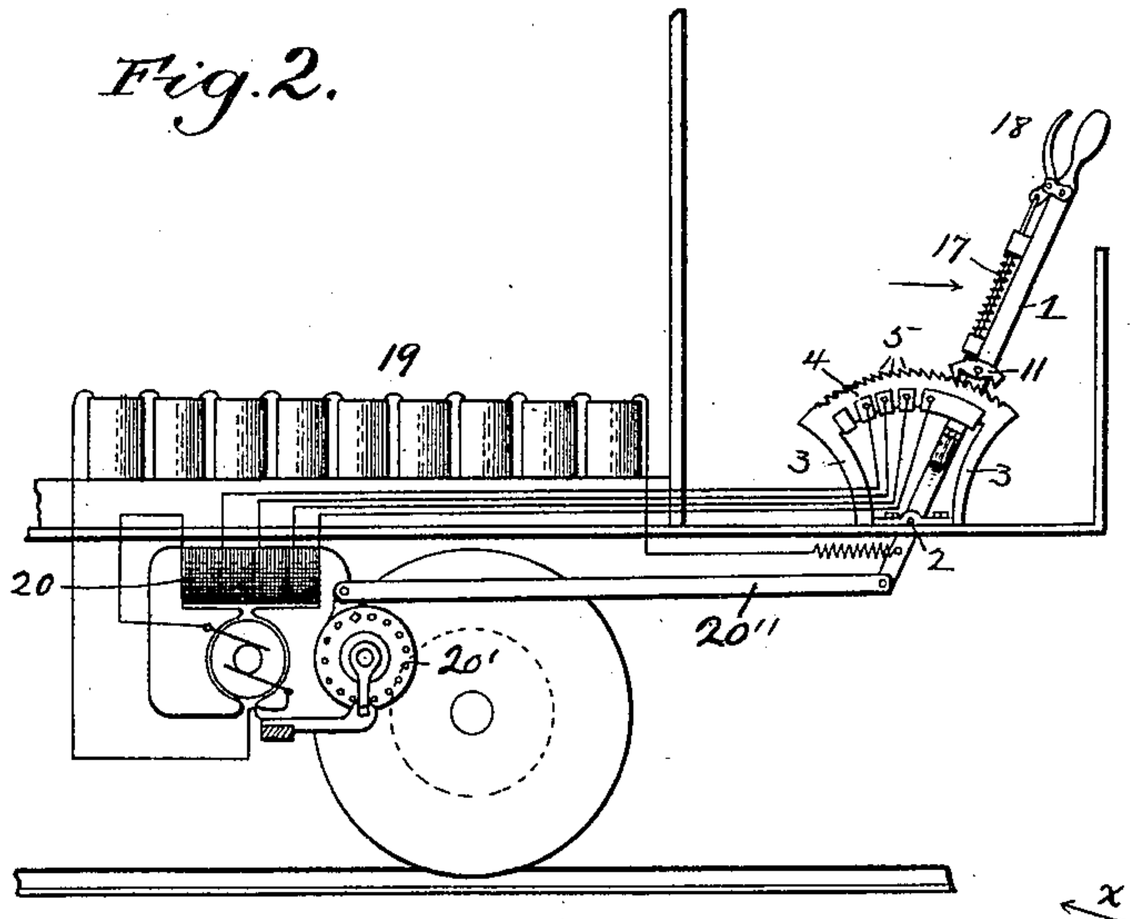
(No Model.) 2 Sheets—Sheet 1.

J. F. McLAUGHLIN.

MECHANISM FOR CONTROLLING THE APPLICATION OF POWER.

No. 467,297. Patented Jan. 19, 1892.

Fig. 2.



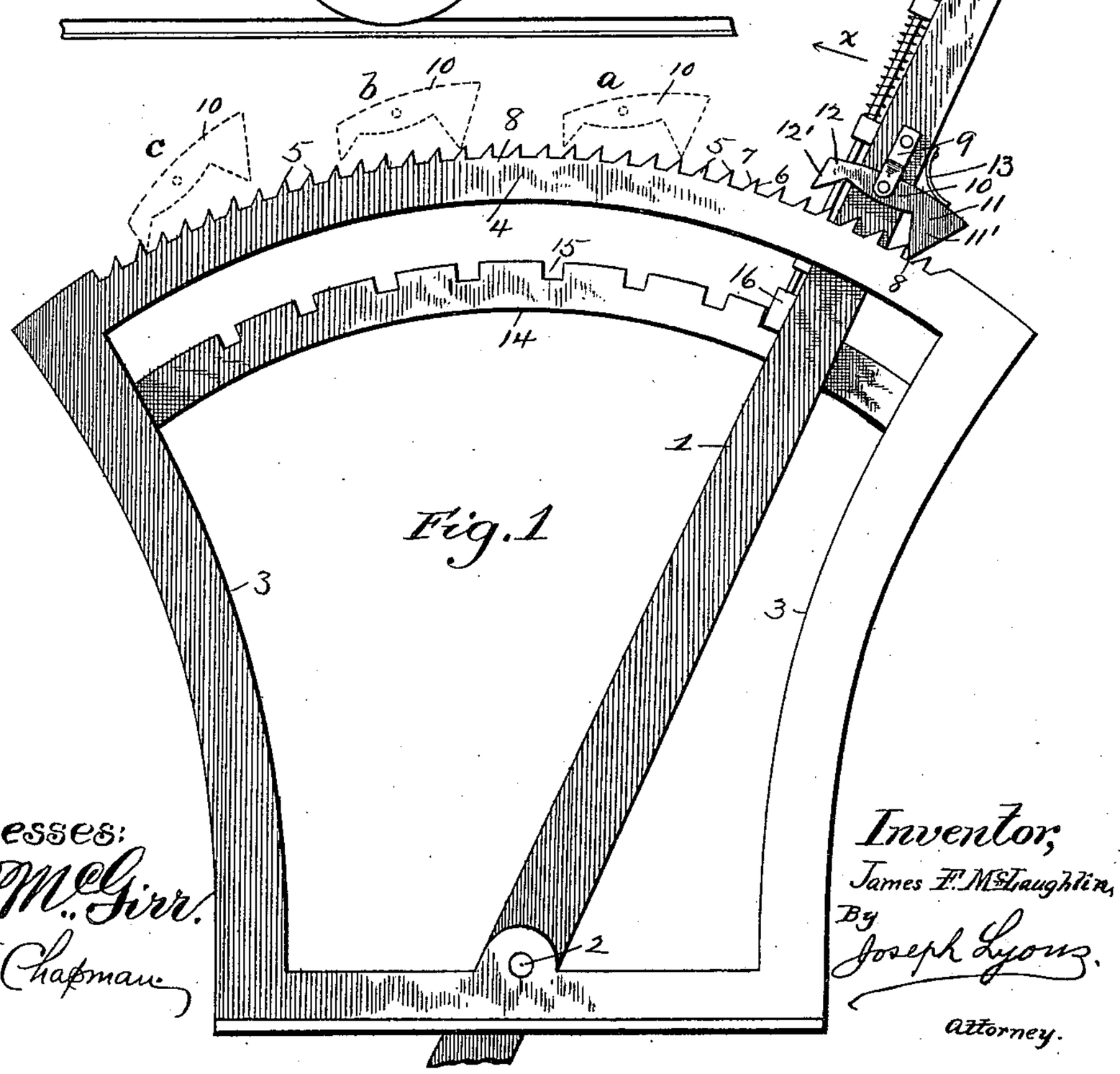


Fig. 1.

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Inventor;
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(No Model.) 2 Sheets—Sheet 2.

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MECHANISM FOR CONTROLLING THE APPLICATION OF POWER.

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Fig. 3.

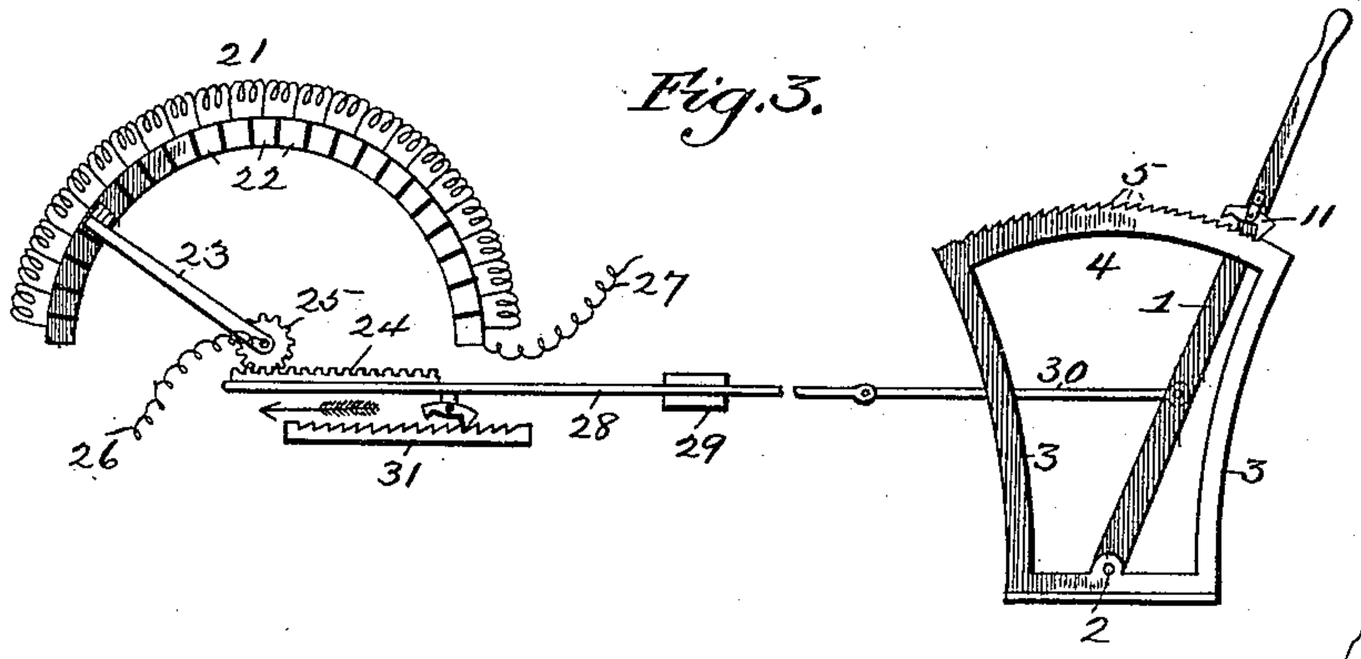


Fig. 4.

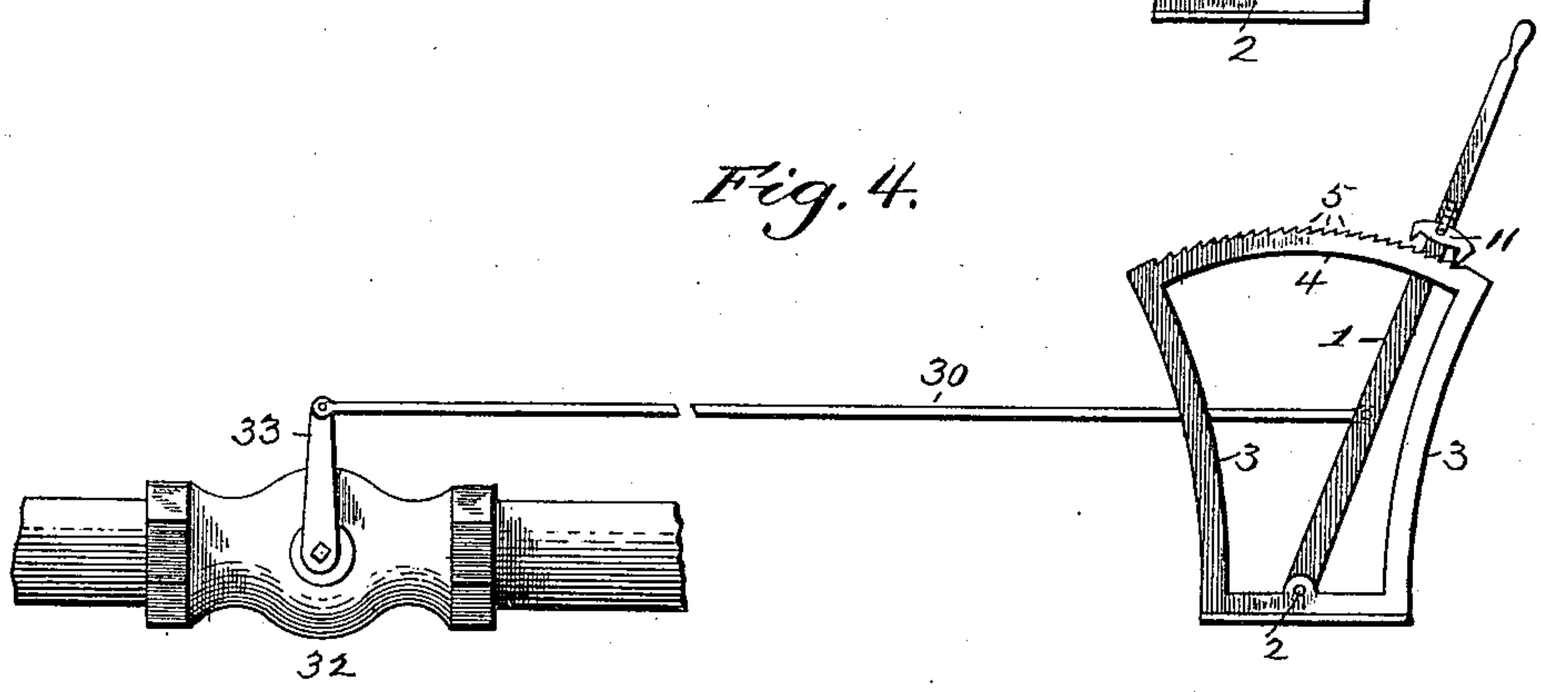


Fig. 5.

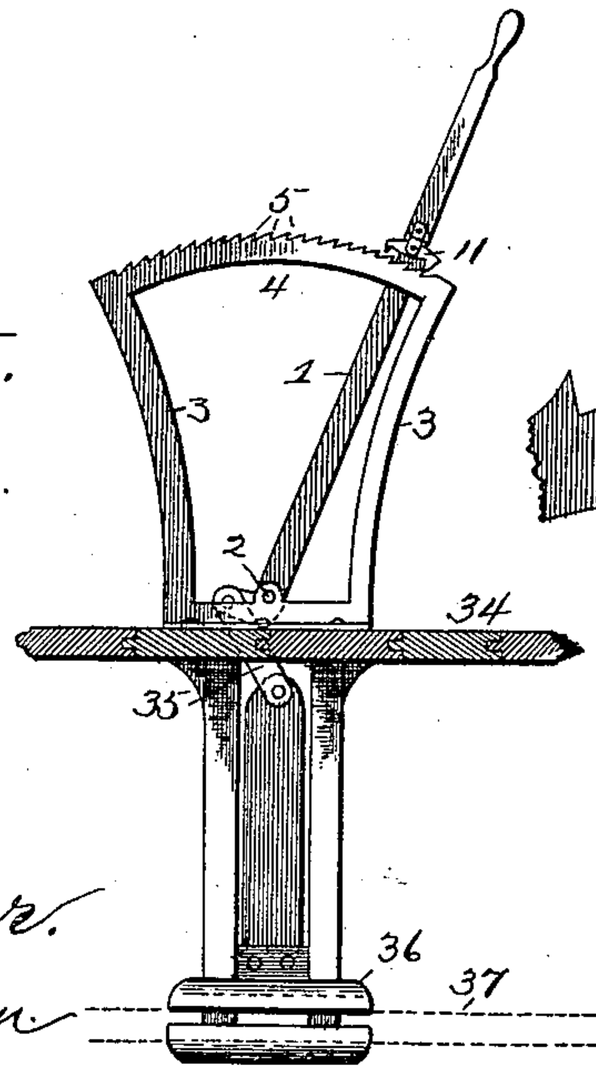
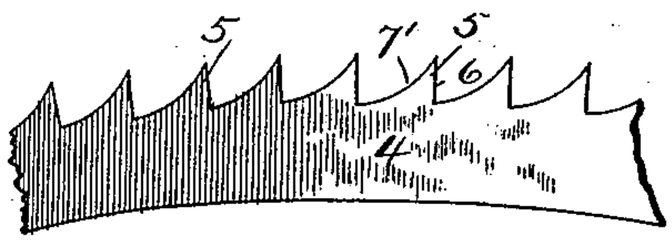


Fig. 6.



Witnesses:
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UNITED STATES PATENT OFFICE.

JAMES F. McLAUGHLIN, OF PHILADELPHIA, PENNSYLVANIA.

MECHANISM FOR CONTROLLING THE APPLICATION OF POWER.

SPECIFICATION forming part of Letters Patent No. 467,297, dated January 19, 1892.

Application filed September 7, 1891. Serial No. 406,003. (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, in the county of Philadelphia and State of Pennsylvania, have invented certain new and useful Improvements in Mechanism for Controlling the Application of Power, of which the following is a specification.

My invention has reference to improvements in power-controlling mechanisms designed to be actuated by an operator for applying power to machinery driven by any available agency, such as electricity, steam, compressed air, water, or by the direct communication of mechanical energy, as by clutches, grips, &c. In mechanism of this sort heretofore used, when it was desired that the power be applied in a gradual manner, either to prevent shocks to the machinery or to secure other advantages, the operator was instructed to actuate the controlling mechanism with a certain moderate speed in the direction for applying the power and rapidly in the direction for cutting off the power; but there was nothing in the mechanism under his control to prevent him to disobey or neglect the instructions received, and by reason of such disobedience, forgetfulness, or neglect injury was frequently done to costly and delicate machinery. Thus, for instance, in electric-motor cars where ordinarily a segmental rack and lever are employed for applying the current and for clutching a freely-rotating armature to the gearing by which motion is communicated to the driving-axle it is of importance to turn on the current gradually and also to apply the clutch in a gradual manner, since otherwise the armature may be burned out and the car-frame may receive dangerous jars. In other electrical operation—as, for instance, in electric welding—it is desirable to turn on the current very gradually, since otherwise the contacting-surfaces of the metals to be welded may be burned. In the operation of steam, water, or air motors it is also desirable that the throttle-valves be opened slowly, and in the ordinary cable cars it is imperative that the grip should be applied in a gradual manner, since the rapid application of the grip would not be tolerated by the passengers patronizing the road. Still, in all these modes of driving machinery and of propelling cars there is no provision made that will prevent the operator from applying the power as suddenly as he desires, and thus the safety of the expensive machinery and the comfort and safety of passengers is entrusted to the intelligence and good will of an operator.

The object of my invention is to overcome these objectionable features in the application of motive power by forcibly and automatically controlling the operator in the application of the motive power in such a manner that he can apply the power only with a certain definite predetermined moderate speed, while he is allowed to withdraw the power with any desired speed. I accomplish this result by combining the operating lever or rod with a segmental or rectilinear ratchet and an anchor or escapement-pawl so related to the ratchet as to lock the lever or rod in one direction against rapid movement, but leaving it free to move in that direction with a certain definite moderate speed, while in the other direction the operating lever or rod is free to move with any speed. Since the escapement pawl and ratchet constructed to effect this result depend for their action directly upon the speed of movement of the actuating lever or rod and since the lever or rod is instantly locked or its speed checked by the action of the escapement-pawl and ratchet, the said escapement-pawl and ratchet constitutes an effective speed-lock or speed-check for the lever or rod.

My improvement is applicable for use in a great number of devices; but it is particularly useful for controlling the speed of application of motive power to motor-cars, and more especially to electric-motor cars, all of which will more fully appear from the following detailed description with reference to the accompanying drawings, in which—

Figure 1 is an elevation representing my improvement by itself and without regard to any specific application in the arts. Fig. 2 is a side elevation, partly in section, of a portion of an electric-motor car with my improvement applied thereto. Fig. 3 is a side elevation of a rheostat controlled by my improved mechanism represented in two forms, both embodying my invention. Fig. 4 is a

side elevation illustrating the application of my invention to the control of throttle-valves. Fig. 5 illustrates an elevation of my invention as applied to cable cars, showing the floor of the car in section; and Fig. 6 is a side elevation of a slightly-modified form of ratchet, which may be used with my invention.

Like numerals and letters of reference indicate like parts throughout all the drawings.

Referring now to Fig. 1, there is shown an operating-lever 1, pivoted at a point 2 to the base of a frame-work 3, the top bar 4 of which is a segment of a circle described about the pivotal point 2, and the upper edge of which is formed with ratchet-teeth 5. The mechanism for applying power may be connected with the lever 1 by rods, links, or otherwise, as will hereinafter appear, or may be connected to and actuated by the pivot 2, in which case the latter is keyed to the lever 1 and loose in its bearings. My invention, however, is in no way limited to any particular mode of and means for connecting the operating-lever with the mechanism actuated by the same for applying power or for any other purpose, and in Fig. 1, which represents my invention in its generic aspect, I have therefore not illustrated any connection of the operating-lever.

It will be observed that the ratchet-teeth 5 are formed with one side 6 radial to the top bar 4, while the other side 7 forms an acute angle with such radius. The ratchet-teeth are spaced in a manner which will hereinafter more fully appear, but preferably the bottoms 8 between two successive teeth are either straight or curved upon the line of circle described from the pivotal point 2 as a center.

To the lever 1, between the latter and a bracket 9, is loosely pivoted an anchor or escapement-pawl 10 in such position that the two teeth of the escapement-pawl, or one of them, may engage the ratchet-teeth when the lever is rocked in one direction or the other. The escapement-pawl is not pivoted exactly in the middle of its length, but at a point nearer to one end, so that the escapement-pawl is in effect a two-armed lever, one arm of which 11 is longer than the other arm 12, so that when the escapement-pawl is left free to the action of gravity the longer arm will preponderate and drop down, causing its tooth 11′ to engage the ratchet-teeth and lifting the tooth 12′ of the short arm to clear the ratchet-teeth. To insure this result more clearly, the tooth 11′ is made heavier than the tooth 12′, and in addition thereto a spring 13, fast on the lever 1, bears upon the long arm 11. If the difference in length of the two arms of the escapement-pawl is made considerable, the tooth 11′ on the long arm 11 need not necessarily be made heavier than the tooth 12′, or the spring 13 may be omitted. For the purpose of my invention it is only necessary that one of the arms of the escapement-pawl or anchor have a tendency to descend, so as to engage the ratchet and to lift the other arm clear off the ratchet. It is therefore not absolutely necessary that one arm be longer than the other if it is sufficiently weighted; or, if not weighted, a spring 13 is used. I am therefore not limited to any particular means for giving to the escapement-pawl a bias to descend with one of its arms so long as it is so biased. In the position of the lever shown in Fig. 1, with the escapement-pawl represented in solid lines, the tooth 11′ engages one of the ratchet-teeth, against which it bears with one of its sides, while the edge of the tooth 11′ is at the bottom 8 of the space between two successive teeth. The other tooth 12′ of the escapement-pawl is in this position lifted above the ratchet-teeth, as is clearly shown in the drawings. It will be understood that the escapement-pawl has come to this position either by the action of gravity upon the longer or weighted arm 11 or by the action of the spring 13, or by the action of both, and it will be noticed that in this position of the lever and escapement-pawl the inner side of the tooth 11′ is inclined to the radial side of the ratchet-tooth which it engages, so that if the lever 1 is moved from this position in the direction of the arrow x the inner side of the tooth 11′ will be acted upon as a cam, so that this tooth will be lifted out of engagement with the ratchet-tooth. The outer side of the tooth 11′ is also inclined to the radial side of the ratchet-tooth, although this is not absolutely necessary, as will appear farther on. The inner side of the tooth 12′ of the escapement-pawl is also inclined to the radial side of the ratchet-tooth below it, for a purpose which will hereinafter appear, while the outer side of the tooth 12′ is practically in the line of a radius drawn from the pivot 2 to said tooth.

The distance between the edges of the teeth 11′ and 12′ is slightly greater than the aggregate distance between the upper edges of any desired number of ratchet-teeth. In the drawings, Fig. 1, the edges of the escapement-pawl teeth are shown to embrace five teeth of the ratchet—that is to say, if the tooth 11′ rests with its edge upon a ratchet-tooth the tooth 12′ reaches beyond the fifth succeeding tooth of the ratchet, counting the ratchet-tooth upon which the tooth 11′ rests as the first; but I am not limited to any particular length of the escapement-pawl, as will be seen by reference to Figs. 3 and 5, which show, respectively, the escapement-pawl embracing four and three ratchet-teeth, and it will be clear that it may embrace any number of ratchet-teeth.

To the frame 3 there is secured a segmental bar 14, provided with notches 15, which are engaged by a pin 16, actuated by a spring 17 and thumb-lever 18 (see Fig. 2) in the usual manner, for locking the lever 1 in various positions to which it may be moved. The operation of my invention will now be readily understood from the following explanation, in which reference will be made to various phases

of operation illustrated in dotted lines, and marked by the letters *a b c*.

Assuming the position which the lever 1 occupies in the drawings to be that which corresponds to that condition of the working mechanism in which the power is "off," and that in order to turn the power "on" it is necessary to move the lever in the direction of the arrow to or near the other end of the ratchet, it being understood that the more the lever is moved in that direction the more power is turned on, or the more forcibly a clutch or grip takes hold of the power-transmitting device. In the position of the lever shown in the drawings, the weighted or biased end of the escapement-pawl is depressed either by gravity or by the spring 13, or both, and the inner side of the tooth 11′ bears upon the edge of a ratchet-tooth on its radial side 6, while the edge of the tooth 11′ rests upon the bottom 8 of the space between two successive teeth of the ratchet. If now the lever is moved in the direction of the arrow for turning on power, the escapement-pawl is tilted by the ratchet-teeth acting upon the inner side of tooth 11′ until the escapement-pawl assumes a position relative to the teeth of the ratchet such as is presented in dotted lines at *a*. This phase of operation is characterized by the fact that the edge of the tooth 11′ rests upon the edge of a ratchet-tooth, while the edge of the tooth 12′ has entered between two adjacent ratchet-teeth and below the edges of the same. If now the movement of the lever is continued slowly, the escapement-pawl will assume a position illustrated in dotted lines at *b*, and this phase of operation is characterized by the fact that the biased end of the escapement-pawl has slightly dropped, riding down the inclined face of the ratchet-tooth, upon the edge of which it had rested a moment before, and thereby the tooth 12′ has been raised above the edge of the ratchet-tooth immediately in front of it. A continued movement from this position will allow the biased arm of the escapement-pawl to still farther descend until it again assumes the position with reference to the ratchet-teeth illustrated in solid lines. These operations will now be repeated over and over again so long as the lever 1 is moved slowly in the direction of the arrow, and there will be no impediment to such movement. If, however, from the phase of operation represented at *a* the movement of the lever be accelerated—that is to say, if the operator should attempt to move the lever rapidly—then the outer face of the tooth 12′ will strike the radial face of the ratchet-tooth immediately in front of it before the biased end of the escapement-pawl has time to descend, and thereby lift the tooth 12′ above the ratchet-tooth. By such rapid movement, therefore, the further progress of the lever is arrested by the abutment of the outer face of the tooth 12′ against the radial face of a ratchet-tooth, and this condition of affairs is represented in dotted lines at *c*. When the lever is thus arrested, the escapement-pawl is tilted, as shown, with its tooth 11′ raised above the ratchet-teeth.

It will now be understood that the escapement-pawl carried by the lever, together with the ratchet, both constructed and co-operating as described, constitute an effective speed-lock or speed-check for the lever, and that by the use of this invention an operator is positively prevented from applying power suddenly with its full force, but is positively forced to apply that power gradually. By reference to the phase of operation represented at *a* it will be seen that the maximum speed with which the power may be applied without obstruction depends upon the distance of the front face of the tooth 12′ from the radial face of the ratchet-tooth immediately in front of it when the edge of tooth 11′ rests upon the edge of the ratchet-teeth, and that it also depends upon the depth to which the tooth 12′ reaches between two ratchet-teeth when the edge of tooth 11′ rests upon the edge of a ratchet-tooth, the greater that depth and the smaller that distance the slower must be the movement of the lever in order to allow the biased arm of the escapement-pawl to lift the shorter arm, with its tooth 12′, clear off the ratchet-tooth in front. Therefore, by making the space between the ratchet-teeth long and the depth to which the tooth 12′ reaches small the speed with which the lever may be moved becomes greater, while when the space between the ratchet-teeth is made small and the depth to which tooth 12′ reaches is made comparatively great the maximum speed with which the lever may be moved in the direction of the arrow is proportionately reduced. With my invention, therefore, the speed with which power may be applied can be predetermined with absolute certainty, and it will now be understood that while the operator controls the movement of the lever the lever in turn controls the action of the operator in a most positive manner. When by a momentary rapid movement of the lever the same is arrested in the manner described and illustrated at *c*, the operator can at once continue the slow movement of the lever by first drawing that lever a very short distance backward, so as to allow the biased arm of the escapement-pawl to descend until it assumes either of the positions represented at *b a* or in solid lines. The backward movement of the lever for cutting off the power may be as rapid as desired, since during such movement the edge of the tooth 11′ rides up the inclined faces of the ratchet-teeth like an ordinary pawl, and if by very rapid movement the inclined face of tooth 12′ should come in contact with the inclined faces of the ratchet-teeth this can offer no impediment.

In Fig. 6 I have shown a modified form of ratchet-teeth which may be used in my invention. In this case each tooth 5 has one radial face 6, as in the form shown in Fig. 1; but the other face 7′, instead of being an in-

clined plane, is curved concavo, so that it merges into the bottom of the space between the successive teeth. In this construction the tooth 11′ is allowed to descend more rapidly at the beginning of its downward movement, so that the tooth 12′ is more rapidly made to clear the edge of the tooth immediately in front of it. The movement of the lever, therefore, for turning on the power may be a little more rapid than with a ratchet of otherwise like proportions in which the inclined faces of the teeth are plane. The form of the ratchet-teeth may be variously changed in accordance with the principle of my invention.

Referring now to Fig. 2, my invention is there shown as applied to an electric-motor car of the kind described and shown in my patent, No. 424,810, granted April 1, 1890, the details of which, therefore, need not be here described. In this instance by the movement of the lever 1 in the direction indicated by the arrow, the current from the secondary battery 19 is first turned on to the electric motor by passing it through one of the coil-sections only of the field-magnet 20. By a continued movement of the lever the current is allowed to pass through additional coils of the field-magnet whereby the power of the motor is increased, and by a still further movement of the lever in the direction of the arrow the armature of the motor is by means of the clutch 20′ clutched to the gearing connecting with the driving-axle, there being for this purpose a link 20″, which connects the lever 1 with the clutch 20′. By my invention this turning on of the motive power and of the clutch is made gradual, as will now be understood, whereby all shocks to the car and injury to the machinery is avoided.

In Fig. 3 my speed-lock or speed-check is shown as applied to the gradual turning on of an electric current for any purpose whatever. In this case 21 represents a rheostat; 22, the contact-plates; 23, the switch-arm carrying a contact-brush, as shown, and this arm 23 is actuated by a rack-bar 24, engaging a pinion 25, fast on the pivoted arm 23. The current may be supposed to enter by the conductor 26, passing by the arm 23 through the rheostat-sections on the right-hand side of the arm and out by conductor 27. When the rack-bar is moved gradually in the direction of the arrow indicated, resistances are gradually cut out and the current correspondingly increased. To accomplish this gradual movement of the rack-bar, it may be mounted upon a rod 28, guided in a rectilinear path by suitable guides 29 and actuated by the lever 1, mounted upon the segmental ratchet-frame 3 4, and provided with the escapement-pawl 11, constructed in accordance with my invention, the lever 1 being jointed to the rod 28 by a link 30. Instead of using a segmental ratchet, I may use a rectilinear ratchet-bar 31, arranged parallel to the rod 28, with the escapement-pawl 11 mounted upon the rod. This arrangement will operate exactly the same as a segmental ratchet and escapement pawl constructed in accordance with my invention, and it will be clear to those skilled in the art that in all cases where the application of power is to be positively graduated I may use a rectilinear ratchet in place of a segmental one.

In Fig. 4 my speed-lock or speed-check is illustrated as applied to a throttle-valve 32, the spindle of which is connected with a crank 33, jointed by a link 30 with the lever 1, which is mounted and equipped in the manner shown in Fig. 1.

In Fig. 5 my invention is shown as applied to the grip of a cable car. In this case the segmental ratchet-frame, with the operating-lever equipped with my improvement, is mounted upon the platform 34 of the car. The lever in this instance is a bell-crank lever, and is connected by a toggle-link 35 to the movable member 36 of the grip, the cable 37 passing between the fixed and movable members of the grip. The advantages of the application of my invention to cable cars are self-evident.

It will be understood that in the practical application of my speed-lock or speed-check it is of no consequence whether the escapement-pawl or the ratchet is connected with the operating lever or rod so long as one of them is stationary, although it is also practicable to move both in opposite directions.

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

1. As a means for controlling an operator in the application of power, the combination of power-transmitting devices and a hand-lever or rod for actuating the same with a rocking escapement-pawl preponderating on one side, carried by said lever or rod, and a ratchet in operative relation to the escapement-pawl and arranged with reference to the same to lock the lever or rod against rapid movement in one direction, substantially as described.

2. In electric-motor cars, the combination of an electric motor and the lever for starting the car with a biased escapement-pawl carried by the lever and a ratchet in operative relation to the escapement-pawl, the two being spaced and shaped with reference to each other to lock the lever against rapid movement in the direction for applying the power, substantially as described.

3. In electric-motor cars, the combination of an electric motor, a clutch for coupling the armature of the motor to the drive-axle and for uncoupling the same, and the lever for admitting current to the motor and for actuating the clutch with a ratchet and a pivoted escapement-pawl moved by the lever along the ratchet and oscillated by the ratchet-teeth and by gravity to lock the lever against rapid movement in one direction, substantially as described.

4. The combination of a lever for actuating power-applying devices with a biased escape-

ment-pawl carried by the lever and a ratchet, both constructed, substantially as described, to react upon the lever to lock the same against rapid movement in one direction, substantially as described.

5. The combination of a lever for actuating power-applying devices with an escapement-pawl carried by the lever and a ratchet in operative relation to the escapement-pawl, both spaced and shaped to bring the escapement-pawl into abutment with the ratchet when the lever is moved beyond a predetermined speed in one direction, substantially as described.

6. A power-controlling lever, in combination with a speed-lock, 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.