E. V. HARTFORD.

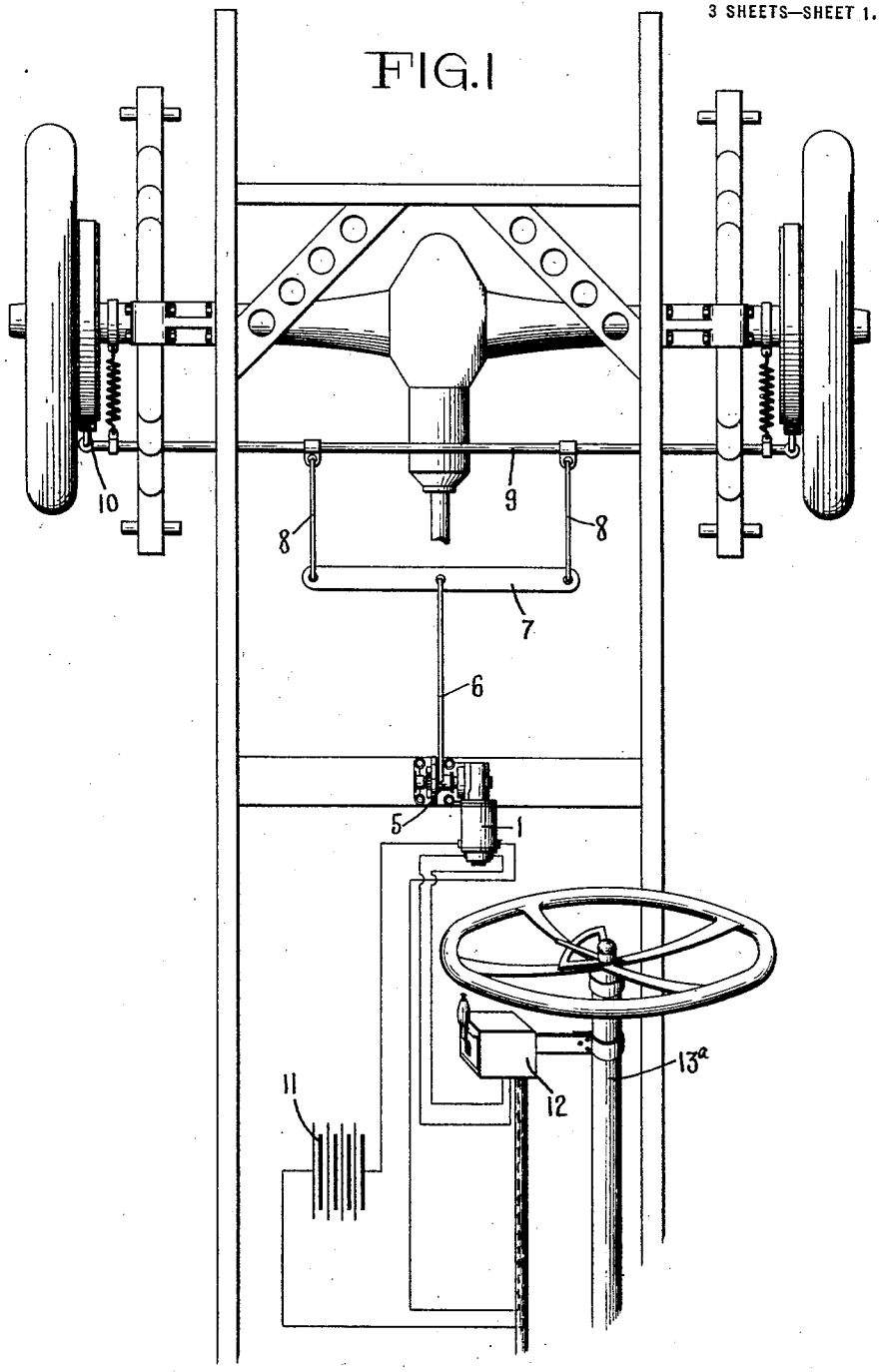
ELECTRICALLY OPERATED BRAKE.

APPLICATION FILED AUG. 27, 1914. RENEWED OCT. 19, 1918.

1,396,426. Patented Nov. 8, 1921.

3 SHEETS—SHEET 1.

FIG. 1



Witnesses:
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W. F. Hammond

Edward Vassallo Hartford Inventor
By His Attorney

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3 SHEETS—SHEET 2.

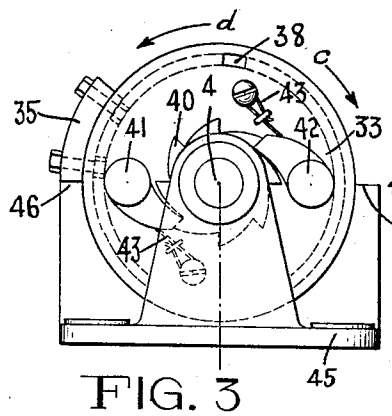


FIG. 3

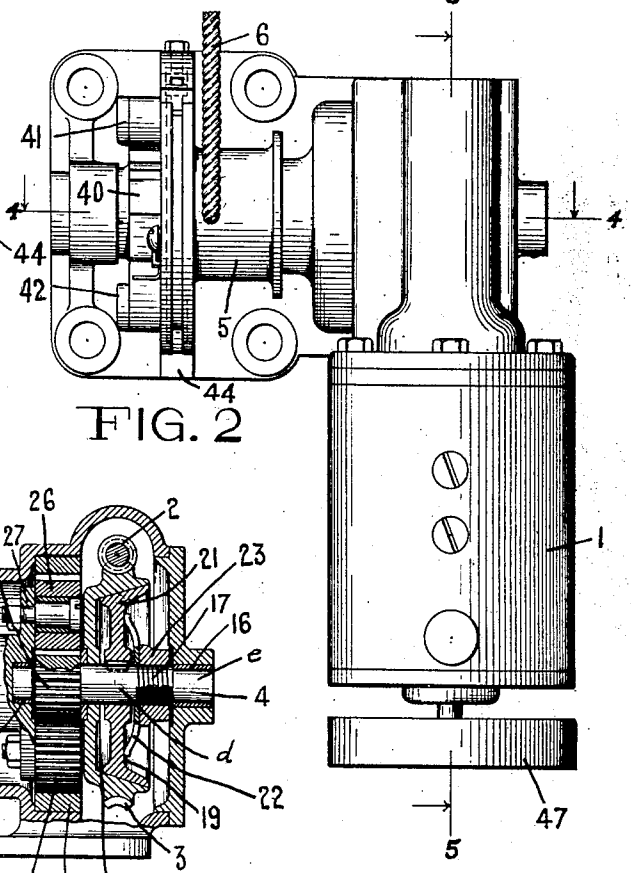


FIG. 2

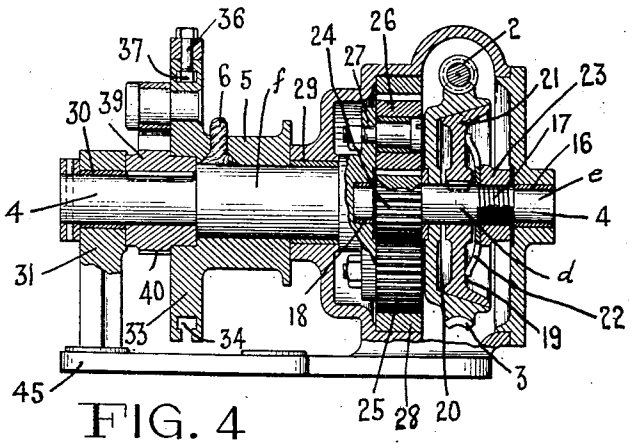


FIG. 4

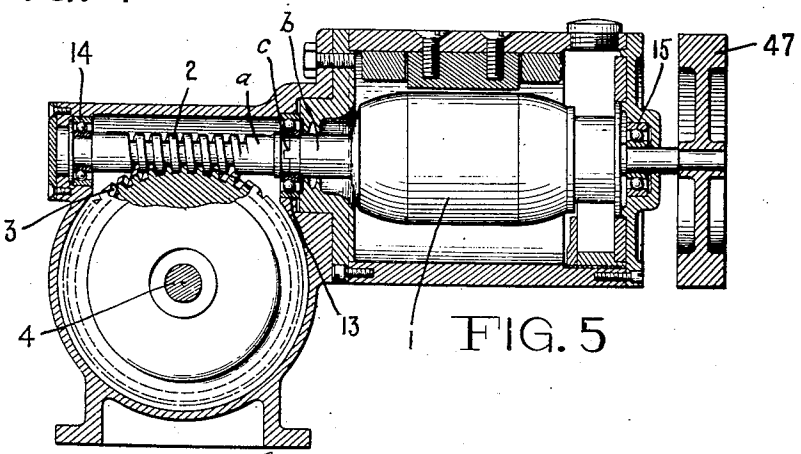


FIG. 5

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ELECTRICALLY OPERATED BRAKE.

APPLICATION FILED AUG. 27, 1914. RENEWED OCT. 19, 1918.

1,396,426. Patented Nov. 8, 1921.

3 SHEETS—SHEET 3.

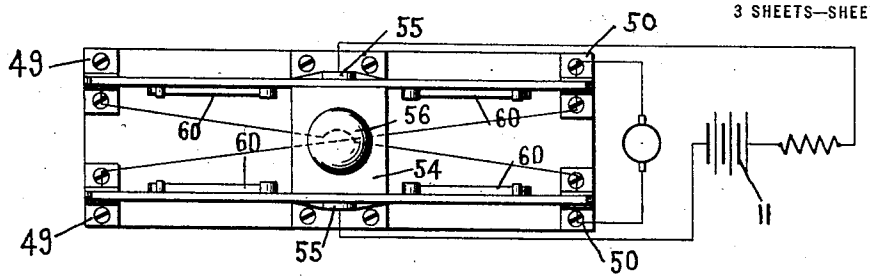


FIG. 6

FIG. 7

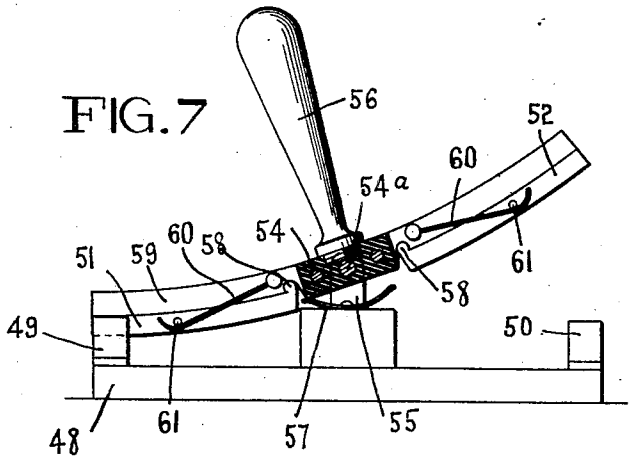
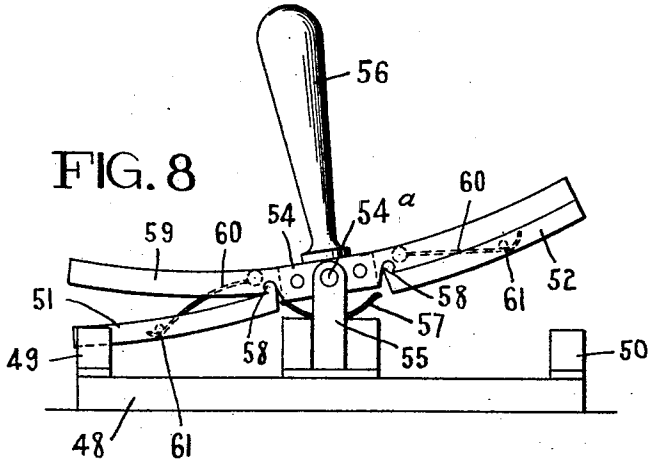


FIG. 8



WITNESSES:

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W. F. Hammond

Edward Vassallo Hartford INVENTOR.

BY Clifford C. Adams

HIS ATTORNEY

UNITED STATES PATENT OFFICE.

EDWARD VASSALLO HARTFORD, OF DEAL, NEW JERSEY.

ELECTRICALLY-OPERATED BRAKE.

1,396,426. Specification of Letters Patent. Patented Nov. 8, 1921.

Application filed August 27, 1914, Serial No. 858,959. Renewed October 19, 1918. Serial No. 258,909.

To all whom it may concern:

Be it known that I, EDWARD VASSALLO HARTFORD, a citizen of the United States, residing at Deal, in the county of Monmouth and State of New Jersey, have invented certain new and useful Improvements in Electrically-Operated Brakes for Automobiles and the like, of which the following, taken in connection with the accompanying sheets of drawings, is a full, clear, and concise description.

The object of my present invention is to provide a more efficient means for operating the brakes on motor cars, than that now in universal use.

The increasing use of motor cars, and the attendant dangers due to automobiles traveling at high speed, and generally heavier traffic conditions, has created a demand for something that would provide greater safety, be more certain and quicker in action than the foot or hand operated brakes now used.

To fill the requirements of these newly created conditions above alluded to, my electrically operated brake mechanism has been devised.

Concisely stated, my invention comprehends employing an extremely small high speed low voltage electrical motor for producing brake applying power, the low voltage, however, being sufficient to crowd the motor beyond its intended load. This overloading is possible owing to the fact that the actual time under which the motor is energized when applying the brakes is of very short duration, thus eliminating the possibility of its burning out or being destroyed when in use. In transmitting the power to the brakes, the high speed under which the motor operates is transmitted to the cable winding drum at a greatly reduced rate of speed by reason of the employment of a large reduction gearing. The amount of cable wound upon the drum when applying the brakes is small; therefore, the drum movement or rotation is correspondingly small. In one concrete instance I have employed a one fourth horse power motor operating under a 6 volt current. This voltage, being in excess of the voltage for which the motor is wound, in energizing this small motor overloads it approximately 400%, causing it to assume a speed of about 20,000 R. P. M. A 2500 to 1 reduction gearing transmits this high speed to the cable winding drum and causes the latter to rotate at a greatly reduced rate of speed, but under sufficient power to exert a 3,000 pound pull upon the cable in a time interval of approximately 2 seconds. In reciting this instance I do so by way of illustration only, because variation in the various instrumentalities employed may be resorted to without departing from my invention. For instance, it is not necessary to overload the motor to the extent mentioned, nor is it essential that such a large gear reduction be employed. In some instances it may be desirable to use a battery of $1\frac{3}{4}$ volts for energizing the motor and a reduction gearing of 500 to 1, in which case the motor would assume a speed approximately 5,000 R. P. M., and the cable winding drum, at the reduced speed, would exert approximately a 1,000 pound pull upon the cable. In both of these specified instances the braking effect is great enough to positively apply the brakes as used in connection with automobiles.

In the accompanying illustrated embodiment my high speed motor is shown cooperatively associated with an equalizer rod of an automobile brake mechanism, the same being connected therewith through a variable friction drive mechanism, which does not permit of excessive strain being placed upon the brake mechanism, but only sufficient energy to be transmitted to operate the brakes to the desired maximum pressure, a feature in itself of great advantage over the present prevailing hand control, which possesses no preventive feature against damage caused by excessive strains. To these general instrumentalities are added certain other features of novelty, such as suitable controlling devices which regulate the action of the brake cable winding mechanism, as will be more fully understood from a reading of the following specification.

Figure 1 illustrates in top plan view so much of a motor car as is necessary for a complete understanding of the construction and operation of my invention.

Fig. 2 is a similar enlarged view of the brake motor, winding drum and a fragmentary part of the brake cable.

Fig. 3 is a detailed end view of the winding drum showing the adjustable limiting stop and the over-running mechanism which allows the motor-driven winding shaft to over-run the drum when the cable is completely wound thereon.

Fig. 4 is a sectional view taken on lines

4—4 of Fig. 2, showing the adjustable friction drive mechanism.

Fig. 5 is a cross-sectional view taken on lines 5—5 of Fig. 2.

Fig. 6 is a top plan view of a controlling switch unhoused showing the various contacts and also showing the circuit diagrammatically.

Fig. 7 is a detail of the switch in side elevation showing it in one of its positions.

Fig. 8 is a like view showing the switch in a different position.

In detail, the electrical motor 1 is of the high-speed type developing approximately one third horse power and is mounted at any convenient point upon the vehicle. The armature of the motor is provided with a worm 2, which is in mesh with a worm wheel 3, the latter being loose upon a counter or transverse shaft 4 mounted in suitable end bearings in the housing. This counter shaft 4 carries the winding drum 5, upon which the cable 6 is wound and unwound during the operation of the mechanism. The other end of the cable 6 is connected through the links or bars 8 and 9 to the brake bands 10. The numeral 11 indicates a 6 volt storage battery or other source of motor energizing current and 12 the current controller fastened to the steering post 13[a]. The wiring diagram shows the battery 11 in circuit through the motor 1 by way of the controller 12. The specific construction of the controller and its operation in connection with the motor energizing circuits will be hereinafter more fully described.

The motor armature shaft upon which the worm 2 is formed is in two sections *a* and *b*, detachably secured together at *c*. The engaging ends of these two sections are positioned within a single bearing 13. This provides for convenient assembling, and at the same time, a cheap and efficient operative structure. The opposite ends of the two-part armature shaft are likewise mounted in bearings 14 and 15, positioned at the ends of the motor housing. The countershaft 4, upon which the worm wheel 3 is loosely mounted, is provided with suitable end bearings, and is also of two-part construction. The part *d*, at one end is reduced at *e* and is mounted in an anti-friction sleeve 16. Adjacent the end *e*, it is screw-threaded at 17. The opposite end of the part *d* of the shaft 4 is mounted in anti-friction sleeve 18. The worm wheel 3 is recessed at 19 and is provided with a circumferential clutch face 20. Within this recess and slidably keyed in a groove in the part *d* of the shaft 4, is a clutch member 21 having a complemental circumferential clutch face, which engages the clutch face of the worm wheel 3 and thereby forms a driving connection therewith. Bearing upon this clutch member 21 is a spider spring 22, the fingers of which bear thereagainst with spring tension, in order to provide a regulatable pressure between the parts. An adjusting nut 23 is mounted upon the screw end 17 of the shaft. The part *d* of the shaft 4 carries a gear 24, which meshes with the gears 25 and 26; the latter two gears are mounted upon bearings carried by a laterally extending annular flange 27 on the part *f* of the shaft 4. The driving of the part *f* is made possible by the gear connection between gears 25 and 26 and an annular rack or internal tooth ring 28, which is fixed fast to the housing. By this arrangement, the gearing serves to reduce the rate of speed of the part *d* of the shaft 4, transmitted to the part *f* of the shaft 4, the high speed of the motor thus imparting a reduced speed to the winding drum 5. The part *f* of the shaft 4 is mounted in end anti-friction sleeves 29 and 30, the former being supported in the housing surrounding the gearing and the latter being mounted in an upright support 31. The drum 5, is loosely mounted upon the part *f* of the shaft 4 and is provided with an aperture through which the cable 6 is threaded and made fast. The drum is also provided with a laterally extending flange 33, the periphery of which is slotted at 34 to provide for the reception of a frictionally held limiting stop 35, which limits the extent of unwinding movement of the drum and prevents excessive slacking up of the cable. This limiting stop is held in place by screw bolts 36 and nuts 37, the latter being received within the base of the groove 34 through a side aperture 38.

In order to prevent excessive unwinding movement of the drum 5 and a consequent excessive slacking of the cable 6, I provide an over-running ratchet connection between the laterally extending flange of the drum 5 and the part *f* of the counter shaft 4. This comprises the following instrumentalities: the ratchet sleeve 39 keyed and made fast to the part *f* of the counter shaft provided with circumferentially arranged teeth 40 and two dogs 41 and 42 mounted upon the laterally extended flange 33 of the drum 5, preferably two in number and located diametrically opposite one another. These dogs are held in engagement with the teeth 40 by the springs 43 and it is through these dogs that movement is imparted to the winding drum 5 by the counter shaft. In applying the brakes, the drum 5 is rotated in the direction of the arrow C, through the ratchet mechanism 40—42, until the limiting stop 35 engages the abutment 44, which may conveniently be an upright extending part of the base 45. Now in unwinding the cable by a reversal of the motor, the drum is caused to rotate in the opposite direction D under the tension of the cable. This movement is limited by the engagement of the opposite end of the limiting stop which en-

gages the stationary stop 46. As soon as this engagement takes place, the counter shaft is permitted to rotate independently of the drum 5, which has thus come to rest by reason of the arrangement just described.

The adjustable limiting stop 35 as has been explained is normally held in place by friction between the parts, sufficient to prevent the drum from moving during the unwinding of the cable beyond a fixed predetermined point, that is, until the limiting stop 35 engages stationary stop 46. In this position, the strain or tension has been taken off the cable and therefore there will not be present any pressure tending to dislodge or slide the limiting stop 35 along the slot 34. During the opposite rotation of the drum, however, when the motor power is applied to wind the cable the limiting stop 35 when brought into engagement with the stationary stop 44 may be moved from the position shown, in the event there should be any slack in the cable 6 due to stretching or other cause. It will be understood that during this operation the limiting stop 35 automatically adjusts itself to compensate for or take up the slack, if any, in the cable 6. By the movement of the stop 35 to and fro between the stationary stops 44 and 46, a definite limited amount of the cable is permitted to wind and unwind.

Should excessive power be generated by the motor, this power, it will be understood, will not be imparted to the winding drum 5, but will be dissipated by the clutch 21. In other words, the frictional adherence between the clutch members, 20 and 21, due to the application of excess power, is sufficient to overcome the tension or strength of the spider spring 22, causing the clutch member 21 to slip, and thus effecting the dissipation of the excess energy.

In order to provide for the control of the motor and the energizing circuit, I employ a switch of simple construction, one convenient form being shown in Figs. 6, 7 and 8 which forms the subject matter of application Serial Number 260,456. This switch is preferably of the two throw double pole type by which the polarity of the motor may be changed to wind or unwind the brake cable as desired. The switch illustrated comprises a base 48 upon which is mounted two pairs of jaw contacts 49 and 50. Coöperating with these contacts are complementary pairs of knife blade contacts 51 and 52. These are carried by a suitable bridge or cross-head 54 insulated and pivotally mounted at 54^a on a support 55 projecting upwardly from the base 48. The cross-head 54 is provided with an operating handle 56 by which the knife contacts are caused to rock or oscillate toward and away from the jaw contacts, as required. A spring 57 coöperates with the cross-head 54 and by reason of its spring tension tends to normally hold the switch in its neutral or "off" position. In order to provide for a quick break between the jaw contacts 49 and the coöperating knife blade contacts 51, I mount the knife blade contacts 51 on a pivot 58 in a fixed part 59 carried by the cross-head 54. On this fixed part, I mount a leaf spring 60, the free end of which engages a pin 61 projecting from the side of the knife contact. In operation when a break between the contacts is about to occur, the knife blade contact will adhere through its frictional connection with the jaw contact, after the switch handle 56 has been moved until the spring tension or pressure of the spring member 60 overcomes the same, whereupon the knife blade contact has imparted to it a rapid movement to effect a quick break and thereby minimize arcing between the contacts.

The necessary circuits are clearly shown in Fig. 6. It will be understood that when the switch handle 56 is rocked, the fixed part 59 will cause the switch blade contact 51 to enter between the jaws of the contact 49 and when the handle 56 is rocked in the reverse direction, the fixed part 59 moves in advance of the knife blade contact 51, the latter lingering until the spring 60 overcomes the frictional adherence between the contacts. By quickly operating the switch in this manner, the motor 1 is energized correspondingly, each movement being imparted to the winding drum 5. By leaving the switch in its "on" position, as thus described, for a continued period at a time, the winding of the brake cable upon the brake drum 5 will be likewise continuous until it is fully wound thereon and the brakes fully applied. In order to unwind the brake cable, the switch is thrown over to bring the contacts 50 and 52 into coöperation. This reverses the direction of the motor and reverses the rotation of the drum, the tension of the cable 6 aiding in the unwinding thereof.

The motor is of the small high speed type developing about ¼ horse power at a speed of about 20,000 R. P. M. In order to increase the power of the motor when the switch has been operated to apply the brakes in an emergency and also to act as a drag upon the motor when the switch has been operated to apply a light application of the brakes, I provide on the motor armature a fly wheel 47. The inertia of this fly wheel (which is approximately two pounds in weight) must be overcome by the rotation of the motor armature so that under a light, or what I may term, a slight pulsation of energy, (which results from a quick or rapid movement of the switch), the winding movement of the drum 5 is accordingly slight and of limited duration whereas under a continuous energization of the motor, in which case the winding movement of the cable on

the drum is greater in applying the brakes in an emergency, the fly wheel 47 stores kinetic energy which supplements the electromotive power of the motor, and is utilized as a braking power.

It will be understood that a relatively small amount of the cable 6 is wound upon the drum 5 when applying the brakes, and it therefore necessarily follows that the motor 1 is under energization for an extremely short interval of time. It is possible, therefore, to use a relatively small, or what may be termed a "toy" motor, which is capable of withstanding an excess or overload of current without detrimental consequences. The utilization of such a motor, traveling at high speed under a six volt current for the purpose is only possible when a large gear reduction is employed; therefore, in connection with the overloaded motor, the gear reduction coöperatively performs a novel function and constitutes an essential instrumentality in the organization of my electrically operated brake mechanism.

It will be manifest from the above that my invention affords an extremely flexible brake control, which can be conveniently manipulated by woman, man or child with equal efficiency for the reason that physical force as required in operating present day brake mechanism on automobiles is done away with. With my electrically applied brake mechanism, improper use or application of the brakes is impossible and many accidents may be avoided by reason of its positive and quick operation.

It will be understood that while I have chosen to illustrate my invention as applied to an automobile, this specific use is mentioned by way of example only, it being manifest that the invention may be applied to trolley cars or vehicles of any kind to equal advantage. Furthermore, I do not wish to be limited to the precise details of construction illustrated and described, as these may be changed or altered without departure from the scope of my invention as defined in the following claims.

Having thus described my invention what I claim as new herein and desire to secure by Letters Patent is:

1. An electrically operated brake mechanism, comprising a motor, a winding drum operably connected with said motor, a self-adjustable limiting means carried by said drum adapted to limit the extent of unwinding movement thereof, said means including a flange formed upon said drum, a peripheral slot formed upon said flange, a stop member having depending parts frictionally engaging said slot, and stop posts adapted to coöperate with said stop member.

2. In combination with the brake applying instrumentalities of a vehicle, a low voltage high speed electric motor having operative connection with said instrumentalities, said operative connection including a flexible cable, a drum upon which said cable is adapted to be wound, said drum being loosely mounted upon a shaft located transverse of, but operably connected with, the motor armature, said shaft having positive driving connection with said drum in one direction of rotation, said driving connection comprising a ratchet drive, which operates upon the reversal of rotation of the shaft, to permit the shaft to over-run or rotate free of the winding drum.

3. In combination with the brake applying instrumentalities of a vehicle, a high speed low voltage electric motor, provided with an armature having a worm, a countershaft, a worm wheel mounted thereon in mesh with the worm, an adjustable driving clutch mechanism coöperatively associated with said shaft and said worm wheel for turning the shaft, a winding drum and a speed reducing gearing coöperatively associated with said shaft and said winding drum, a cable connecting the brake applying instrumentalities and the winding drum and adapted to be wound thereon, a releasable driving connection between the winding drum and shaft, and an automatically adjustable limiting stop carried by the winding drum and adapted to limit the extent of unwinding movement thereof during the release of the brakes.

4. In combination with the brake applying instrumentalities of a vehicle, a low voltage high speed electric motor, provided with a weighted armature, a counter-shaft of two-part construction coöperatively associated with said motor through a variable friction driving mechanism interposed between the countershaft and the electric motor for regulating the amount of motive power to operate the shaft, a cable winding drum on one part of the shaft, a brake applying cable associated with the brake applying instrumentalities and the drum, and a reduction gearing interposed between the drum and the variable friction driving mechanism whereby the high speed of the electric motor imparts to the winding drum a relatively lower rate of speed.

5. In combination with the brake applying mechanism of a vehicle, a high speed low voltage electric motor, a two-part shaft in driving connection therewith, the parts of said shaft being operably associated through a reducing train of gears, a drum operably associated with one part of said two-part shaft, and a driving connection between said part and said drum adapted to impart to said drum a winding movement, said driving connection being releasable upon a reversed rotation of the winding drum to release the brakes.

6. An electrically operated brake mecha-

nism, comprising a high speed low voltage motor, a winding drum operably connected with said motor, a reducing train of gears between the motor and the winding drum adapted to transmit power at a reduced speed to the winding drum, an adjustable releasable driving connection between the shaft and the winding drum, and a self adjustable limiting stop carried by the drum adapted to limit the extent of unwinding movement thereof.

7. A winding device comprising a small high speed motor, a two-part countershaft, a speed reduction device provided with a frictional connection between the motor and shaft, means coöperatively associated with one part of said countershaft for driving the second part at a reduced speed, a drum on the second part of the countershaft, and a one way driving mechanism between the drum and the portion of the shaft on which it is mounted.

8. A winding device comprising a small high speed motor, a two-part countershaft, a speed reduction device provided with a frictional connection between the motor and shaft, means comprising a fixed internal gear and a planet gear coöperatively associated with one part of said countershaft for driving the second part at a reduced speed, a drum on the second part of the countershaft, and a one way driving mechanism between the drum and the portion of the shaft on which it is mounted.

9. A winding device comprising a high speed driving shaft, a two-part countershaft, a speed reduction device provided with a frictional connection therebetween, means comprising a fixed internal gear and a planet gear coöperatively associated with one part of the countershaft for driving the second part at a reduced rate of speed, a casing for said parts which provides a support for the internal gear and a bearing for the driving shaft, and a drum on the second part of the countershaft.

10. A winding device comprising a high speed driving shaft, a two-part countershaft, a speed reduction device provided with a frictional connection therebetween, means comprising a fixed internal gear and a planet gear coöperatively associated with one part of the countershaft for driving the second part at a reduced rate of speed, a casing for said parts which provides a support for the internal gear and a bearing for the driving shaft, a drum on the second part of the countershaft, and a one way driving mechanism between the drum and the second part of the countershaft.

11. In a winding device, a drum, a cable wound thereon, a pair of spaced apart fixed stops, a member connected to the drum and adapted to be brought into engagement with one or the other of the fixed stops, and a power drive for the drum, said connection being adapted to slip when the power is applied to wind the cable and bring the member into engagement with one of the fixed stops and being unyielding when brought against the other stop by residual cable tension, whereby slack in the cable is compensated for.

12. In a winding device, a drum, a cable wound thereon, a pair of spaced apart fixed stops, a member connected to the drum and adapted to be brought into engagement with one or the other of the fixed stops, and a one way power drive for the drum, said connection being adapted to slip when the power is applied to wind the cable and bring the member into engagement with one of the fixed stops and being unyielding when brought against the other stop by residual cable tension, whereby slack in the cable is compensated for and the power drive may be freely reversed without damage.

13. In combination, a small high speed electric motor having connected to one end of the shaft thereof a fly wheel and to the other end thereof a worm, a frame, a shaft having a first part and a second part and having bearings in the frame, one of said parts being journaled in the other, a worm wheel loosely mounted on the first part in a position to coöperate with the worm, a variable friction drive connection between the worm wheel and the first part, said connection comprising a spider spring and an adjustable nut, a pinion on said first part, a pair of planet gears loosely mounted on a flange of said second part and in mesh with the pinion, and an internal gear fixed to the casing and in mesh with said planet gears.

14. An electrically operated brake mechanism, comprising a high speed low voltage motor, a winding drum operably connected with said motor, a reducing train of gears between the motor and the winding drum adapted to transmit power at a reduced speed to the winding drum, an adjustable, releasable driving connection between the motor and the winding drum, and a self-adjustable limiting stop carried by the drum adapted to limit the extent of unwinding movement thereof.

15. A winding device comprising a small high speed motor, a two-part countershaft, a speed reduction device between the motor and shaft, means coöperatively associated with one part of said countershaft for driving the second part at a reduced speed, a drum on the second part of the countershaft, and a one way driving mechanism between the drum and the portion of the shaft on which it is mounted.

16. A winding device comprising a small high speed motor, a two-part countershaft, a speed reduction device between the motor and shaft, means comprising a fixed internal

gear and a planet gear coöperatively associated with one part of said countershaft for driving the second part at a reduced speed, a drum on the second part of the countershaft, and a one way driving mechanism between the drum and the portion of the shaft on which it is mounted.

17. A winding device comprising a high speed driving shaft, a two-part countershaft, a speed reduction device therebetween, means comprising a fixed internal gear and a planet gear coöperatively associated with one part of the countershaft for driving the second part at a reduced rate of speed, a casing for said parts which provides a support for the internal gear and a bearing for the driving shaft, and a drum on the second part of the countershaft.

18. A winding device comprising a high speed driving shaft, a two-part countershaft, a speed reduction device therebetween, means comprising a fixed internal gear and a planet gear coöperatively associated with one part of the countershaft for driving the second part at a reduced rate of speed, a casing for said parts which provides a support for the internal gear and a bearing for the driving shaft, a drum on the second part of the countershaft, and a one way driving mechanism between the drum and the second part of the countershaft.

In witness whereof I have hereunto set my hand in the presence of two subscribing witnesses.

EDWARD VASSALLO HARTFORD.

Witnesses:
ARTHUR WATERMAN,
MORRIS E. ROTHHOUSE.