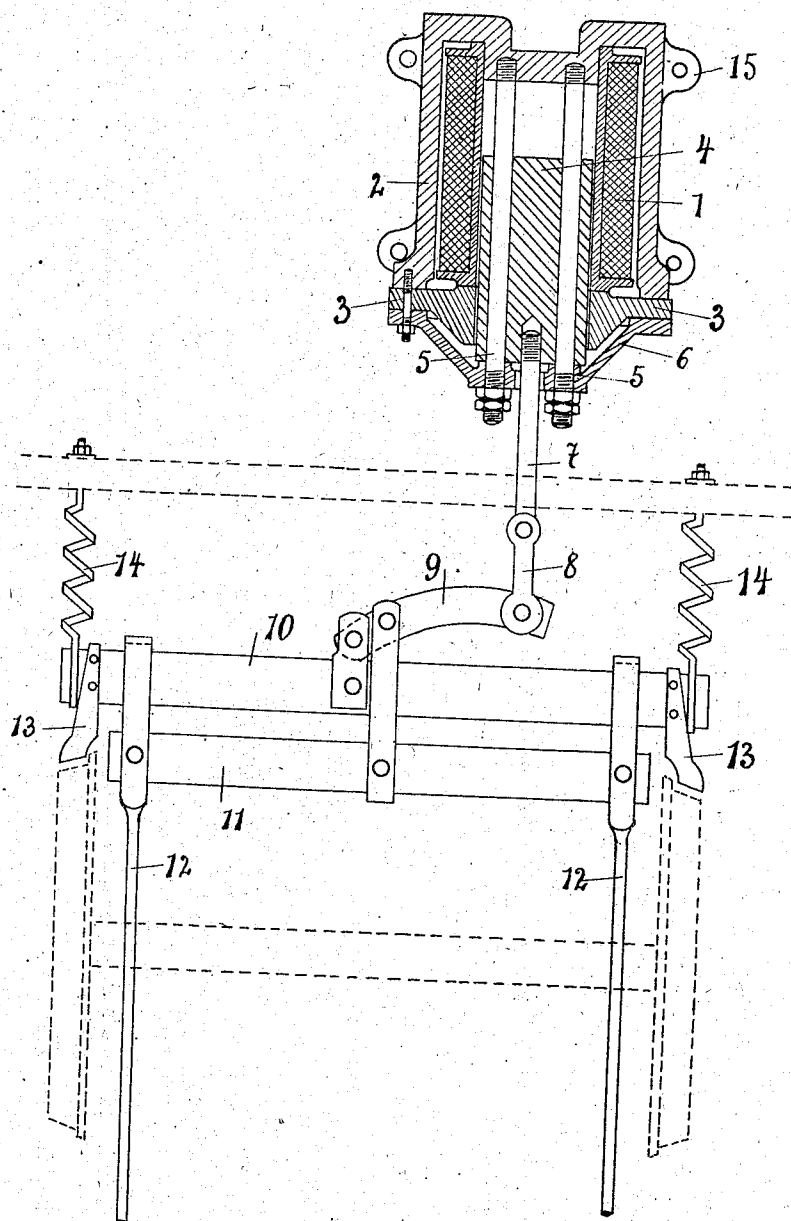


No. 814,910.

PATENTED MAR. 13, 1906

E. KRAMER.  
ELECTROMAGNETIC BRAKE.  
APPLICATION FILED AUG. 3, 1904.



Witnesses:

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# UNITED STATES PATENT OFFICE.

ERWIN KRAMER, OF BERLIN, GERMANY.

## ELECTROMAGNETIC BRAKE.

No. 814,910.

Specification of Letters Patent.

Patented March 13, 1906.

Application filed August 3, 1904. Serial No. 219,401.

*To all whom it may concern:*

Be it known that I, ERWIN KRAMER, a subject of the King of Prussia, German Emperor, residing at No. 9 Paul street, Berlin, Germany, have invented certain new and useful Improvements in Electromagnetic Brakes, of which the following is a specification.

My invention relates to brakes, principally for electrical street-railways, provided with an electromagnet, which actuates a system of levers and presses the brake-blocks to the wheels.

The object of my invention is to produce a brake consisting of an electromagnet of such a construction that for every intensity of current the armature of the electromagnet is moved to a definite position, and of the connection of such an electromagnet with an apparatus driven by the wheel-axle which regulates the intensity of the current, energizing the electromagnet in accordance with the speed of rotation of the wheels. The said magnetic effect or attraction is attained, owing to the fact that the cross-section of the path of the lines of force between the iron body of the solenoid and the core is decreased by the deeper drawing in of the latter, whereby the too high increase of the magnetic force, and the consequent drawing in by starts of the core, is obviated. As, therefore, the force with which the brakes are attracted depends upon the intensity of the current, so above a certain limit the application of the brake-blocks is proportionate to the velocity of rotation of the wheels. I attain these objects by the mechanism illustrated in the accompanying drawing, in which the operating parts are shown in full lines and some details of the carriage in dotted lines.

The solenoid attracting the brakes consists of a coil of wire 1, inclosed in an iron casing 2. The fore extremity of the casing is partially closed by an annular iron shoe 3, which is fixed thereon by screws or the like. In the cavity of the coil 1 and of the shoe 3 an iron core 4 is displaceable axially, and the core 4 is made of such a length only that the outer end of the same is in a deeper position than the outer end of the shoe, when the core is drawn into the coil, whereby the cross-section of the path of the lines of force from the shoe to the core is reduced the more deeply the core is drawn in. By this means the too speedy increase of the magnetic force is obviated, so that the core is not drawn inward deeper than

corresponds to the intensity of the magnetizing-current for the time being.

The core 4 is provided with a number of longitudinal bores and is guided by means of these on bolts 5, the ends of which are fastened in the rear wall of the iron casing 2 and in a cap or bridge 6, respectively, which latter is fixed upon the shoe 3. Eyes 15 serve for mounting the electromagnet on the vehicle-frame.

Instead of the electromagnet here represented, others might be employed, the armatures of which would assume a definite position for each current intensity.

Upon the outer end of the core is fixed a rod 7, which, by means of a link 8 and lever 9, acts upon the usual brake-rods 10 11 12, which carry the brake-blocks 13 and which are taken off by springs 14 when the brake is released.

The braking-electromagnet is preferably energized directly by the electromotors of the vehicle, which by the intermediary of the starting-switch are connected with the electromagnet, if necessary, with the interposition of resistance in such a manner that they act as current-generators. It is well-known that with such an arrangement the current intensity produced by the motors of the vehicle is dependent on the velocity of rotation of the wheels. As, however, as already explained, the position of the core corresponds with the current intensity, the pressure of the brake-blocks upon the wheels is dependent upon the rotative speed of these latter.

The brake acts in the following manner: When the driver desires to apply the brake, he switches the electromotors onto the brake-electromagnets. The motors then generate current, the strength of which corresponds to the velocity of rotation of the wheels, so that the core 4 is drawn into the corresponding position in the coil and the brake applied with a certain force. When, owing to the decreased velocity of the car and of the wheels the intensity of the current falls, the pressure of the brake is also gradually diminished till the vehicle comes to rest entirely without shock. The brakes are likewise immediately released when the wheels, owing to too energetic braking, would be liable to slide, as in this case also the rotative velocity of the wheels, and consequently the current intensity, decreases. It is therefore impossible for the wheels to be locked. If,

on the other hand, the vehicle should start rolling upon an incline or owing to other causes, the current intensity rises and the brakes will be applied more firmly.

5 Instead of connecting the motor of the vehicle directly with the brake-electromagnet, a centrifugal governor might be coupled with the wheel-shaft and switch in current of greater intensity for the brake-electromagnet  
10 when the speed of rotation of the wheels was high and lower intensities when the speed was lower. In this case, however, a source of current which is constant to some extent, at least, must be used.

15 The brake may be varied in different ways without departing from the principle of my invention. I therefore do not wish to be limited to the construction illustrated in the drawing; but

20 What I claim as my invention and desire to secure by Letters Patent, is—

1. In an electromagnetic brake for vehicles, the combination with an electromagnet, having a coil, an iron casing inclosing the coil,  
25 an iron shoe closing the open end of the casing, a central opening in the shoe coinciding with the hole of the coil, a core adapted to move axially in the said cavity of the coil and shoe, the core being of such a length that  
30 its outer end takes a position within the shoe, when the core is drawn into the coil; of a system of brake-levers which bear the brake-blocks and are connected to the core; a current-generator coupled with the vehicle-axle  
35 which produces different current intensities

in conformity with the rotative speed of the wheels; and circuit connections between the electromagnet and the current-generator, substantially as described.

2. An electromagnet for vehicle-brakes, 40 having a coil, an iron casing inclosing the coil, an iron shoe closing the open end of the casing, a central opening in the shoe coinciding with the hole of the coil, a core adapted to move axially in the said cavity of the coil and 45 shoe, the core being of such a form that the cross-section of the path of the lines of force from the shoe to the core is reduced, when the core is drawn into the coil, substantially as described.

3. An electromagnet for vehicle-brakes, 50 having a coil, an iron casing inclosing the coil, an annular iron shoe partially closing the open end of the casing, a core adapted to move axially in the cavity of the coil and 55 shoe, the core being of such a form that the cross-section of the path of the lines of force from the shoe to the core is reduced, when the core is drawn into the coil, which electromagnet is energized by the vehicle-motor, 60 with which it is short-circuited; in combination with a system of brake-levers, substantially as described.

In testimony whereof I have signed my name to this specification in presence of two 65 subscribing witnesses.

ERWIN KRAMER.

Witnesses:

GEORG BONUS,  
CARL APMAN.