(No Model.) 2 Sheets—Sheet 1.

J. F. McLAUGHLIN.

MEANS FOR OPERATING ELECTRIC MOTORS.

No. 575,490. Patented Jan. 19, 1897.

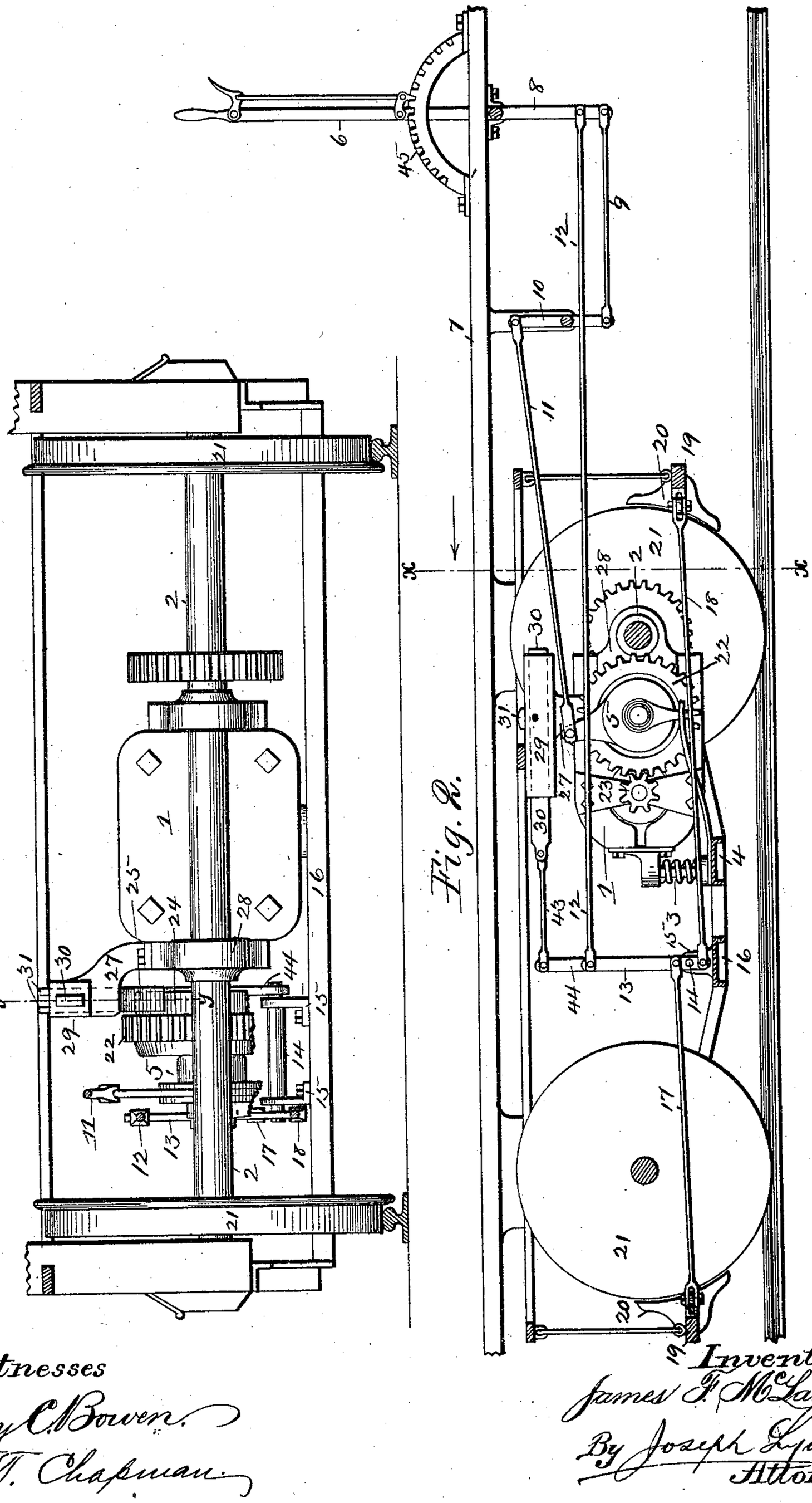

Fig. 1.

Fig. 2.

Witnesses
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(No Model.) 2 Sheets—Sheet 2.

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Fig. 3.

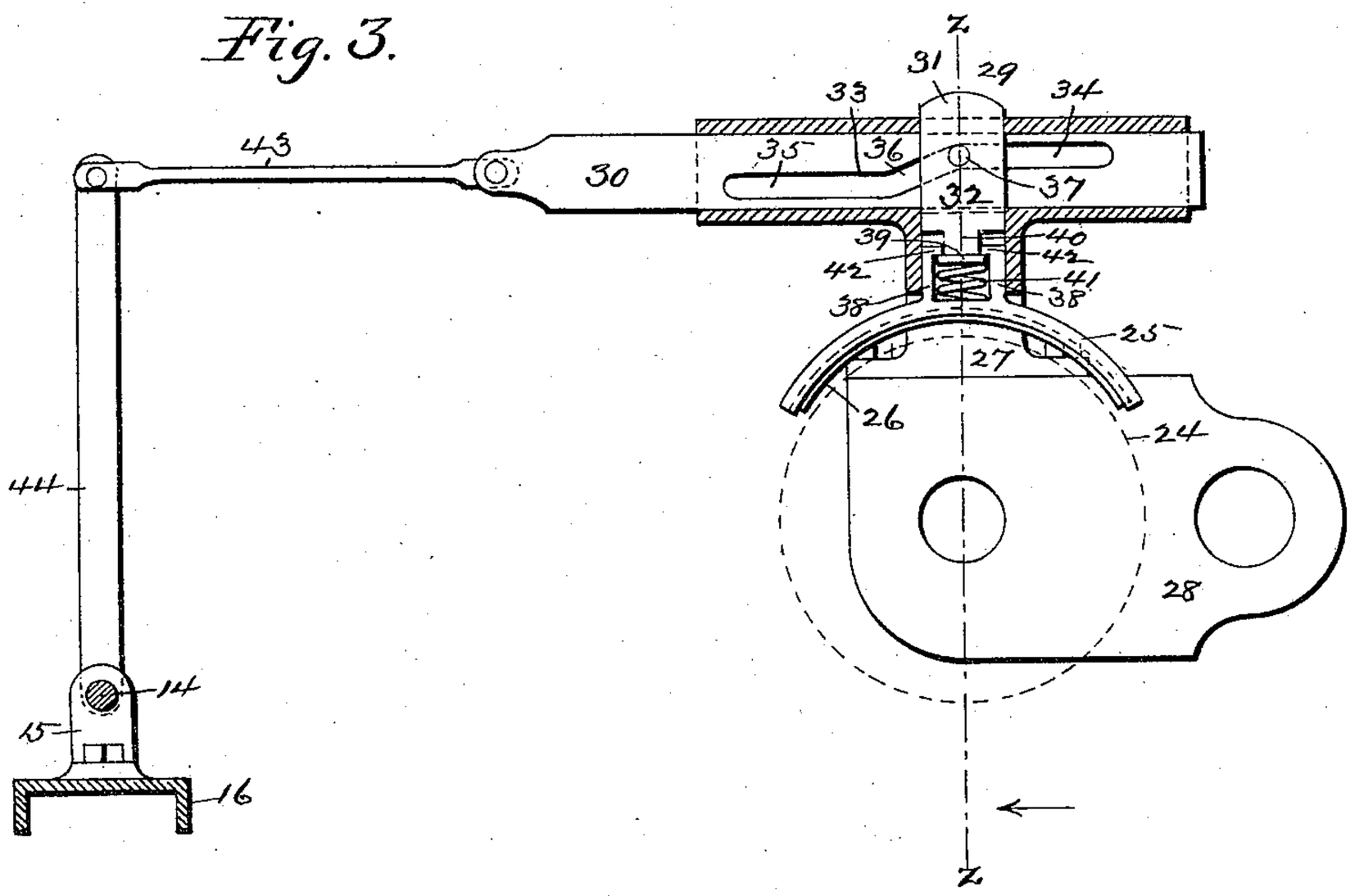

Fig. 4.

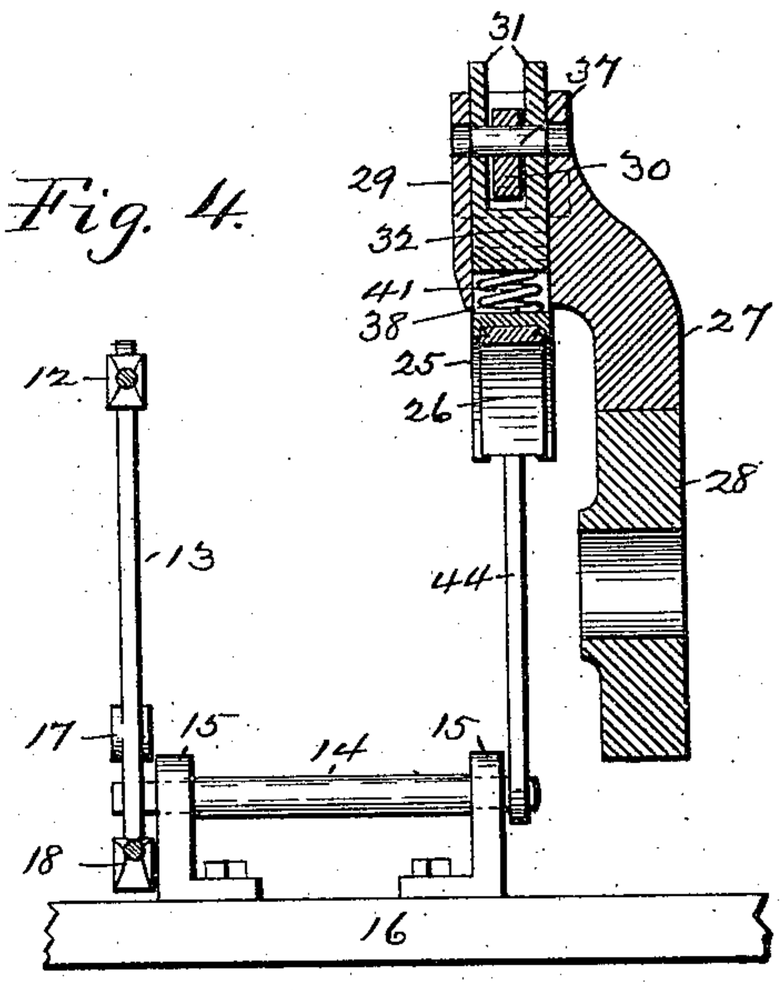

Fig. 5.

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UNITED STATES PATENT OFFICE.

JAMES F. McLAUGHLIN, OF PHILADELPHIA, PENNSYLVANIA.

MEANS FOR OPERATING ELECTRIC MOTORS.

SPECIFICATION forming part of Letters Patent No. 575,490, dated January 19, 1897.

Application filed September 1, 1891. Serial No. 404,441. (No model.)

To all whom it may concern:

Be it known that I, JAMES F. McLAUGHLIN, a citizen of the United States, and a resident of Philadelphia, county of Philadelphia, and State of Pennsylvania, have invented certain new and useful Improvements in the Method of and Means for Operating Electric Motors, of which the following is a specification.

My invention has reference to improvements in the method of and apparatus for operating electric motors which are connected by clutches with the work, and my improvement, although not confined to, is more especially adapted for, use on electric-motor cars of the type shown in my Letters Patent No. 424,810, granted to me on April 1, 1890. In such motor-cars, and also in motor-cars of different types, the car is started by turning on the current to the motor before the same is clutched to or connected with the driving-axle, then allowing the armature to attain a considerable speed, so as to generate a considerable counter electromotive force, and then clutching or gearing the armature to the driving-axle. When such a car is being stopped, the armature is unclutched from or thrown out of gear with the driving-axle and the current is turned off either simultaneously with the unclutching operation or immediately before or after the same. After this the brakes are applied to the driving-wheels as usual. In this operation the armature, being disconnected from the work at a time when it has attained a high speed of rotation, will continue to rotate a considerable time by its momentum, and the wear and tear incident thereto is very objectionable. Another objection to this mode of operation is the noise which is unavoidable in a piece of mechanism rotating at a high speed at a time when its rotation is not needed.

It is the object of my invention to overcome these objectionable features in the operation of electric motors for driving machinery generally, and more especially for driving electric-motor cars; and I overcome these objections by applying a brake to the idly-running armature when its rotation is not needed. It will therefore be understood that in accordance with my invention a car is arrested by unclutching the armature of the driving-motor from the driving wheel or axle, then applying a brake to the idly-running armature, and then applying the brakes to the car-wheels, it being understood that the circuit to the motor is broken before the armature-brake is applied, and preferably simultaneously with the unclutching operation.

In my Patent No. 432,308, granted to me on July 15, 1890, I have shown means for actuating the clutch and car-wheel brakes in succession by means of a single lever, and in my present improvement I connect the armature-brake with the same lever, so that the operations of unclutching, of applying the armature-brake, and of applying the car-wheel brakes are all controlled by the same lever in proper succession. Of course the operations of releasing the wheel-brakes, releasing the armature-brake, and applying the clutch are also controlled by the same lever in their proper order. In this connection any means for controlling the circuit may be used. All this will more fully appear from the following detailed description, in which reference is made to the accompanying drawings, in which—

Figure 1 is a cross-section, mainly in elevation, of the truck of an electrically-propelled car with the improved brake applied thereto, the section being taken on the line *x x* of Fig. 2, looking in the direction of the arrow. Fig. 2 is a longitudinal section of the same. Fig. 3 is a section, upon an enlarged scale, on the line *y y*, Fig. 1, showing the armature-brake and a portion of the operating mechanism therefor. Fig. 4 is a section on the line *z z* of Fig. 3, looking in the direction of the arrow; and Fig. 5 is a detail view illustrating a mechanical resistance-stop indicating one of the positions of the operating-lever.

Like numerals of reference indicate like parts throughout the drawings.

In the drawings the invention is illustrated as applied to electric-motor cars, although it is applicable to electric motors generally.

The car-truck is not shown or described in detail, since any suitable construction of truck adapted to the purposes of the present invention may be employed. Mounted on the truck there is an electric motor 1, hung at one end on one of the car-axles 2 and supported at the other end by means of a spring-buffer 3 on a cross-beam 4 of the truck-frame,

but the motor may be otherwise mounted on the truck, if desired. The motor drives the axle 2 by means of a train of speed-reducing gear, such as is commonly used with high-speed motors on electric-motor cars, and interposed in this gear-train there is a clutch 5 for coupling the motor-armature to or uncoupling it from the axle. The clutch may be of any suitable construction, but it is preferably such as shown and described in Letters Patent No. 451,653, granted to me on May 5, 1891. The clutch is operated by means of a lever 6, pivotally mounted on the car-platform 7, within convenient reach of the motorman. This lever has an arm 8 extending below the car-platform, which arm is connected by a link 9 to one end of a rock-lever 10, mounted below the car-platform, and the other end of the rock-lever is connected by a link 11 to the clutch.

The construction of the clutch and its operating mechanism is such that when the lever is moved in one direction the motor-armature will be coupled through the reducing-gear to the axle, and when the lever is moved in the other direction the motor-armature and axle will be uncoupled.

The arm 8 of the lever 6 is connected by a link 12 to an upright arm 13 on a rock-shaft 14, journaled in brackets 15 on a cross-beam 16 of the truck-frame. Pivoted to the arm 13, on opposite sides of its point of connection with the rock-shaft 14, are links 17 18, extending to brake-beams 19, which latter carry brake-shoes 20, in operative relation to the car-wheels 21. The connections between the operating-lever 6 and clutch and wheel-brakes is such that when the said lever is moved in one direction the wheel-brakes are carried clear of the wheels and the clutch is put into operation, connecting the motor-armature and drive-wheel axle, and when the operating-lever is moved in the other direction the clutch is released and the wheel-brakes are applied, while when the operating-lever is in a central position both the wheel-brakes and clutch are out of operation.

For a full and complete description and illustration of the combined clutch and wheel-brake operating mechanism reference is made to my Patent No. 432,208, hereinbefore referred to.

Referring now to the armature-brake, it is shown in the drawings applied to one member of the clutch, which member consists of a loosely-rotating gear-wheel 22, permanently meshing with a pinion 23, fixed on the armature-shaft, substantially in the manner shown in my Patent No. 424,810, above referred to. For the purposes of my present invention the gear 22 has formed on it a laterally-projecting annular flange 24, forming a bearing or contact face for a brake-shoe 25, which latter is shaped to conform to the said flange and is provided with a removable face-plate 26, of wood or other suitable material, that may be readily exchanged when worn out. The brake-shoe 25 is supported by a bracket 27, secured on one of the side pieces 28 of the motor 1, and this bracket terminates in a head 29, overhanging the flange 24 of the gear 22. The head 29 is extended horizontally on each side of the bracket 27, and passing longitudinally through the said extended head is a flat bar 30, free to slide lengthwise therein. This bar 30 also passes through the bifurcated end 31 of a block 32, which latter is mounted to slide freely in the bracket-head in a vertical direction. The sliding bar 30 has a slot 33 formed in it, with one branch 34 close to and parallel with one edge of the said bar, the other branch 35 close to and parallel with the other edge of the bar, and the intermediate portion 36 inclined, as shown. The bifurcated end 31 of the block 32 has its two wings connected by a pin 37, which passes through the slot 33 in the bar 30.

Assuming that the bar 30 is in such position that the pin 37 is at or near the closed end of the branch 34 of the slot 33, and that the bar 30, as shown in Fig. 3, is moved toward the right of said figure, it will be seen that the block 32 will be held in an elevated position until the inclined portion 36 of the slot is reached, when, as the movement of the bar is continued, the block 32 will be forced downward, the pin 37 riding down the said inclined portion 36 of the slot until the branch 35 of the slot is reached, and the block 32 will be held in the depressed position as the movement of the bar is continued toward the right. It will be understood that on moving the bar 30 in the other direction the block 32 will be lifted when the pin 37 reaches the inclined portion 36 of the slot 33, and will be held in the elevated position as the pin rides along the branch 34. The block 32 is connected at its lower end to the brake-shoe 25, so that when the said block is elevated or depressed by sliding the bar 30 in one direction or the other the said brake-shoe participates in said movement. Thus in the construction shown in the drawings, when the bar 30 is moved from left to right, the block 32 and brake-shoe 25 will be depressed, and the bearing-face of the said brake-shoe will be forced into contact with the flange 24 on the gear 22, and when the bar 30 is moved from right to left the block 32 and brake-shoe 25 will be lifted until the latter is free from the said flange 24. It will therefore be evident that when the armature is rotating idly by its own momentum it is only necessary, in order to stop the rotation of the same, to move the bar 30 in the proper direction to bring the brake-shoe 25 into contact with the flange 24 of the gear 22, with which latter the armature is permanently geared.

In order to compensate for the wear of the brake-shoe, I provide a yielding connection between the same and the block 32. The brake-shoe is provided about midway of its length with two ears 38 38, between which is a head 39, formed on one end of a neck 40,

projecting from the lower end of the block 32, and between the said head and the brake-shoe is a strong helical spring 41. The ends 42 of the ears 38 are bent one toward the other at right angles to the said ears and in the path of the head 39, so as to prevent the brake-shoe from falling away from the block 32 when the latter is lifted. The construction of the wear-compensating device is such that when the block is forced downward the brake-shoe will make contact with the flange 24 on the gear 22 before the block 32 has reached its lowermost position, and then the spring 41 will yield sufficiently to permit the additional movement of the said block. It will be understood that the spring 41 is strong enough to hold the brake-shoe when applied in firm contact with the flange 24, even when the brake-shoe has become worn.

The bar 30 is connected at one end to a link 43, extending to and connected with the outer end of an upright arm 44, fast on the rock-shaft 14, before described, so as to move with it when the lever 6 is operated, the said lever thus controlling the bar 30 and through it the armature-brake, as well as the clutch 5 and car-wheel brakes 20. When the lever 6 is moved so as to apply the clutch, and thereby couple the armature and car-axle, the car-wheel brakes are out of contact with the wheels and the bar 30 is moved to the left, so that the pin 37 of the block 32 is near the closed end of the branch 34 of the slot 33, and the brake-shoe 25 is therefore out of contact with the flange 24 of the gear 22. When the parts are in this position, the motor-circuit having been closed, the car will be driven by the motor in the usual manner.

When the car is to be stopped, the circuit is first opened in any desired manner. Then the lever 6 is moved in the opposite direction, first unclutching the armature from the car-axle, then applying the armature-brake, and finally applying the wheel-brakes.

It will be observed that the slot 33 in the bar 30 is so shaped as to effect the elevation or depression of the brake-shoe 25 only when the said bar is in an intermediate position and when neither the clutch nor the wheel-brakes are in operation. Thus the armature may be uncoupled from the drive-axle and the armature-brake be applied without applying the wheel-brakes. Likewise the armature may be released from its brake and the motor-circuit closed, so that the armature may attain a high speed before the clutch is applied.

It is desirable that the motorman in starting the car should know when the armature-brake is off before he applies the clutch, so that he may close the motor-circuit and permit the armature to attain a high rate of speed previous to clutching it to the drive-axle. For this purpose, in addition to the usual segmental rack and retaining-pawl for the lever 6, there is an additional segment 45 (see Fig 5) on the other side of the lever and having a smooth upper edge, with a single shallow notch 46 about midway of its length, and on one side of the lever there is a sleeve 47, open at the lower end to receive a pin 48, provided with a reduced portion 49, extending through the other end of the sleeve and surrounded by a helical spring 50, confined within the sleeve and tending to force the pin downward. This pin 48 rides on the smooth upper edge of the segment 45 as the lever 6 is moved to and fro, and when the notch 46 is reached the spring forces the pin into the same. The lower end of the pin is rounded, so that by an extra effort on the part of the motorman the pin may be made to ride out of the notch against the action of the spring. The notch 46 is so located that when the pin 48 reaches it the clutch, wheel-brakes, and armature-brake are all out of action.

The extra effort required for moving the lever 6 from the central position, wherein the pin 48 engages the notch 46 in the segment 45, apprises the motorman of the fact that the brakes and the clutch are "off." This arrangement therefore has the function of an indicator which conveys intelligence in an unfailing manner whether the motorman is attentive or not.

While I have specifically described the application of my invention to motor-cars, it is quite evident that it may be applied with advantage to any electric-motor plant or to electric motors used for driving any kind of machinery by the interposition of a clutch or other coupling between the armature and said machinery. In general a brake corresponding to the wheel-brakes herein described will not be used except on motor-cars, although it may be used for arresting the machinery after it has been unclutched from the armature or other rotating member of the motor.

Having now fully described my invention, I claim and desire to secure by Letters Patent—

1. The combination with an electric motor, of a clutch for coupling it to the work, a brake for the motor-armature, and connections between the clutch and armature-brake for operating them in succession, substantially as described.

2. The combination with an electric motor of a clutch for coupling the motor to the work, one member of said clutch being constantly geared to the motor-armature and provided with a smooth bearing-face; a brake in operative relation to said bearing-face, and connections between the clutch and brake for operating them in succession, substantially as described.

3. The combination, in an electric-motor car, of an electric motor, a clutch for coupling the motor-armature with and uncoupling it from the driving-wheels, a brake for the armature, and operating mechanism actuating the clutch and armature-brake in succession, substantially as described.

4. The combination, in an electric-motor

car, of an electric motor, a clutch for coupling the motor-armature with and uncoupling it from the driving-wheels, a brake for the armature, brakes for the car-wheels, and operating mechanism actuating the clutch, armature-brake, and wheel-brakes in succession, substantially as described.

5. The combination, in an electric-motor car, of an electric motor, a clutch between the same and the driving-wheels, a brake for the armature, brakes for the car-wheels, a system of links and levers connecting the clutch, armature-brake and wheel-brakes, and a single operating-lever for the same, substantially as described.

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

JAMES F. McLAUGHLIN.

Witnesses:
EDWARD ELDRED,
H. F. REARDON.