

- [54] **ELECTROMAGNETIC BRAKE**
 [75] Inventor: Alessandro Marzocco, Milan, Italy
 [73] Assignee: SOCIMI-Societa Costruzioni
 Industriale Milano S.p.a., Milan,
 Italy
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- [52] U.S. Cl. 188/165
 [51] Int. Cl. F16d 65/34
 [58] Field of Search 188/164, 165; 303/3

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Primary Examiner—Duane A. Reger

Attorney—Shlesinger, Fitzsimmons & Schlesinger

[57] ABSTRACT

An electromagnetic brake is disclosed in which the connection between adjacent padlike braking members is obtained with a particular kind of hinged connection. More particularly, a semicylindrical projection of a pad cooperates with a corresponding hollow formed in the adjoining padlike member. The component parts are so arranged that the replacement of a padlike member is accompanied by the replacement of the hinged connection also.

3 Claims, 14 Drawing Figures

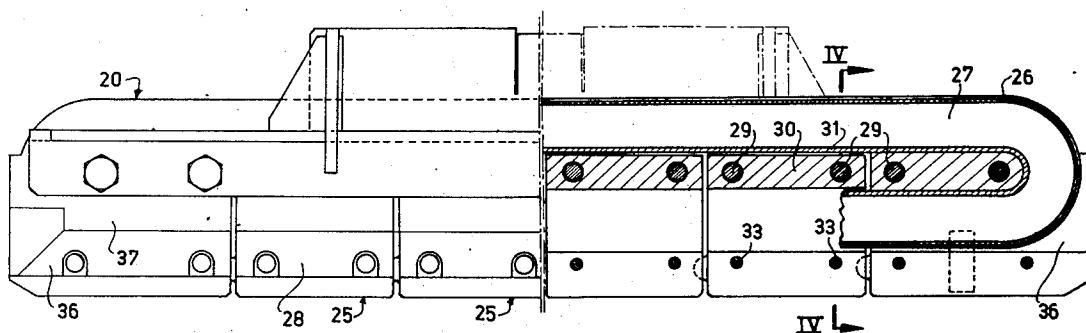
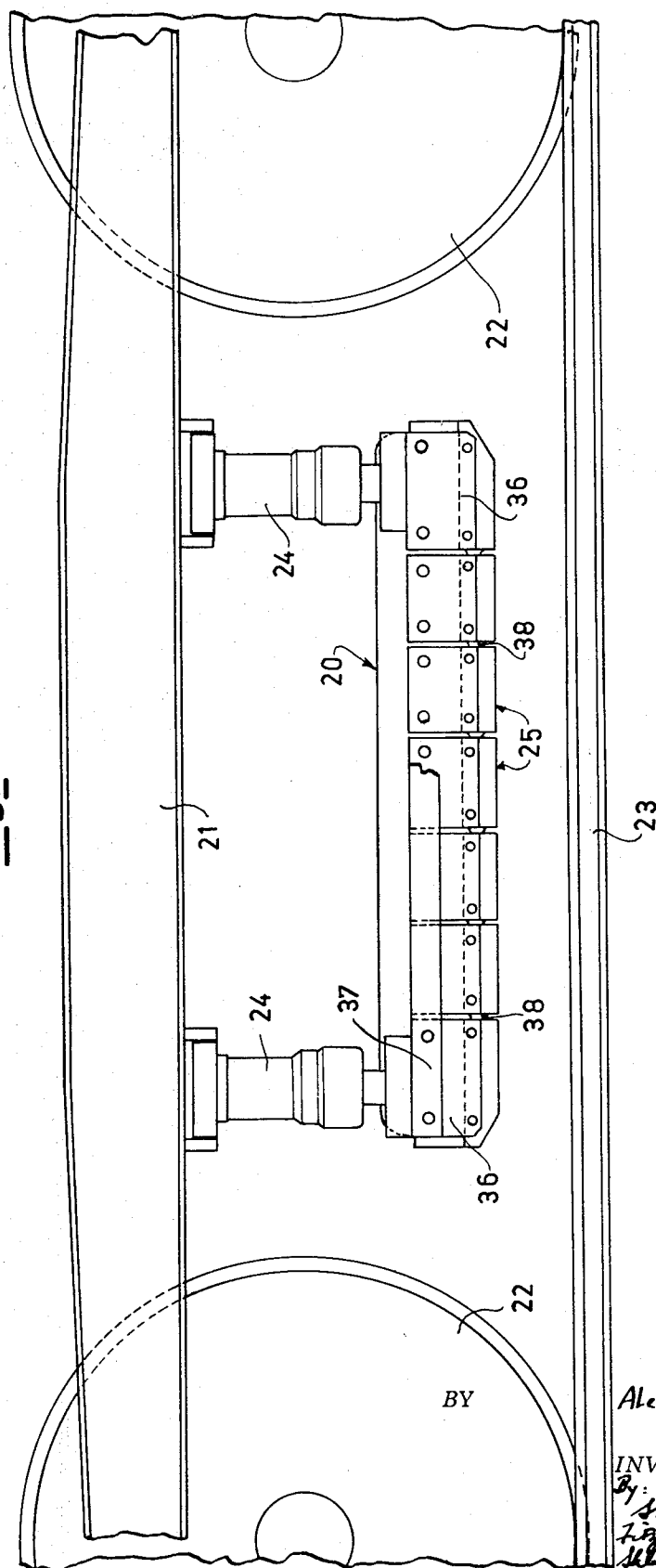


Fig. 1

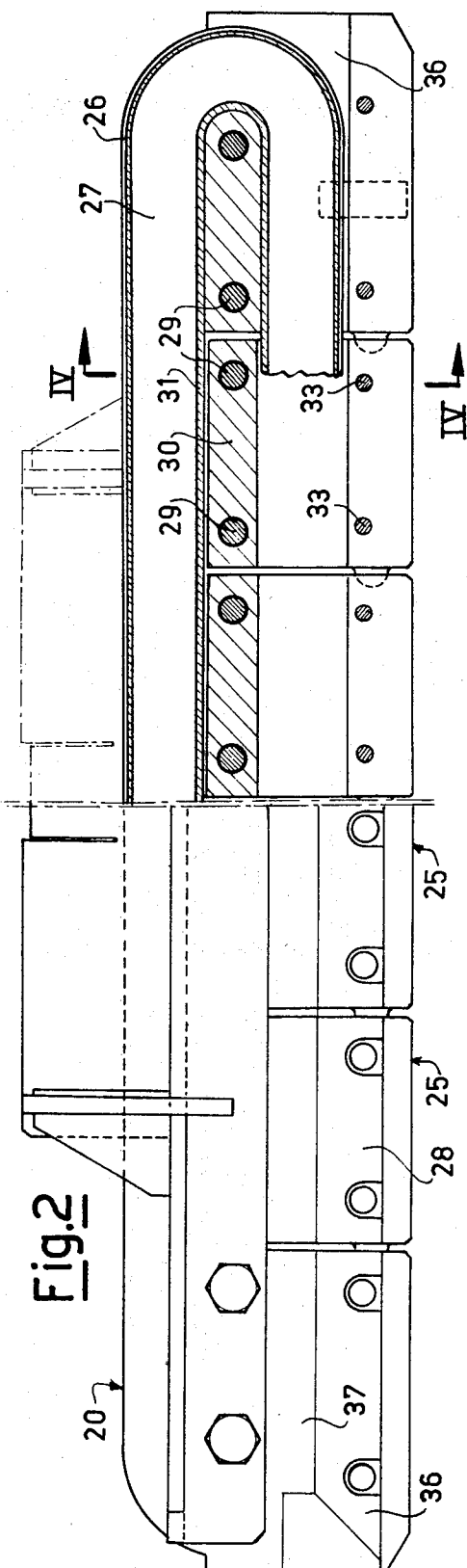
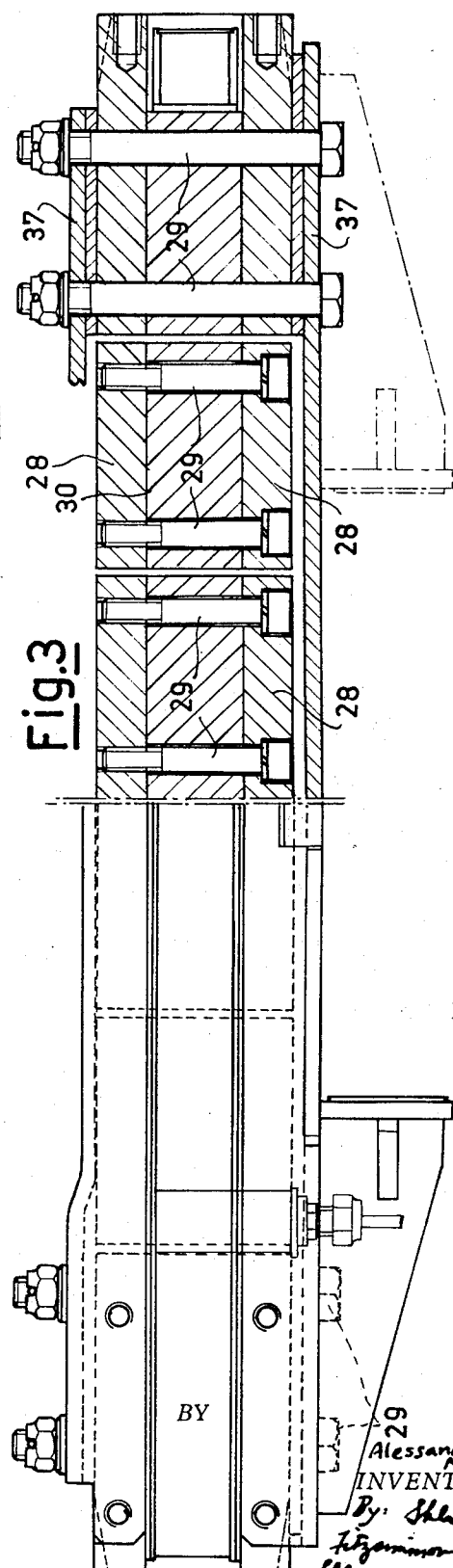


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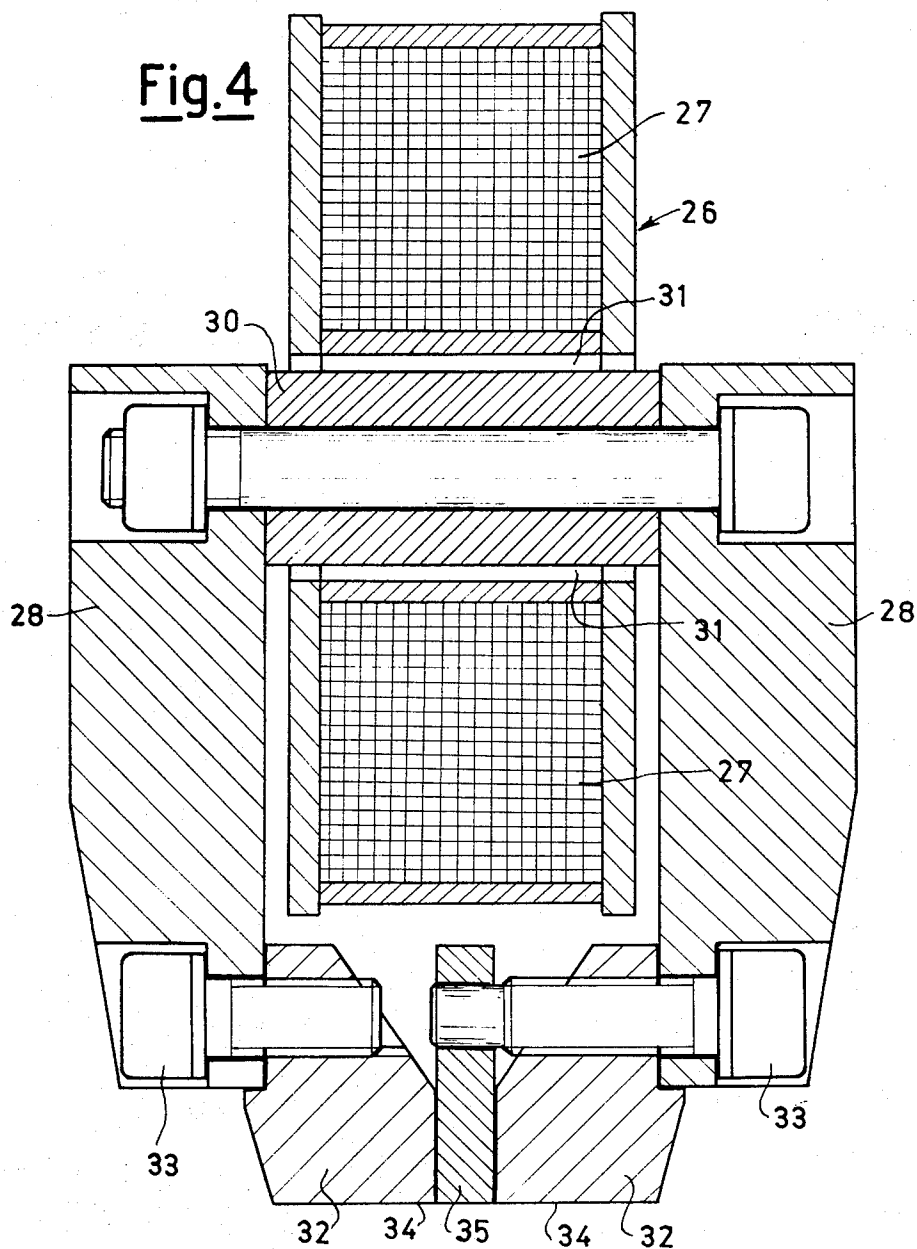
Alessandro
Marzocco

INVENTOR.

By: *Shlenger,*
Fitzgerald &
Shlenger, Attorneys



BY
Alessandro Marzocco
INVENTOR.
By: Schwingen,
Fitzgibbon &
Schwingen, Attorneys



Alessandro Marzocco
INVENTOR.

By
Shlenger, Fitzsimmons & Shlenger
Attorneys

Fig.5

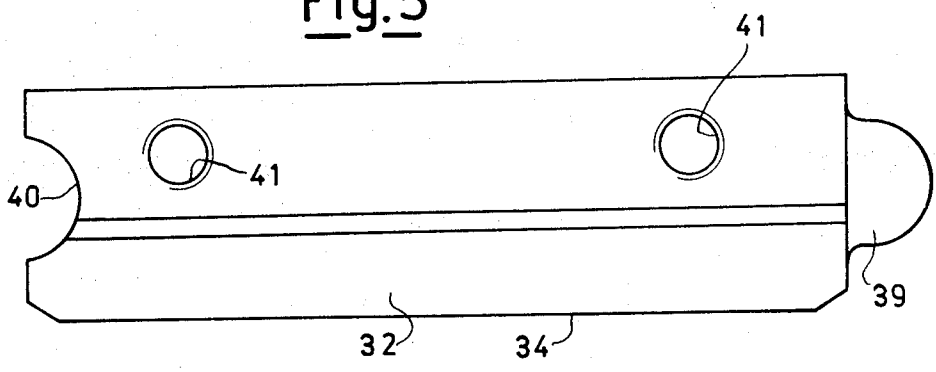


Fig.6

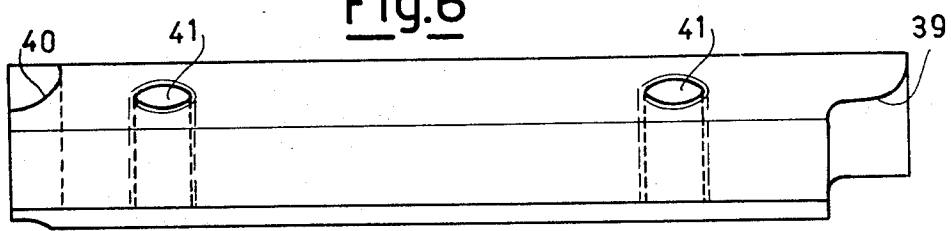


Fig.7

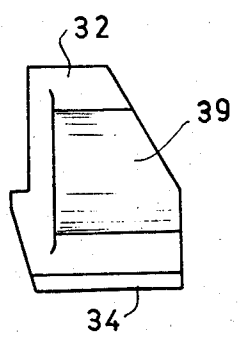
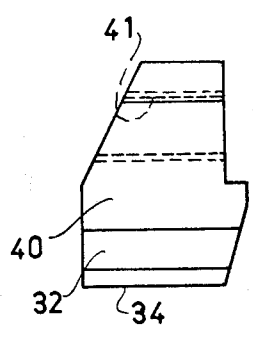
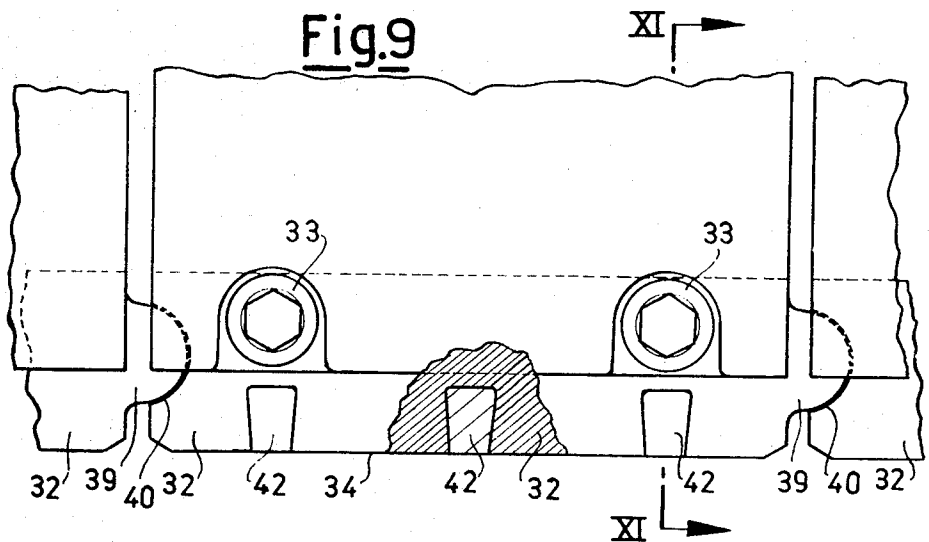
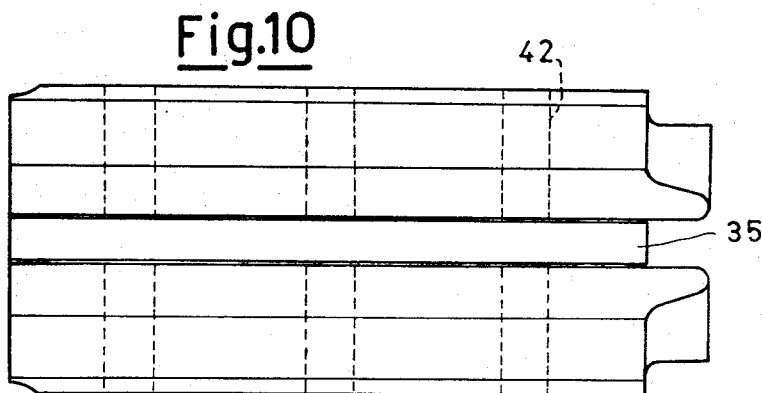
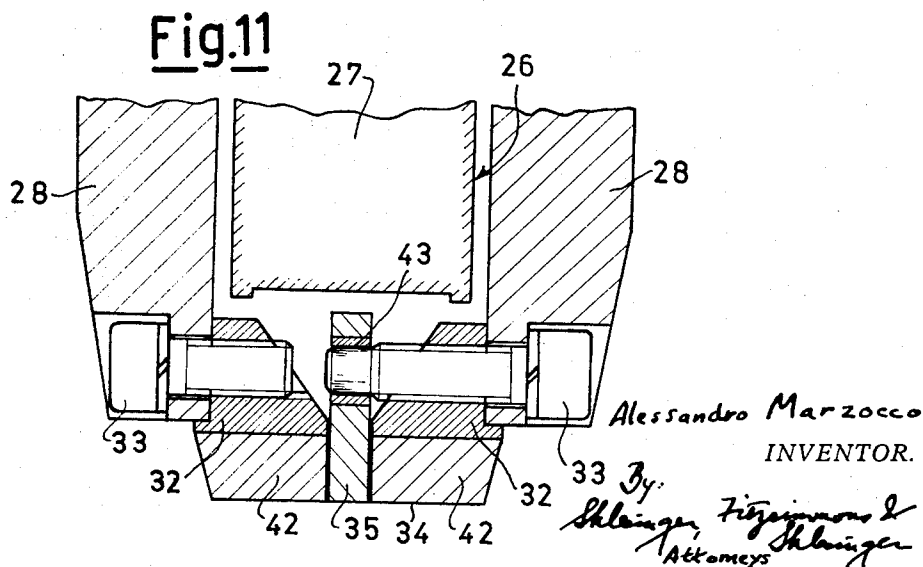


Fig.8



Alessandro Marzocco
INVENTOR.

By: *Shlenger, Fitzgibbon & Shlenger*
Attorneys



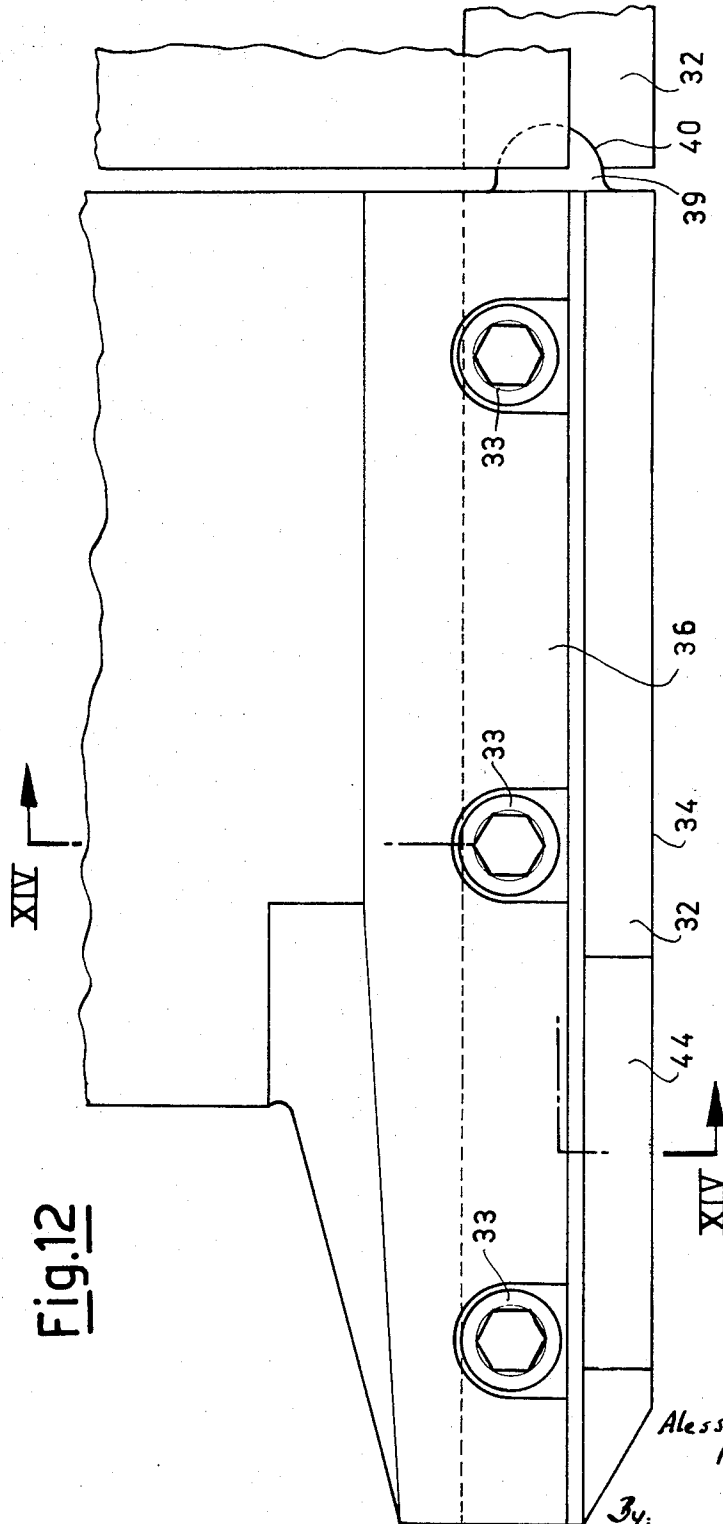


Fig. 12

Alessandro
Marzocco
INVENTOR.

By: *Shlenger, Fignarmono & Shlenger*
Attorneys

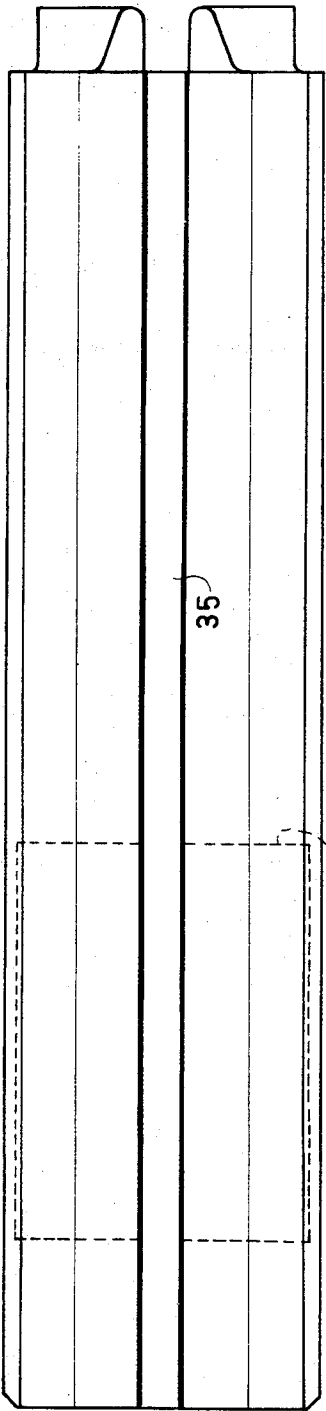


Fig. 13

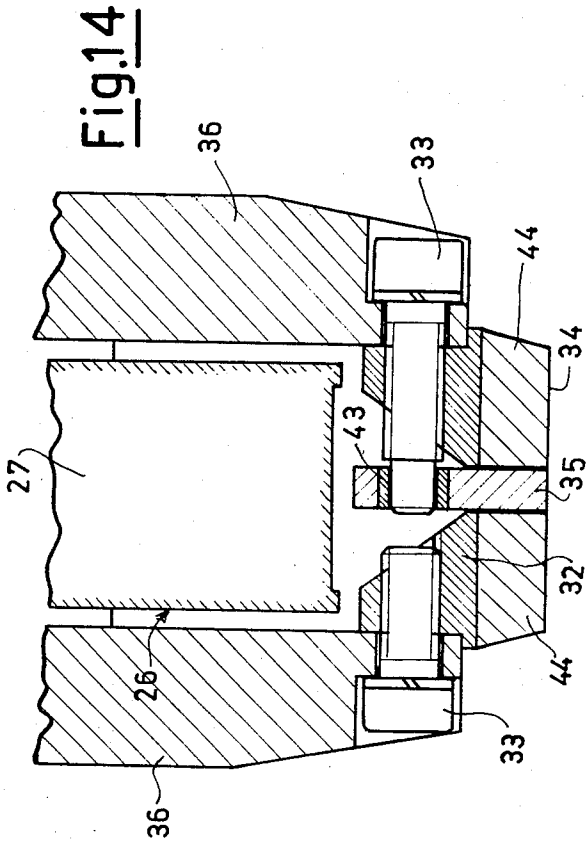


Fig. 14

Alessandro Marzocco

INVENTOR.

By: *Shlenger, Figgimano & Shlenger*
Attorneys

ELECTROMAGNETIC BRAKE

This invention relates to an electromagnetic brake for vehicles rolling on rails. More particularly, this invention relates to improvements in electromagnetic brakes adapted to ensure an even and regular wear of the sliding shoes of the brakes and an improved frictional force in the sliding motion experienced during the braking action.

Electromagnetic brakes are known long since and, in their most updated types, substantially comprise a set of padlike members which slide and are associated with an electromagnetic coil which is energized during braking so that the whole assembly of the padlike elements, which are mounted in their at rest positions at a certain level above the rail, is sucked by an electromagnetic force toward the rail itself and engages, with sliding friction, the top portion of the rail. More particularly, in order to ensure a certain capability for the padlike elements to conform to the top surface of the rail, the individual padlike members are pivoted at their upper portion to a frame which is integrally movable with the energizing coil.

The principal shortcoming of electromagnetic brakes of this kind is that of the uneven wear of the frictional surfaces of the pads so that their replacement becomes necessary with a frequency which is much greater than would be required if the wear of the frictional surfaces were uniform. Another serious drawback is that of the uptilting moments of force on the pads during braking, said moments hindering, on the one side, a thorough adherence of the frictional surfaces to the rail and, on the other hand, being responsible for the uneven wear of the sliding surfaces themselves.

In point of fact, the reason for the exceedingly high and irregular wear of the frictional surfaces can be found in the fact that the forces to which the pads are subjected during braking are, in addition to the magnetic drawing force with respect to the rail, the horizontal drag imparted by the vehicle and the frictional forces obtaining between the pads and the rail. Inasmuch as the padlike members are pivoted to the brake structure at a certain level above the rail level, the horizontal drag induces in the padlike members a tilting moment whose result is a considerably uneven pressure of the pad on the rail, said pressure being greater in the direction of travel and being liable to cause, inter alia, a jamming of the pad on the rail, especially when the rail surface is not adequately planar and smooth.

It has now been found, and this is the subject matter of the present invention, that the shortcomings and defects as outlined above can be substantially overcome by the electromagnetic brake made according to the present invention, comprising a set of sliding pads and an electromagnetic energizing coil, and characterized in that each padlike member is attached to the adjoining padlike members by a hinged connection, the axis of said hinged connection being located above the active sliding surface of each padlike member underlying the bottom contour of the coil, of each the end padlike members being mounted on said coil in a rigidly fixed position, and the intermediate members being mounted with a certain clearance.

An additional drawback of prior brakes is that of the rapid wear of the friction linings, that is, the poor resistance to the wear forces as generated during the braking sliding movement.

According to another embodiment, the electromagnetic brake according to this invention is characterized in that a portion of the sliding surface of each pad is composed of a frictional material, as well known in the art, such as an organic or sintered material, said friction material being applied by insertion of inset members in suitable seating previously provided in the active sliding surface.

More particularly, when the frictional material is positioned in suitable housings formed in the fixed end pads, so that the overall length of the magnetic surface of the brake contacting the rail is not reduced, the longitudinal size of the brake in its top portion is not increased, and the resultant friction between the pads and the rail is remarkably increased.

Obviously, the two inventive features as outlined above can either be applied individually, or conjointly.

Stated another way, it may be assumed that the present invention contemplates electromagnetic brakes whose padlike members are pivoted in the way explained above, as well as the electromagnetic brakes of conventional type in which the active sliding surface is partly formed of friction materials, and also, lastly, electromagnetic brakes in which the padlike members are hinged in the way defined above and the active sliding surfaces of the padlike members are partly made of frictional materials.

It should be pointed out, in addition, that, according to the second aspect of the present invention as outlined above, the proportion of active surface occupied by the frictional material and the arrangement of the latter should be compatible, as is well known to all those skilled in the art, with the requirements for the padlike members both from the electromagnetic and the functional standpoints.

The principal advantage of the brake made according to the present invention is that the wear of the active sliding surfaces of all the padlike members becomes substantially uniform; by virtue of their improved insensitivity to dynamic tilting and overturning actions. By so doing, in fact, the sliding padlike members can adapt themselves more closely to any irregularity of the surfaces of the top of the rail on which the braking action takes place. Of course, a more uniform wear has, as a result, an increase of the useful working life of the brakes themselves and an increased constancy of the efficiency of the braking action as the wear of the sliding members proceeds.

Another substantial advantage of the present invention is the increase of the friction coefficient due to the friction material inserted on a portion of the active sliding surface of a pad, a fact whose result is an improved efficiency and constancy of the braking action especially at high speeds, a diminished wear of the active surface and the possibility of having at hand, the overall braking forced exerted by the brake being the same, a decreased magnetic driving force and thus a much less consumption of electric power.

The foregoing and other features and advantages of the present invention will become clearly apparent from the ensuing description, which is given by way of example only without any limitation, reference being had to the accompanying drawings, wherein:

FIG. 1 is a general side elevational view of an electromagnetic brake for vehicles rolling on rails are made, according to one embodiment of the present invention.

FIG. 2 is a similar view, enlarged and partly in section.

FIG. 3 is a top plan view of FIG. 2.

FIG. 4 is a partial cross-sectional view taken along the line IV—IV of FIG. 2.

FIG. 5 is a detailed side elevational view of a sliding pad.

FIG. 6 is a top plan view of the pad shown in FIG. 5.

FIG. 7 is a view of the pad of FIG. 5, as viewed from the right end.

FIG. 8 is a view of the pad of FIG. 7 as viewed from the opposite end.

FIG. 9 is a side view of a sliding pad member having inset friction material.

FIG. 10 is a bottom plan view of the pad member of FIG. 9.

FIG. 11 is a cross-sectional view taken along the line XI—XI of FIG. 9.

FIGS. 12, 13 and 14 are views corresponding to FIGS. 9, 10 and 11, respectively, of another embodiment of the sliding pad having inset frictional material.

Having initially reference to FIGS. 1 to 8 inclusive, the electromagnetic brake according to the present invention, generally shown at 20, is mounted on a frame 21 of a railway vehicle having wheels 22 adapted to roll on a rail whose railhead is shown at 23. The mounting of the brake 20 on the frame 21 is carried out by means of ram and piston assemblies 24 or other equivalent systems, or electric systems adapted to jut out as the brake 20 is actuated so as to cause it to contact the rail 23.

As shown in more detail in FIGS. 2, 3, and 4, the electromagnetic brake 20 comprises a plurality of sliding padlike members, generally shown at 25, which are mounted in the way which will be explained in more detail later, on an electromagnetic energizing coil 26, having a winding 27 intended to generate a magnetic field having a considerable intensity and directed in such a direction that the sliding padlike members 25 be vigorously drawn towards the rail 23.

Each padlike member 25 comprises a pair of lateral jaws 28 which flank the lower portion of the winding 27 of the coil 26, to which they are affixed by means of bolts 29. The latter engage spreader blocks 30, which, in turn, are housed with a certain clearance 31 between the two portions (upper and lower) of the winding 27.

To the lower ends of the jaws 28 there are affixed, by means of bolts 33, sliding pads 32, whose active surfaces 34 are those of which engage the rail 23 during the braking action and are gradually worn out.

As is clearly shown in FIG. 4, the two pads 32 are separated by a plate 35 of a non-magnetic material, which is mounted on either of two bolts 33, so that the magnetic field which is generated during braking becomes closed through the rail 23.

The rail sliding padlike members placed at the ends of the electromagnetic brake 20, shown at 36, are mounted, conversely, without the clearance 31 and are affixed to two shielding plates 37 by mean of the same bolts 29 which clamp their associated jaws 28 together. By so doing, the two padlike members 36 are prevented from effecting any displacement relative to the coil 26.

By observing FIG. 1, it will be seen that the several members 25 are connected to one another by hinges 38, as formed in the pads 32. The structural configuration of these hinges will become more clearly apparent upon looking at FIGS. 5 to 8, wherein a single pad 32

is shown. It has, at a first end (to the right, as viewed in FIG. 5) a semicylindrical projection 39 which is properly shaped so as to match the contour of the pad (FIG. 7).

At its opposite end, the pad 32 has a cavity 40, whose shape accurately matches that of the projection 39 aforesaid. In FIGS. 5 and 6, in addition, there are, clearly shown, the holes 41 which house the mounting bolts 33 for positioning the pads 32 on the jaws 28.

It is thus obvious that each sliding padlike member 25 is united to the adjoining members 25 by matching the respective projections 39 to the cavities 40. In addition, the pads 32 of the end members 36 could also have the projections 39 only at their ends which are intended to be coupled with an adjoining sliding padlike member, whereas the central padlike member could have only the cavities 40 to house the projections of the adjoining pads so as to provide a symmetrical and dynamically balanced assembly.

It is important to notice that the hinge axis between adjoining members 25, that is, the center of curvature of the semicylindrical projection 39 is at an extremely low level relative to the rail, and, substantially, is slightly above that portion of the sliding pad which is intended to be worn out during subsequent braking actions.

Consequently, by virtue of the low level at which the hinge axis is placed and also of the clearance with which the intermediate padlike members 25 are mounted with respect to the coil 26, the members 25 are allowed, during the braking action, perfectly to match the top surface of the rail head without applying to the adjacent members any forces which would be liable to keep said members away of their optimum positions.

In addition, any force which would possibly be applied to any adjoining member has an extremely reduced influence.

Considering now FIGS. 9, 10 and 11, another feature of the present invention is illustrated, according to which inset members 42 of a frictional material are placed in the pads 32, more particularly of an organic or sintered material, such as that used in the braking shoes of motor vehicles (brake linings) placed in recesses which have been specially provided in the pads 32.

In the example shown, also the plate 35 may be made of the same frictional material as members 42 and, in such a case, a bushing 43 (FIG. 14) serves to receive the mounting bolt 33.

A further, especially preferred embodiment is concerned with the end members of the set of sliding pads, as shown in FIGS. 12, 13 and 14. In this case the lower portion of each member 36 has an extension which is directed outwardly with respect to the set of the braking members, whose bottom surface consists, for a predominant fraction, of the frictional material which has already been suggested above, as indicated at 44. In this case, the magnetic circuit is not disturbed by the presence of the frictional material and thus the magnetic drawing force between the brake and the rail remains unaltered, while increasing the extension of the braking surface which has obvious advantages.

However, the amount and the positioning of the frictional material is a function only of considerations as to the optimum braking action, in view of the first cost and the assemblage cost of the material itself, and, simultaneously, it depends on the fact that magnetic

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principles should be abode by, according to which the electromagnetic field as generated by the coil 26 must include also the rail on which the braking action takes place.

It is also obvious that the application of the frictional material 42 is contemplated also on the sliding pads of conventional electromagnetic brakes.

It is important to stress the fact that the hinged connection is formed on those parts of the brake which can be easily, quickly and independently replaced. Thus, differently from the prior art, whenever one or more sliding members are replaced for normal repair due to wear or any other irregularity of the sliding elements concerned, the associated hinge is replaced, so that any damage to the hinge, due to prior defects or to an unforeseen clearance which cannot be tolerated, is automatically corrected.

The invention has been described in connection with a few preferred embodiments thereof, it being understood that any modifications which are conceptually and mechanically equivalent are included in the scope of the invention.

What is claimed is:

1. An electromagnetic brake for track mounted vehicles, comprising
 - an elongate electromagnetic brake energizing coil,
 - a plurality of padlike braking members mounted in a row on said coil to extend longitudinally thereof,
 - and having thereon active braking surfaces disposed beneath said coil frictionally to engage a rail surface when said coil is energized,
 - means for rigidly fixing the two members at opposite ends of said row to said coil,
 - means mounting the remaining members in said row

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between said two members for limited movement relative to said coil,

each of said members including a removable wearing pad having thereon one of said braking surfaces, said mounting means including means hingedly connecting the confronting ends of adjacent members in said row to allow pivotal movement of said remaining members about axes disposed to extend through said wearing pads below said coil and above said braking surfaces.

2. An electromagnetic brake as defined in claim 1, wherein said

connecting means comprises a semi-cylindrical projection on one end of each of said wearing pads, and a correspondingly shaped semi-cylindrical recess formed in the confronting end of the adjacent wearing pad to receive said projection, said projection having a horizontal axis.

3. An electromagnetic brake as defined in claim 1, wherein

said connecting means comprises a semi-cylindrical projection formed on the inner end of each of the wearing pads on said two end members, the wearing pad on the central member of said row having in opposite ends thereof semi-cylindrical recesses matching in shape said projections, and the pads on the members positioned between said central member and said two end members having on opposite ends thereof a semi-cylindrical projection and a correspondingly shaped recess, respectively, whereby the adjacent ends of said members are pivotally connected together.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,768,607 Dated October 30, 1973

Inventor(s) Alessandro Marzocco

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

In column 1 of the patent after the listing of class, subclass and field of search insert:

Claims priority, application Italy, May 30, 1970,
No. 25360 A/70

Signed and sealed this 4th day of June 1974.

(SEAL)

Attest:

EDWARD M. FLETCHER, JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents