PATENT SPECIFICATION

Application Date : Jan. 30, 1934. No. 3084/34. **429,525**

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Complete Specification Accepted : May 31, 1935.

PROVISIONAL SPECIFICATION

Improvements in and relating to Electrically Driven Toy Locomotives

I, FRANK HORNBY, of 236, Binns Road, Old Swan, Liverpool, British, do hereby declare the nature of this invention to be as follows:—

In electrically driven toy locomotives several arrangements have been already proposed for remotely controlling the stopping, starting and reversing of the toy locomotive upon a toy track, that is to say instead of the main control switch being mounted on the locomotive itself such switch has been disposed in some suitable position adjacent the toy track. In such known arrangements it has been proposed to make the field magnet of the motor of the toy locomotive in two parts, one part separated transversely to the direction of the lines of force passing through the magnet frame when the latter was energised, such separated part being arranged movably to the whole magnet so that when the magnet was energised the resulting movement of the loose part was utilised to operate a reversing switch on the locomotive. In such known arrangements the loose part of the magnet frame, or a corresponding element operating the reversing switch on the locomotive, tended to be normally maintained in its inoperative or separated position by a spring control which asserted itself when the field magnet was de-energised. It is found, however, that owing to inequalities in the toy railway track due to imperfect rails or the joints thereof, or owing to bad contact between the collector shoes and the rails, a momentary and accidental interruption of the current passing through the track rails to the locomotive may take place and in such cases the spring controlled loose piece of the field magnet would return to its inoperative position and, after the locomotive had been carried on past the point of interruption of the current and the circuit restored, the loose piece would be again actuated and the reversing switch on the locomotive operated. In this way a see-saw action of the toy locomotive is apt to take place about any defective point in the track where accidental interruption of the electric circuit takes place and the object of the present invention is to provide means for preventing operation of the reversing switch on the locomotive due to such causes and ensure that such reversing switch shall only be effectively operated from the main remote control switch of the system.

According to this invention, therefore, the separation or return movement of the loose element associated with the field magnet on the locomotive is damped or delayed by a suitable mechanism. This mechanism may consist either of a weight, a spring, a dash pot or analogous device. Preferably, from the possible simplicity of construction and adjustment a weight is utilised and means may be provided for adjusting the effective action of the damping weight, spring or other device. The action of the damping mechanism is such that it shall retard the return movement of the loose piece when the current is momentarily and accidentally broken, such delaying or retarding action preventing the loose piece from returning to its normal position in the short time during which the circuit remains accidentally broken and so preventing such a complete travel of that piece and the reversing switch element actuated therefrom as would effect an actuation of the reversing switch. In other words slight accidental separative movements of the magnet loose piece will be rendered inoperative by ensuring a time lag in its action.

In one suitable embodiment of the invention the field magnet is divided into two parts one of which is movably mounted relatively to the other or main magnet frame. The loose part may move slidably to the magnet frame but is preferably pivoted and a light spring tends to separate the loose part from the magnet when the field magnet is not excited. When current is switched on by the main remote control switch and the field magnet on the locomotive becomes excited the loose part is drawn up to the main frame of the magnet, this movement being transmitted to a slidably guided bar carrying a pivoted pawl, the point of which latter engages with one or other of two abutments on a disc or other element, according to the position in which such

element has been left by the last operation, which element is attached to the commutator of a current reversing switch connected in the armature circuit of the locomotive motor. After the pawl engages the abutment its continued movement rotates the element in one or other direction and the direction of rotation of the motor is thus reversed. Preferably the element consists of a disc rotatable in opposite directions between limiting stops, the disc having two recesses of V-shape cut in its periphery, the adjoining walls of the two recesses forming a pointed wedge, against one or other of the obliquely converging sides of which the point of the pawl makes contact, sliding down such side to the valley of the recess when the element is then positively rotated. If an accidental momentary interruption of the current occurs, then, owing to the delay or time lag in the return movement of the pawl, an inoperative sliding merely takes place along the oblique face of the wedge, the complete actuation of the reversing switch by turning the element in an opposite direction only taking place when the pawl has so far returned to its normal position that its point has passed the point of the wedge, when on its return movement it engages the opposite oblique face of the wedge, sliding down such face to turn the element in an opposite direction and reverse the switch. The pawl after leaving the point of the wedge on the element is held in a normal aligned position on the slidable bar by a spring. In this way the motor of the locomotive is alternately reversed each time the field magnet is excited by the operation of the remote control switch but not by any accidental momentary interruption of the current.

In another embodiment of the invention instead of dividing the field magnet frame into two parts, such magnet frame is left complete and an additional movable piece or armature mounted in proximity thereto and normally held out of contact therewith by a spring or gravity, the action of which spring is similarly delayed or retarded by a compensating weight, spring or dash pot, so that accidental and momentary interruption of the current is similarly prevented from actuating the reversing switch on the locomotive. Such loose piece or armature associated with a complete magnet frame is adapted by its movement to operate a reversing switch of any suitable type on the locomotive.

Dated this 29th day of January, 1934.
A. J. DAVIES,
Patent Agent,
24, Moorfields, Liverpool, 2.

COMPLETE SPECIFICATION

Improvements in and relating to Electrically Driven Toy Locomotives

I, FRANK HORNBY, of 236, Binns Road, Old Swan, Liverpool, a British Subject, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

In electrically driven toy locomotives several arrangements have been already proposed for remotely controlling the stopping, starting and reversing of the toy locomotive upon a toy track, that is to say instead of the main control switch being mounted on the locomotive itself such switch has been disposed in some suitable position adjacent the toy track. In such known arrangements it has been proposed to make the field magnet of the motor of the toy locomotive in two parts, one part separated transversely to the direction of the lines of force passing through the magnet frame when the latter was energised, such separated part being arranged movably to the whole magnet so that when the magnet was energised the resulting movement of the loose part was utilised to operate a reversing switch on the locomotive. In such known arrangements the loose part of the magnet frame, or a corresponding element operating the reversing switch on the locomotive, tended to be normally maintained in its inoperative or separated position by a spring control which asserted itself when the field magnet was de-energised. It is found, however, that owing to inequalities in the toy railway track due to imperfect rails or the joints thereof, or owing to bad contact between the collector shoes and the rails, a momentary and accidental interruption of the current passing through the track rails to the locomotive may take place and in such cases the spring controlled loose piece of the field magnet would return to its inoperative position and, after the locomotive had been carried on past the point of interruption of the current and the circuit restored, the loose piece would be again actuated and the reversing switch on the locomotive operated. In this way a see-saw action of the toy locomotive is apt to take place about any defective point in the track where accidental interruption of

the electric circuit takes place and the object of the present invention is to provide means for preventing operation of the reversing switch on the locomotive due to such causes and ensure that such reversing switch shall only be effectively operated from the main remote control switch of the system.

According to this invention, therefore, the separation or return movement of the loose element associated with the field magnet on the locomotive is damped or delayed by a suitable mechanism. This mechanism may consist either of a weight, a spring, a dash pot or analogous device. Preferably, from the possible simplicity of construction and adjustment, a weight is utilised and means may be provided for adjusting the effective action of the damping weight, spring or other device. The action of the damping mechanism is such that it shall retard the return movement of the loose piece when the current is momentarily and accidentally broken, such delaying or retarding action preventing the loose piece from returning to its normal position in the short time during which the circuit remains accidentally broken and so preventing such a complete travel of that piece and the reversing switch element actuated therefrom as would effect an actuation of the reversing switch. In other words slight accidental separative movements of the magnet loose piece will be rendered inoperative by ensuring a time lag in its action.

One embodiment of the invention is shown by way of example in the accompanying drawing, in which:—

Fig. 1 is a side elevation of the electric motor and reversing switch of a toy electric locomotive,

Fig. 2 being a plan view, and

Fig. 3 an end elevation of Fig. 1.

Fig. 4 is a detail rear elevational view of the commutator of the reversing switch mechanism.

Fig. 5 being an end elevation thereof.

Figs. 6 and 7 show the circuit arrangement and the manner in which the reversing of the electric motor is effected.

The frame of the electric motor and locomotive comprises a pair of spaced frame plates 1, 2 between which is mounted an armature 3 secured upon a spindle 4 carried in bushes within the frame plates. One end of the spindle 4 is toothed at 5, and serves to drive a pair of rail wheels 6, 7 at one side of the locomotive through gear wheels 8, 9 in engagement with gear rings 10, 11 integral with the driving wheels 6, 7.

The armature 3 rotates between a pair of pole-pieces 12, 13 of an electro field magnet 14, the frame of which is divided into two parts, one of which comprises the pole-piece 12 and integral yoke 15 carrying the field coil 16, such main part of the magnet frame 14 being fixedly secured between the frame plates, while the other part of the magnet frame 14 consists of the pole-piece 13 which is pivotally mounted at its lower end on a pin 17 presented by the frame plate 1, so that the upper end of the movable pole-piece is capable of being moved towards and away from the yoke 15 of the main magnet frame. A light spring 18 carried by the pivot pin 17, and abutting against a pin 19 projecting from the upper end of the pole-piece 13, normally maintains the pole-piece 13 in the separated position shown in chain lines in Fig. 1.

Movement of the pivoted pole-piece 13 is damped by means of a weight 20 secured on a bolt 21 between a pair of arms 22 extending substantially horizontally from the top of the pole-piece 13 in a direction such that the weight tends to counteract the action of the spring 18.

The movable pole-piece is adapted to operate an electric reversing switch for reversing the current through the armature, and for this purpose the projecting pin 19 on the pole-piece 13 engages in a slot 23 within a cranked portion 24 of a slidable bar 25 longitudinally movable in guides within a part 26 presented by the frame plate 1. At the free end of the slide bar 25 is carried a pivoted pawl 27 which in the retracted position of the pole-piece 13 is maintained in alignment with the slide bar 25 by means of a spring 28. On energizing the field coil 16, and thereby exciting the main part of the magnet frame 14, the movable pole-piece 13 is drawn towards the yoke 15, and this will result in the slide bar moving towards the left of Fig. 1, when the point of the pawl 27 is adapted to engage one or other of two abutments presented by a rotatable disc member 29 of the current reversing switch. When it is desired to put the reversing switch mechanism out of operation, a cranked lever 48 pivoted to the frame plate 2 may be swung about its pivot to retain the pole-piece 13 in engagement with the yoke 15.

The disc member 29 is secured to a pivot pin 30 mounted in the frame plate 1 and carrying a commutator 31 connected in the armature circuit of the motor, and its rotational movement in either direction is limited by means of an abutment member 32 which moves between and is adapted to engage a pair of stops 33 cut in the top edge of the frame plate 1. The abutments in the disc member 29 are formed by cutting two adjacent V-shaped recesses 34*a*, 34*b*, in its periphery so that the

adjoining walls of the recesses form a pointed wedge, against one or other of the obliquely converging sides of which the point of the pawl 27 makes contact on movement of the slide bar 25 towards the left, sliding down such side to the valley of the recess, when the disc element will be positively rotated upon continued movement of the slide bar 25. As the disc is moved to the full extent, the point of the wedge is left, on the retreat of the pawl 27, tilted above or below a line joining the centres of the pin 30 and the pivot of the pawl, the arrangement being such that in a series of movements of the slide bar towards the left, the point of the pawl 27 enters the recesses 34*a*, 34*b* alternately, to cause the disc member 29 and commutator 31 to be rotated in alternately opposite directions.

The commutator 31 is shown more clearly in the detail rear elevation of Fig. 4 and the corresponding end elevation of Fig. 5. It comprises a disc 34 of insulating material upon one of the faces of which are mounted a pair of opposed peripheral metal contact segments 35, 36 and an intervening conducting plate having peripheral segmental portions 37, 38 interposed between the segments 35, 36. Engaging the segments 35, 36 and 37 of the commutator are the free upper ends of three contact-making blades or fingers 39, 41 and 40 which are carried by an insulator strip 42 supported between the frame plates. The two outer blades 39, 41, are connected to the armature 3 of the motor.

Figs. 6 and 7 indicate the electrical connection to the wiper blades 39, 40 and 41, and the manner in which rotation of the commutator 31 through rotation of the disc member 29 serves to effect reversal of the current through the armature, and therefore reversal of the direction of rotation of the latter and of the movement of the locomotive.

The current for the motor is supplied from any suitable source, here shown as a battery 43, and is controlled by a remote switch 44 connected across the wheel rails 45 and a centre rail 46. The centre rail 46 is engaged by a pair of contact shoes 47 on the underside of the locomotive. Referring to Fig. 6, on closing the switch 44, current will pass from the battery to the centre rail 46, shoes 47, field coil 16, centre blade 40, segment 37, blade 41 and thence through the armature 3 to the blade 39, segment 35, lead 48, wheels 6 and 7 and back to the battery 43. The pole piece 13 will then be attracted to the magnet yoke 15, and so cause rotation of the commutator 31. On now opening and then again closing the switch 44, the commutator will be rotated in the opposite direction through the resulting movement of the pole-piece 13 and slide bar 25 to the position shown in Fig. 7, current passing as before through the field coil 16 to the centre blade 40 of the commutator; by reason, however, of the changed position of the commutator segments, the current will now pass through the segment 37 to the blade 39, and consequently in a reverse direction through the armature 3, to cause a reversal in its direction of rotation and therefore in the direction of travel of the locomotive; and current will subsequently pass to the blade 41, through the segment 36, and thence as before to the wheels 6 and 7, rails 45, and battery 43.

It has been found in practice that owing to various causes, such as those due to imperfect rails or to the joints between the rails, momentary and accidental interruptions in the current passing through the rails to the locomotive are liable to take place, and these interruptions of the current have the same effect as if the control switch 44 were opened and closed, in that the magnetic retention of the loose pole-piece 13 is momentarily lost causing it to open and then close and the reversing switch is thus operated to cause an undesired reversal in the direction of travel of the locomotive. If such an accidental momentary interruption of the current occurs, then, owing to the consequent delay or time lag in the opening movement of the pole-piece 13, an incomplete and inoperative sliding of the pawl 27 merely takes place to and fro along the same oblique face of the wedge of the disc element 29, the complete actuation of the reversing switch by turning the element 29 in an opposite direction only taking place when the pawl 27 has so far returned to its normal position that its point has passed the point of the wedge, when on its return movement it engages the opposite oblique face of the wedge, sliding down such face to turn the element in an opposite direction and reverse the switch. In this way the motor of the locomotive is alternately reversed each time the field magnet 14 is energised by the operation of the remote control switch 44, but not by any accidental momentary interruption of the current.

Although it is preferred to use a weight for damping the movable element of the field magnet, any other suitable damping means or mechanism may be employed, such as for example a spring, a dash-pot, or analogous device. In order to vary the effective action of the damping weight 20, it may be made adjustable on the supporting arms 22 so as to vary their effective

length; where alternative damping means are employed, adjustment means may also be provided for the same purpose.

In another embodiment of the invention, instead of dividing the field magnet frame into two parts as shown, such magnet frame is left complete, and an additional movable piece or armature mounted in proximity thereto and normally held out of contact therewith by a spring or gravity, the action of which spring is similarly delayed or retarded by a compensating weight, spring or dash pot, so that accidental and momentary interruption of the current is similarly prevented from actuating the reversing switch on the locomotive. Such loose piece or armature associated with a complete magnet frame is adapted by its movement to operate a reversing switch of any suitable type on the locomotive.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:—

1. A remote controlled toy electric locomotive having electric reversing mechanism thereon operated by an element movable relatively to and electromagnetically controlled by the field magnet frame of the locomotive motor when energised, wherein means is provided for delaying or damping the separative movement of the element away from the field magnet frame when the field magnet is de-energised.

2. A remote-controlled toy electric locomotive in which the frame of the electro field magnet of the motor is divided, one of the elements or parts of the magnet frame being movable relatively to the other main magnet frame part, and being operatively connected to an electric reversing switch on the locomotive, means being provided for damping or delaying the separative movement of the movable element.

3. A toy electric locomotive according to either of Claims 1 or 2, wherein movement of the movable element associated with the field magnet of the motor is damped by means of a weight.

4. A toy electric locomotive according to either of Claims 1 or 2, wherein movement of the movable element associated with the field magnet of the motor is damped by means of a spring.

5. A toy electric locomotive according to either of Claims 1 or 2, wherein movement of the movable element associated with the field magnet of the motor is damped or delayed by means of a dashpot or analogous device.

6. A toy electric locomotive according to Claim 2, wherein the field magnet frame is divided by pivotally mounting one of the pole-pieces so that it is movable relatively to the main magnet frame part.

7. A toy electric locomotive according to any of claims 1, 2 or 6, wherein the movable element or pole-piece associated with the field magnet frame is operatively connected to a pawl adapted to alternately engage one or other of two abutments carried from a rotary reversing switch connected in the armature circuit of the locomotive motor, and so reverse the motor.

8. A toy electric locomotive according to Claim 7, wherein the pawl is adapted to engage a pair of abutments presented by two adjacent recesses formed in the peripheral edge of a rotary disc member coupled to a rotary commutator connected in the armature circuit of the locomotive motor, the adjoining walls of the recesses in the disc member forming a wedge, down one or other of the obliquely converging sides of which the pawl slides ineffectively until it reaches the valley of the recess when the commutator is rotated by the continued movement of the pawl.

9. A toy electric locomotive according to Claim 8, wherein the pawl is pivoted to one end of a slidable bar, with which it is normally maintained in alignment by means of a spring when the movable pole-piece or element associated with the field magnet is in the separated position, the other end of the slidable bar being operatively connected to the movable pole-piece or element.

10. A toy electric locomotive according to Claim 7, wherein the pivoted pole-piece is normally maintained by means of a spring in a retracted position relatively to the main magnet frame part, a damping weight being carried from a pair of arms on the movable pole-piece and acting in opposition to the spring.

11. A remote-controlled toy electric locomotive substantially as described with reference to the accompanying drawing.

Dated this 9th day of November, 1934.

A. J. DAVIES,
Patent Agent,
24, Moorfields, Liverpool, 2.

Leamington Spa: Printed for His Majesty's Stationery Office, by the Courier Press.—1935.

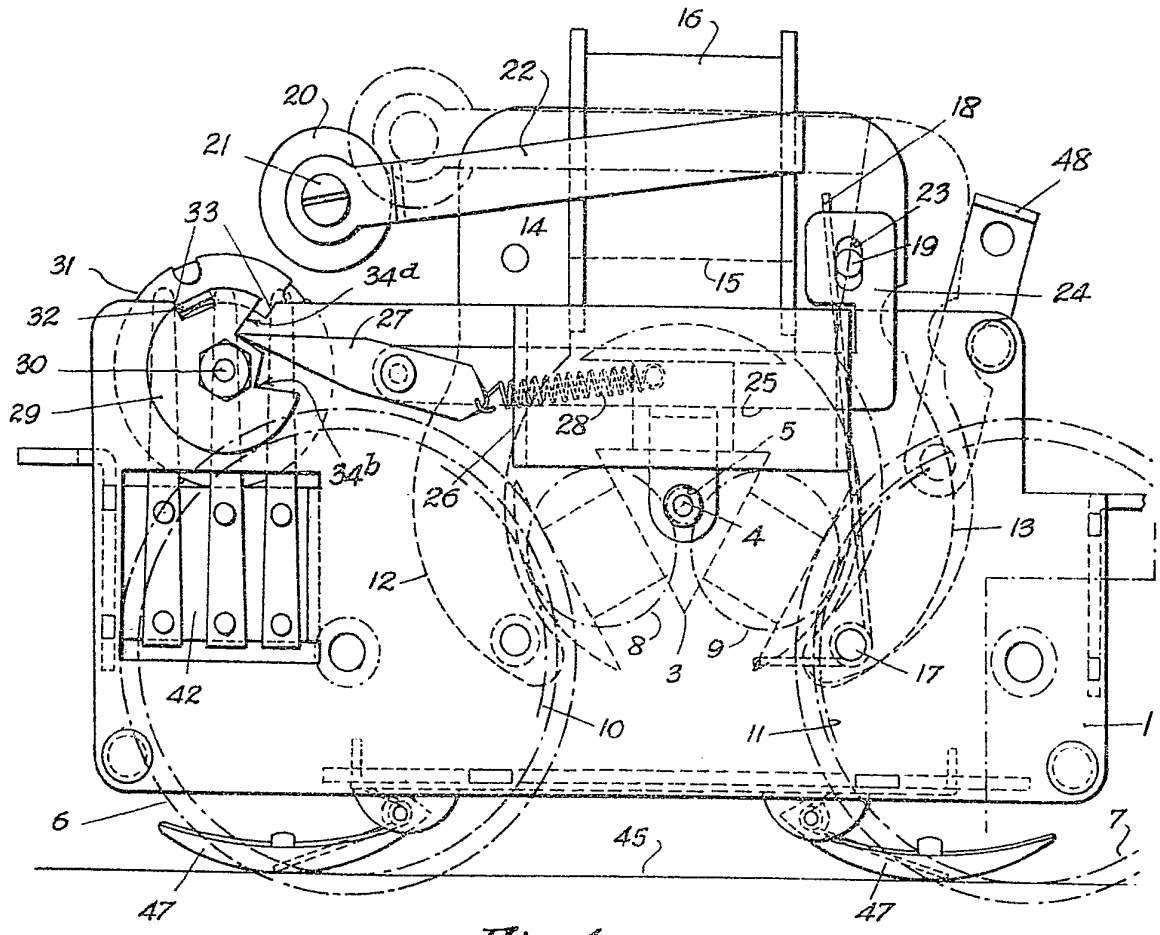


Fig. 1.

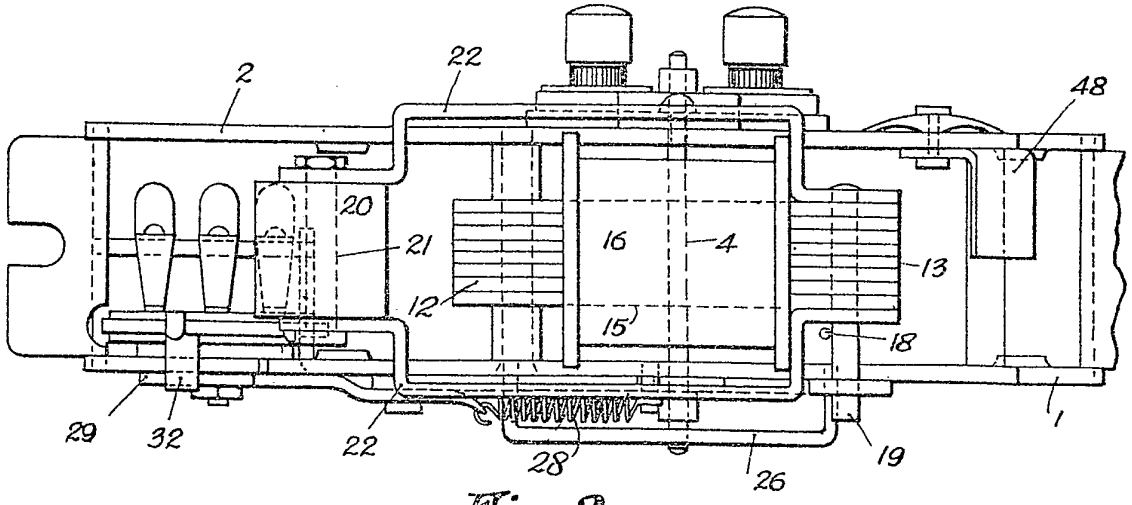
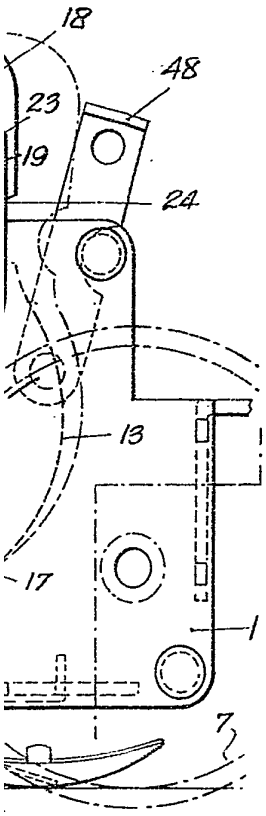
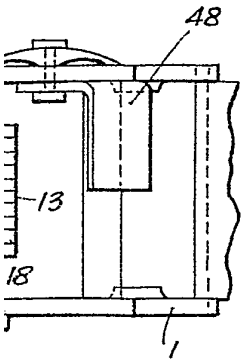


Fig. 2.

2 SHEETS

SHEET 1





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SHEET 2

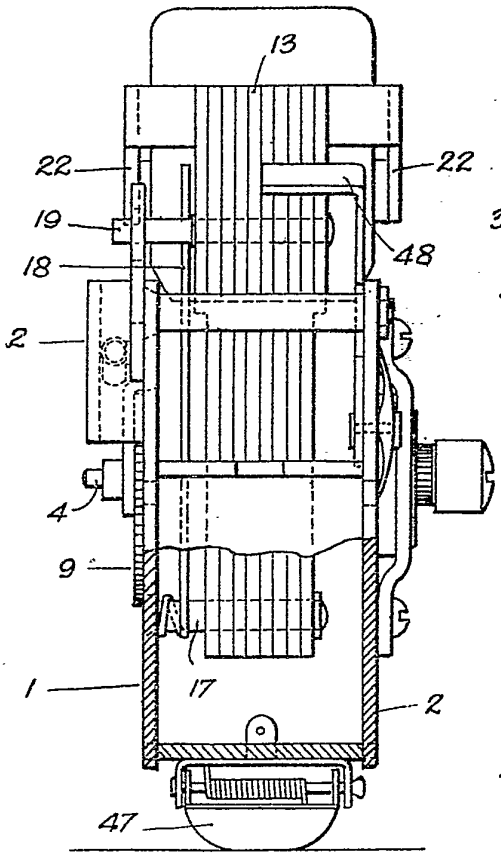


Fig. 3.

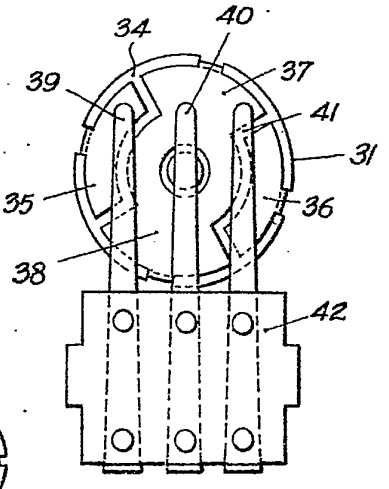


Fig. 4.

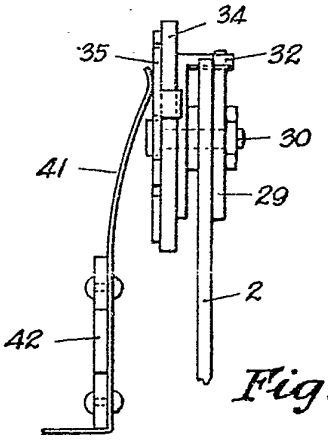


Fig. 5.

Fig. 6.

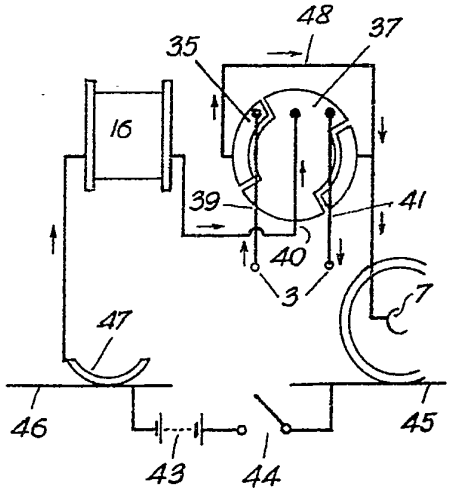
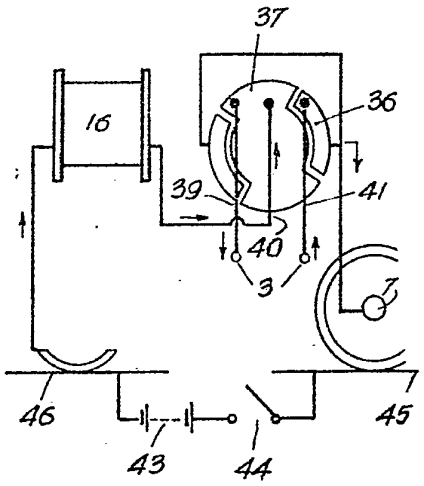


Fig. 7.



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429,525 COMPLETE SPECIFICATION

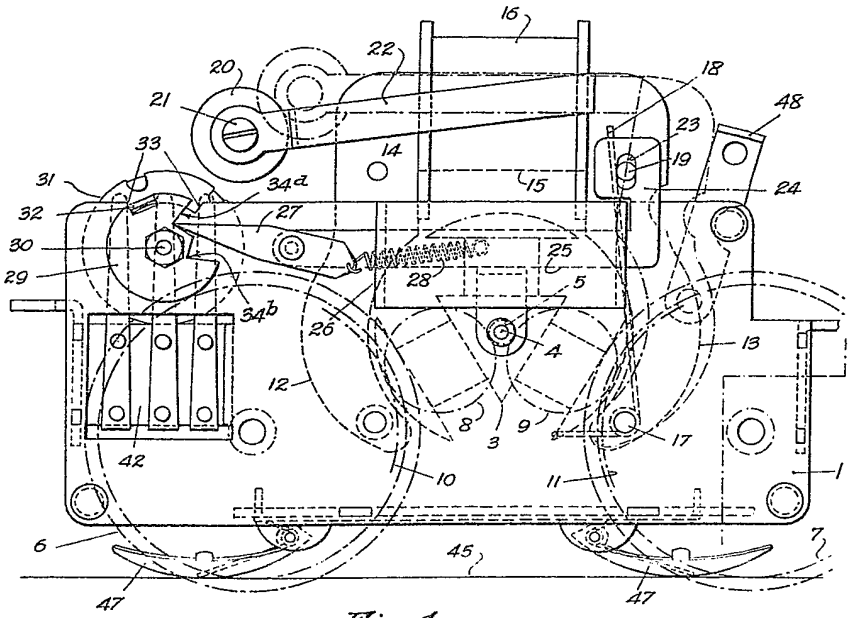
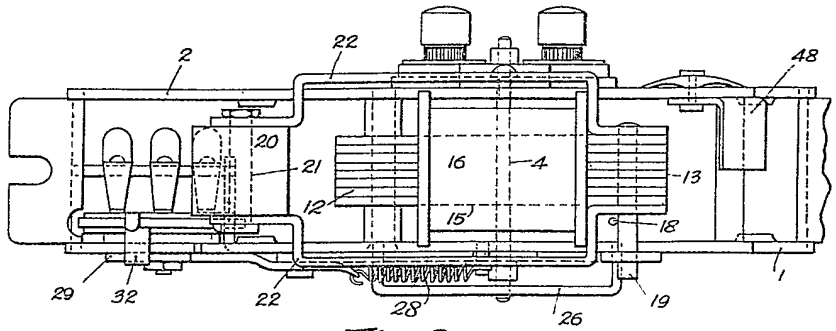


Fig. 1.



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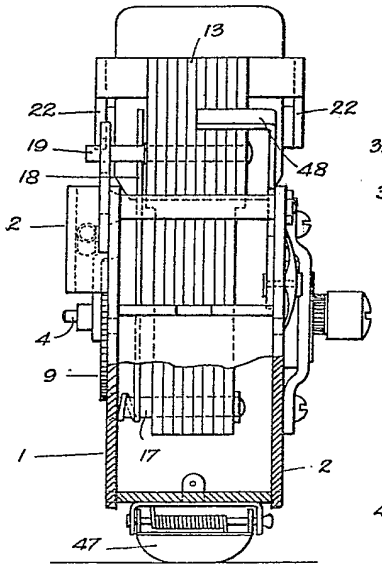


Fig. 3.

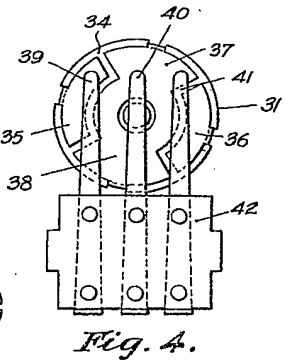


Fig. 4.

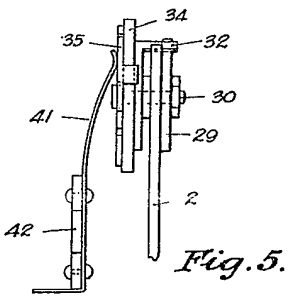


Fig. 5.

Fig. 6.

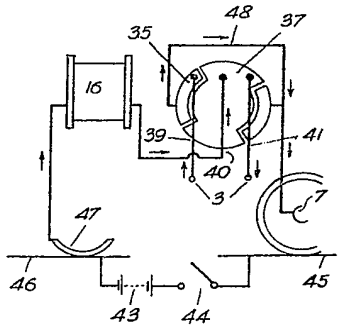
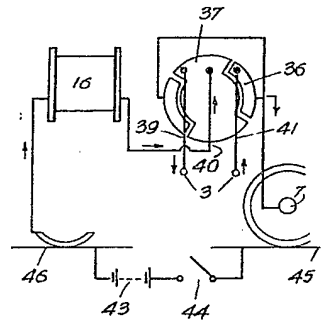


Fig. 7.



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