Nov. 16, 1926. 1,606,745

E. M. BOUTON

ELECTROMAGNETIC BRAKE

Filed Jan. 3, 1920 2 Sheets-Sheet 1

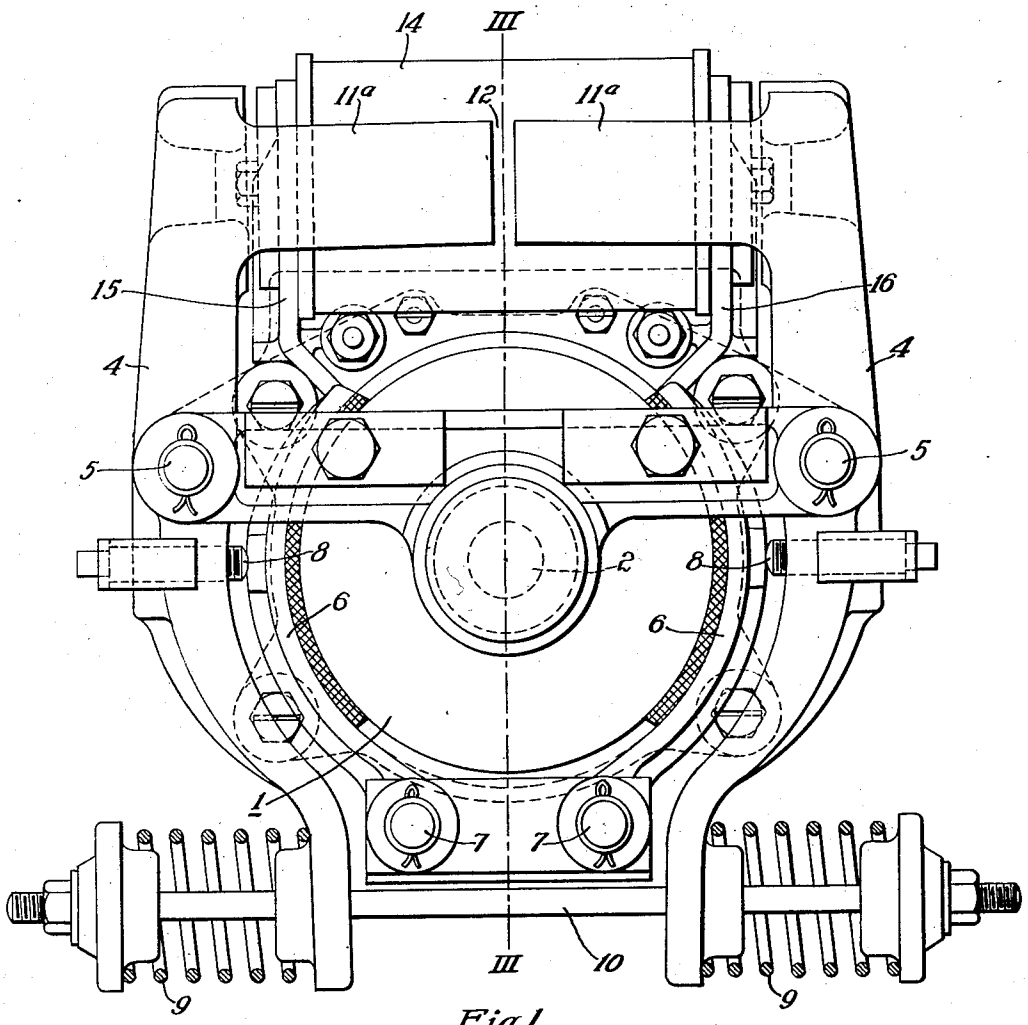


Fig. 1.

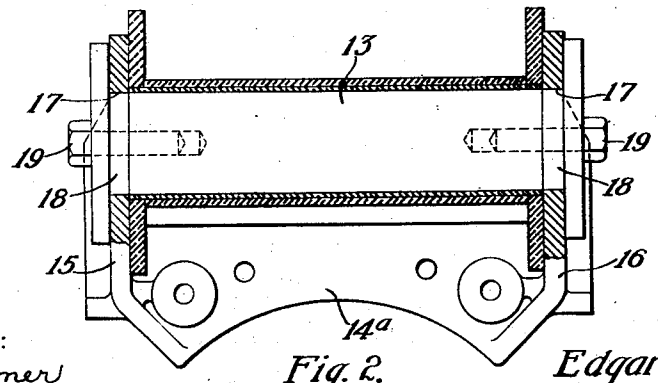


Fig. 2.

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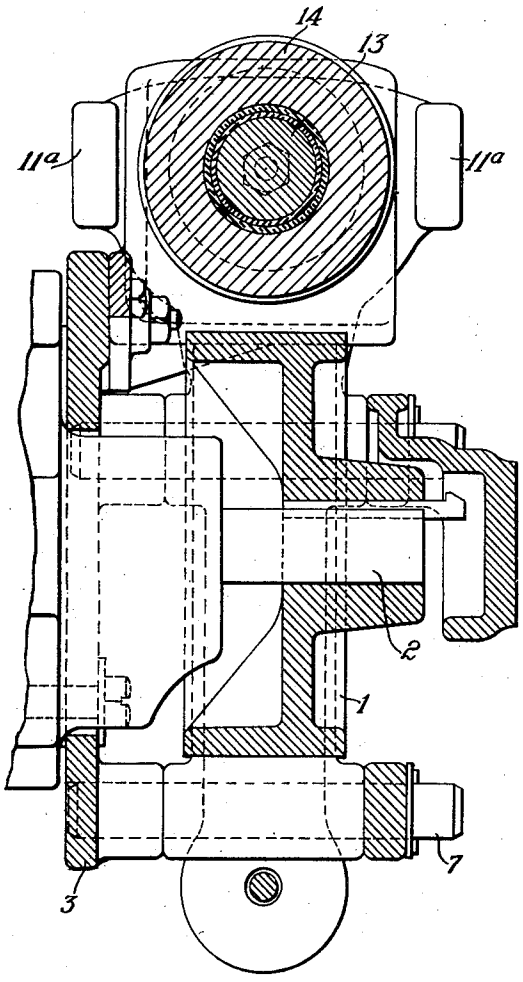


Fig. 3.

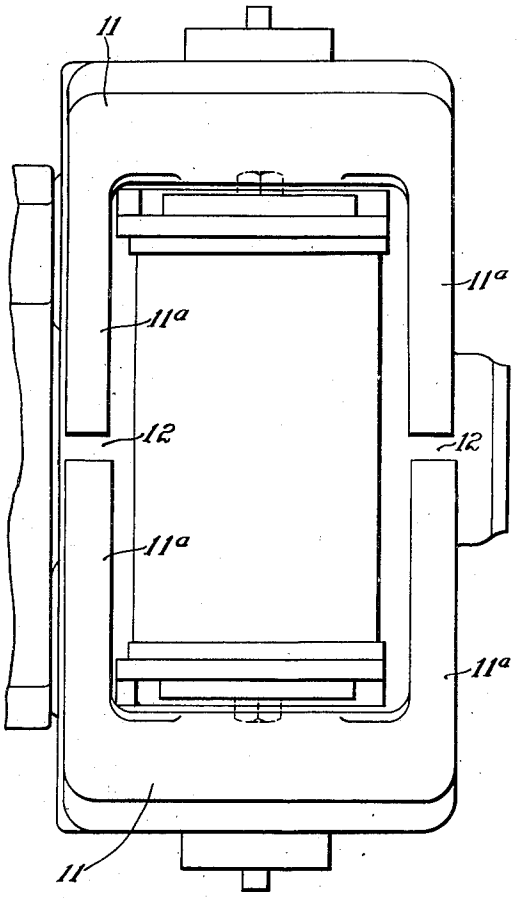


Fig. 4.

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UNITED STATES PATENT OFFICE.

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ELECTROMAGNETIC BRAKE.

Application filed January 3, 1920. Serial No. 349,308.

My invention relates to electromagnetic brakes and it has particular relation to such brakes as are employed in connection with elevators, hoists and similar machines.

One object of my invention is to provide an arrangement whereby the leakage flux of electromagnets may be utilized to perform useful work.

A second object of my invention is to provide a mechanism of the above-indicated character in which the usual brake shoes that are mounted for movements independent of their actuating levers are actuated in both directions by the levers.

A further object of my invention is to provide an electromagnet so constructed that its parts may be readily detached and assembled for purposes of inspection and repair.

In the construction of brakes of the same general character as that of the mechanism covered by the present application, it has been customary to provide one or more magnetic circuits having air gaps between the respective ends of the core members and coacting portions of the lever arms. In other arrangements, two movable core members attached to the respective levers have an air gap in approximately the central portion of the energizing coil. In each of the above-described arrangements, it is possible for the leakage flux to traverse paths which do not comprise air gaps between relatively movable parts. Such flux does not, therefore, perform any useful work and the efficiency of the electromagnet is impaired to a degree corresponding to the value of such flux.

In the present arrangement, I provide an electromagnet having two parallel magnetic circuits, the core member constituting the common portion of the magnetic circuits. The lever arms of the brake are bifurcated at their respective upper ends to provide arms which extend adjacent to opposite sides of the magnet coil. The members of each pair of oppositely-extending arms are in substantial alinement and have an air gap between their adjacent ends that is adjacent to the central portion of the coil.

It will be apparent that, in the arrangement described above, any leakage flux traversing paths constituting portions of the coil and the oppositely-extending arms must traverse the air gaps between the arms. Accordingly, when the coil in energized, the leakage flux traversing the air gaps between relatively movable parts produces forces which assist those exerted by the core member to actuate the levers.

Another feature of my invention resides in the provision of means whereby the brake shoes, which are pivotally mounted for movements independent of the brake levers, are actuated into engagement by the brake levers and are actuated out of engagement by the force of gravity assisted by electromagnetic forces exerted by energized portions of the levers. The latter force is produced by reason of the fact that a portion of the useful flux of the brake traverses a path comprising the brake levers, the brake shoes and a portion of the frame of the brake.

Brakes of the prior art have been so constructed as to render it necessary to practically dismantle the brake mechanism in order to remove the coil and its core member for the purposes of inspection and repair. This procedure was rendered necessary by the fact that the coil could only be removed through openings in the supporting structure adjacent to the ends of the coil.

In the embodiment of my invention, I provide supporting means of non-magnetizable material adjacent to the ends of the coil comprising portions of the brake frame and removable members of magnetizable material secured to the ends of the core members by means of bolts that are inserted longitudinally with respect to the axis of the coil. By means of this arrangement, it is only necessary to remove the securing bolts whereupon the coil and its core member may be removed by lifting upwardly without disturbing any of the remaining parts of the brake structure.

In the accompanying drawings, Fig. 1 is an end view of an electromagnetic brake constructed in accordance with my invention; Fig. 2 is a view partially in elevation and partially in longitudinal section, of the core member and its supporting means; Fig. 3 is a view in longitudinal section taken on line III—III of Fig. 1; and Fig. 4 is a top plan view of the mechanism of Fig. 1.

Referring to the drawings, a brake wheel 1 is mounted on a shaft 2 which may, for example, be the armature shaft of an electric motor. A brake mechanism comprises a

frame 3 which may be secured to the frame of an electric motor or other machine with which it is operatively connected. A pair of brake levers 4, which are respectively mounted on opposite sides of the wheel 1, are pivotally supported at 5. Each of the levers controls a brake shoe 6 which is pivotally supported at 7. Each of the levers is provided with an adjustable stud 8 for engaging the corresponding brake shoe to actuate it to its operative position.

The respective levers are retained in such positions as to effect the engagement of the brake shoes with the wheel 1 by means of springs 9 and a rod 10 for connecting the outer ends of the springs. The upper portions of the levers 4 are bifurcated to form members 11 of substantially U-shape, the arms 11^a of the bifurcated members extending inwardly toward each other, but having air gaps 12 therebetween. The levers are controlled by an electromagnet comprising a substantially cylindrical core member 13 and a coil 14. The core member 13 is supported by a stationary bracket 14^a, of non-magnetizable material, having upwardly-extending flanges 15 and 16. Each of the flanges 15 and 16 is provided with a central opening 17 corresponding in size and shape to the cross section of the core member. The core member 13 is retained in position by means of members 18 of magnetizable material, which comprise two concentric disks, the smaller of which is disposed within the openings in the flanges and the larger of which covers and surrounds the openings. Bolts 19, also of magnetizable material, rigidly secure the core member 13 to the member 18. The levers 4 are recessed and do not mechanically engage the bolt heads.

It may be assumed that the brake wheel 1 is at rest and that the several parts of the brake mechanism occupy their respective illustrated positions to maintain the brake wheel at rest. In case it is desired to operate the mechanism to which the brake wheel 1 is connected, the coil 14 of the brake magnet is energized by closing its circuit by any suitable means (not shown). The core member 13 is energized to attract the adjacent portions of the lever arms to actuate the levers about their points of pivotal support in opposition to the forces of the springs 10. The studs 8 are moved outwardly to release the brake shoes 6 and the latter are permitted to be moved outwardly by the force of gravity assisted by electromagnetic forces, as will be hereinafter described. The opening of the circuit of the coil 14 de-energizes the magnet and the springs actuate the several parts to their initial positions.

It is well known that, when the coil of electromagnets are energized to relatively high degrees, considerable flux traverses leakage paths including side portions of the coil and such magnetizable material as may be adjacent to the sides of the coil. In case the magnetic circuits traversed by the leakage flux does not comprise parts that are relatively movable during the operation of the magnet, no useful work is performed by such leakage flux. Such magnet is, therefore, inefficient and must be of greater size and contain larger quantities of material than are necessary in case the leakage flux is utilized to assist the force of the main magnetic circuit.

Each of the air gaps adjacent to the central portion of the coil 14 is traversed by such leakage flux as may emanate from the opposite sides of the coil and traverse various portions of the arms. Thus, when the coil is energized, considerable forces, due to leakage flux, are exerted across the air gaps 12 and these forces assist those exerted by the flux in the normal paths at the air gaps 12 and at the ends of the core member 13 to actuate the brake levers.

An additional path for flux of the coil 14 comprises the levers 4, the studs 8, brake shoes 6 and the base portion of the frame 3. The effect of the energization of the leakage path just described is to cause the studs 8 to exert forces upon the brake shoes 6 which assist the force of gravity and thereby effect the quick separation of the brake shoes and the wheel 1 when the levers 4 are actuated to release the brakes.

In case it becomes necessary or advisable to inspect or repair the magnet structure, it is only necessary to remove the bolts 19, whereupon the core member 13 and the coil 14 may be removed upwardly without disturbing the position of the arrangement or any of the associated parts. The core member and the coil may be replaced by reversing the operation just described.

Numerous advantages result from the employment of a brake mechanism constructed and arranged in the manner described above. The electromagnet structure may be materially smaller than those of the prior art by reason of its more efficient operation. The rotating parts controlled by brakes of this character may be released more quickly than is possible in such arrangements as provide for the release of the wheel by the force of gravity alone. The various parts of the brake mechanism, particularly the structure of the electromagnet, may be easily and quickly assembled or removed whenever the occasion so demands.

The coil contains no moving parts which necessitate the provision of guide members and which are frequently a source of injury to the insulation in the interior of the coil.

I claim as my invention:

1. The combination with a coil of substantially cylindrical shape, of supporting means therefor comprising a stationary mem-

ber having portions respectively extending adjacent to the opposite ends of said coil, and means comprising pole pieces and members axially movable relatively to said coil for securing the latter in position and for securing the pole pieces to said coil and to said stationary member.

2. The combination with a coil of substantially cylindrical shape, of supporting means therefor comprising members extending adjacent to the respective ends of said coil, and means for securing said coil to said members, said means comprising pole pieces and members for securing said pole pieces to said coil, said securing members being movable axially relatively to said coil, whereby said coil may, upon removal of said securing means, be actuated laterally from its normal position.

3. The combination with a coil of substantially cylindrical shape and a core member therefor, of members extending adjacent to the respective ends of said core member and having openings therein, of members constituting pole pieces for said core disposed within said openings, and means movable axially relatively to said coil for securing said pole pieces to said core member.

In testimony whereof, I have hereunto subscribed my name this 17th day of December, 1919.

EDGAR M. BOUTON.