by currents dephased with respect to each other, and means for connecting the movable core elements of the different magnets independently of each other with said control lever.

4. The combination with an elevator brake mechanism comprising a brake drum, braking means co-acting therewith, and a control lever, of a plurality of independent single phase electro-magnets whose magnetic circuits are substantially independent and each comprising relatively movable core elements and a winding, the windings of the different magnets traversed, respectively, by currents dephased with respect to each other, means for connecting the movable core elements of the different magnets independently of each other with said control lever, and means for effecting adjustment whereby the movable core elements come simultaneously into engagement with the stationary core elements.

5. The combination with an elevator brake mechanism comprising a brake drum, braking means co-acting therewith, and a control lever, of a plurality of single phase electro-magnets each comprising a movable U-shaped plunger, a co-acting stationary core element loosely mounted to effect engagement with the ends of the limbs of said U-shaped plunger, and an exciting winding, said windings traversed, respectively, by currents which are dephased with respect to each other, means for connecting said U-shaped plungers with said control lever, and means for effecting adjustment whereby said movable plungers come simultaneously into engagement with their said stationary core elements.

6. The combination with an elevator brake mechanism comprising a brake drum, braking means co-acting therewith, a control lever, and spring means tending to move said braking means in a predetermined direction, of a plurality of independent single phase electro-magnets each comprising relatively movable core elements and a winding, the windings of the different magnets traversed, respectively, by currents dephased with respect to each other, said core elements engaging each other at a restricted area of magnitude sufficient to prevent chattering and less than the area of the neighboring faces of said core elements, and

means for connecting said core elements with said control lever to oppose said spring means upon energization of said magnets.

7. The combination with an elevator brake mechanism comprising a brake drum, braking means co-acting therewith, and a control lever, of a single phase electro-magnet comprising an exciting winding and relatively movable core elements, one core element connected to said control lever, and spring means opposing attraction of said core elements towards each other, said core elements engaging each other in a restricted area materially less than the area of the opposing faces of said core elements and sufficiently great to prevent separation of said core elements under the influence of said spring means at the intervals of zero magnitude of exciting alternating current.

8. The combination with an elevator brake mechanism comprising a brake drum, braking means co-acting therewith, and a control lever, of an alternating current electro-magnet comprising an exciting winding, a

relatively fixed core element, a movable U-shaped core element co-acting therewith, and means for loosely supporting said relatively fixed core element to permit it to effect accommodation with the ends of said U-shaped core element, and means for connecting said U-shaped core element with said control lever.

9. The combination with an elevator brake mechanism, of a plurality of single phase electro-magnets controlling said brake mechanism, said electro-magnets having substantially independent magnetic circuits, and each comprising relatively movable core elements and a winding, means connecting the windings of the different magnets with different phases of a polyphase circuit, whereby the currents traversing said windings are dephased with respect to each other, and means for connecting the movable core elements of the different magnets with said brake mechanism.

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