No. 891,632. PATENTED JUNE 23, 1908.

M. E. NEENAN.

ELECTRIC BRAKE MECHANISM FOR CARS, ELEVATORS, CRANES, AND OTHER PURPOSES.

APPLICATION FILED MAR. 22, 1905.

4 SHEETS—SHEET 1.

Fig. 1

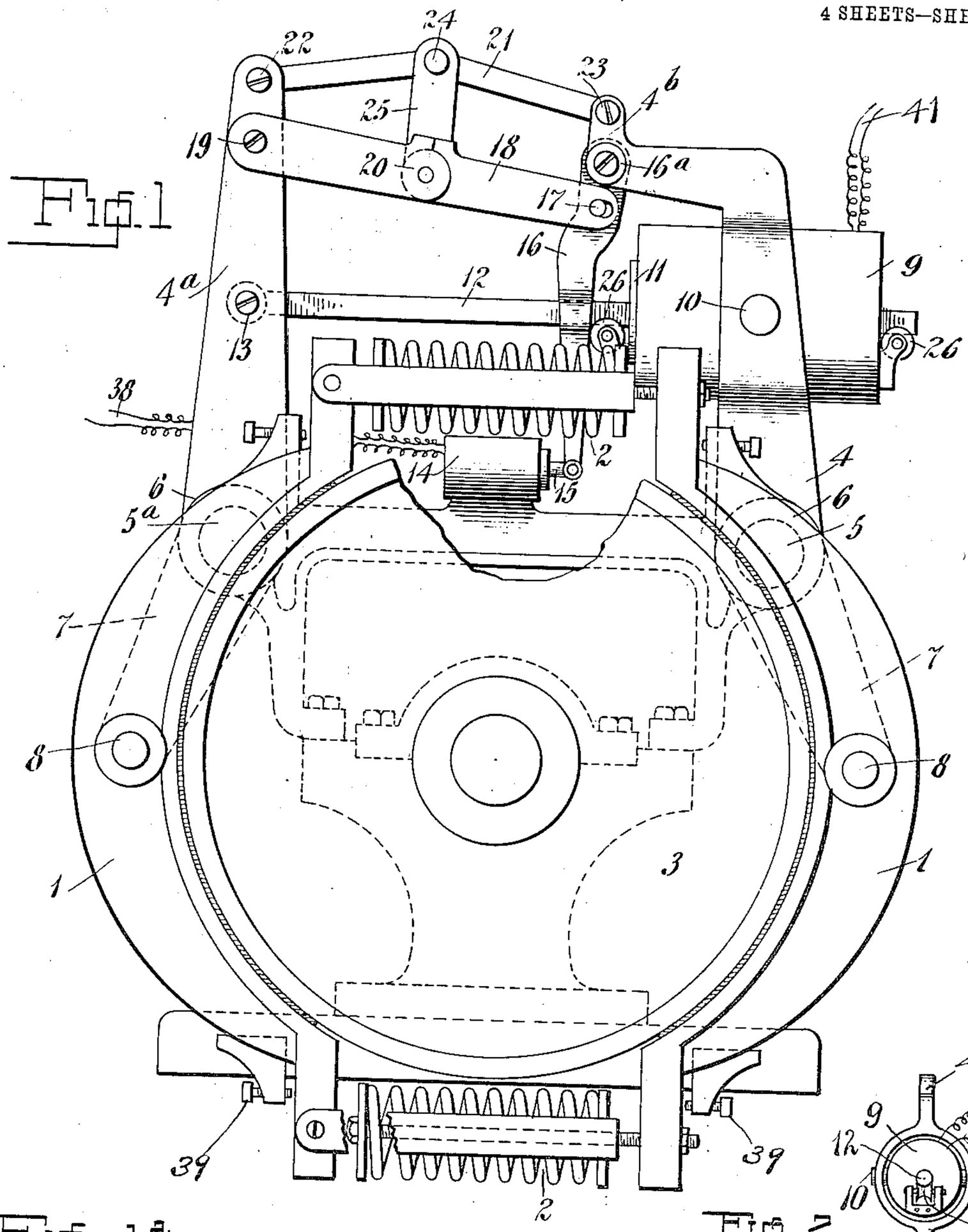


Fig. 1a

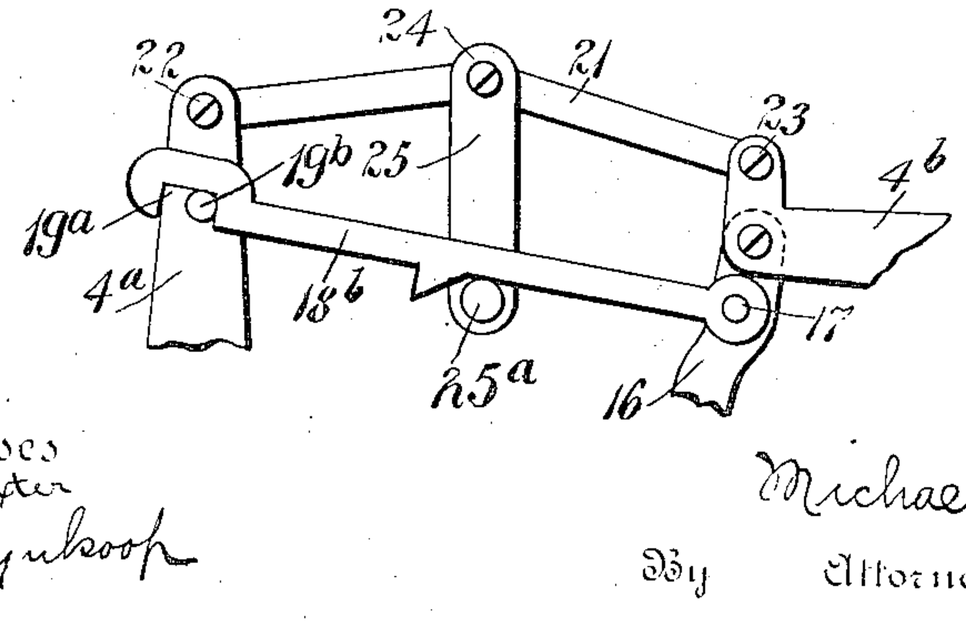
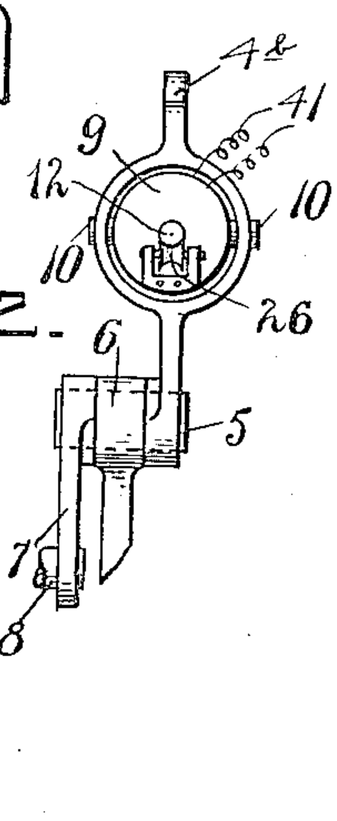


Fig. 2.



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4 SHEETS—SHEET 2.

Fig. 3

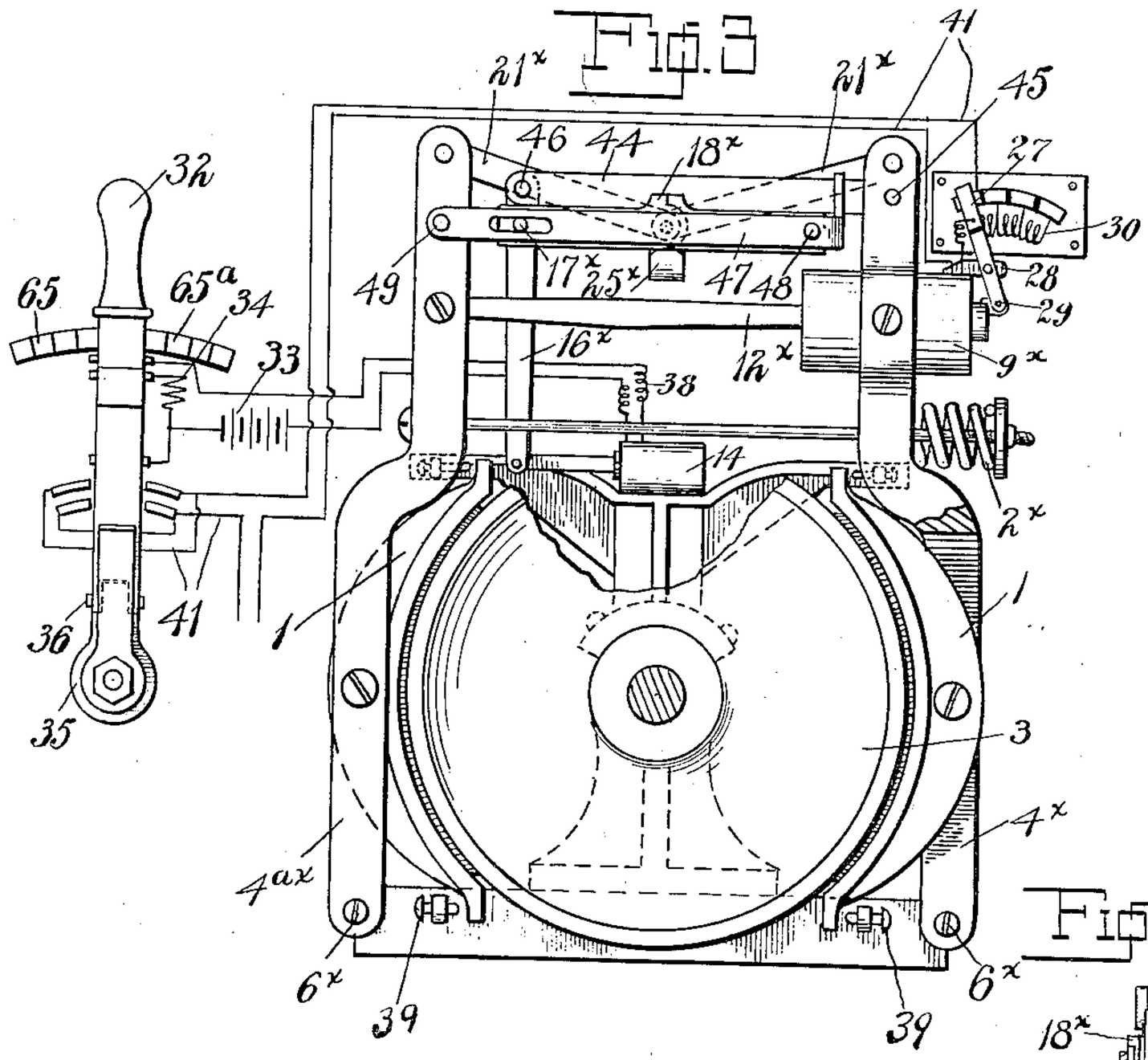


Fig. 3a

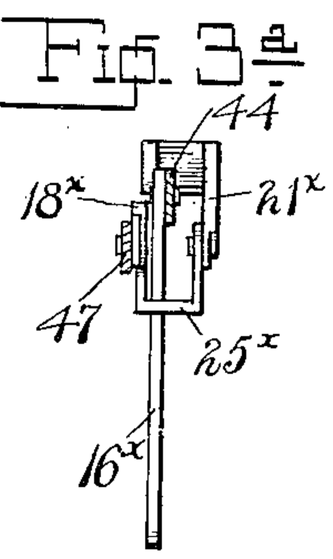
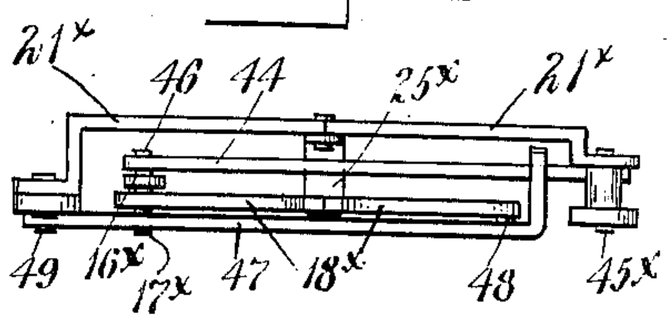


Fig. 4



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4 SHEETS—SHEET 3.

Fig. 6

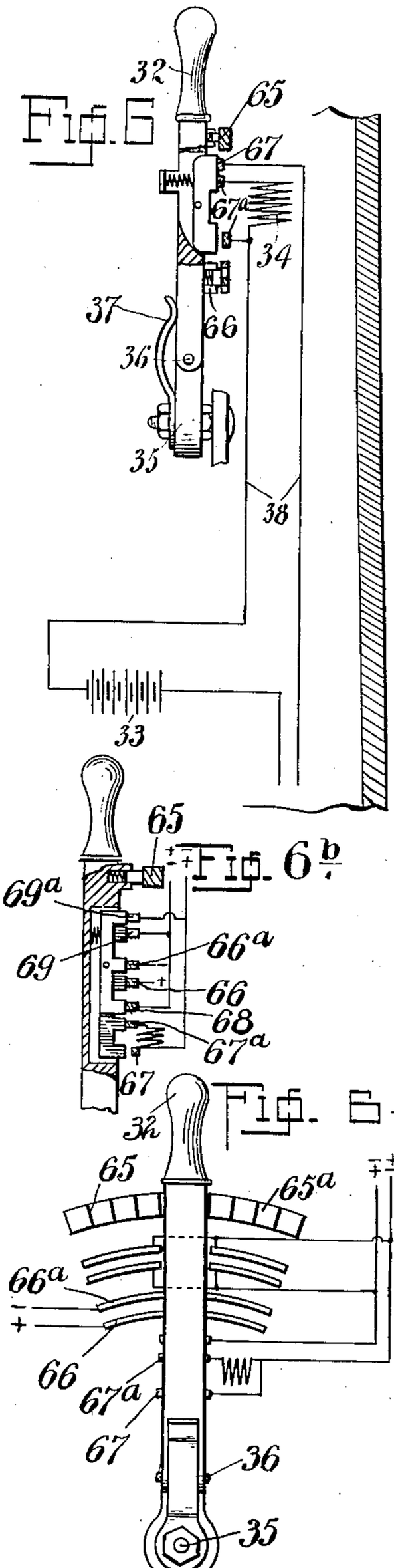


Fig. 6b

Fig. 7

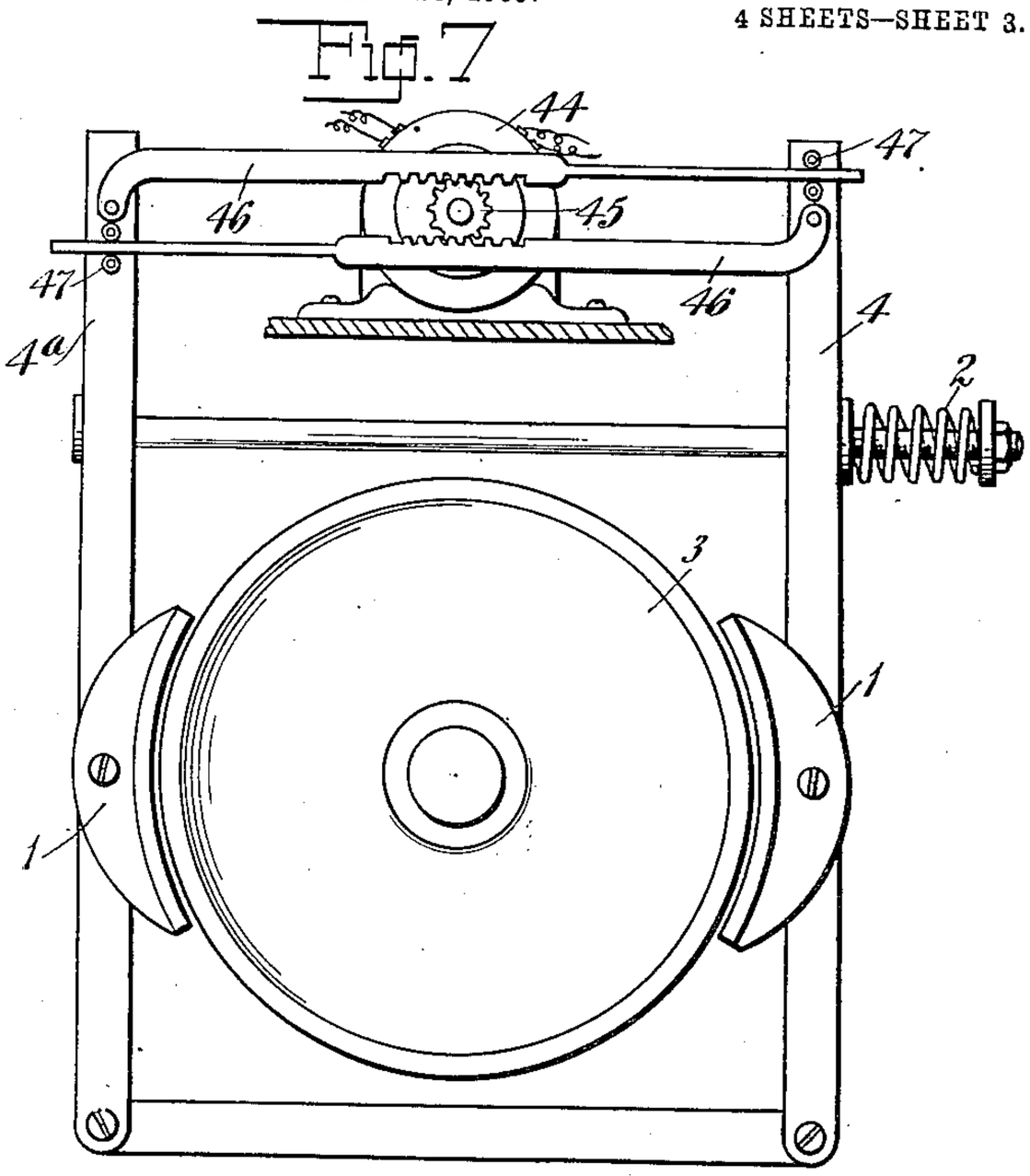
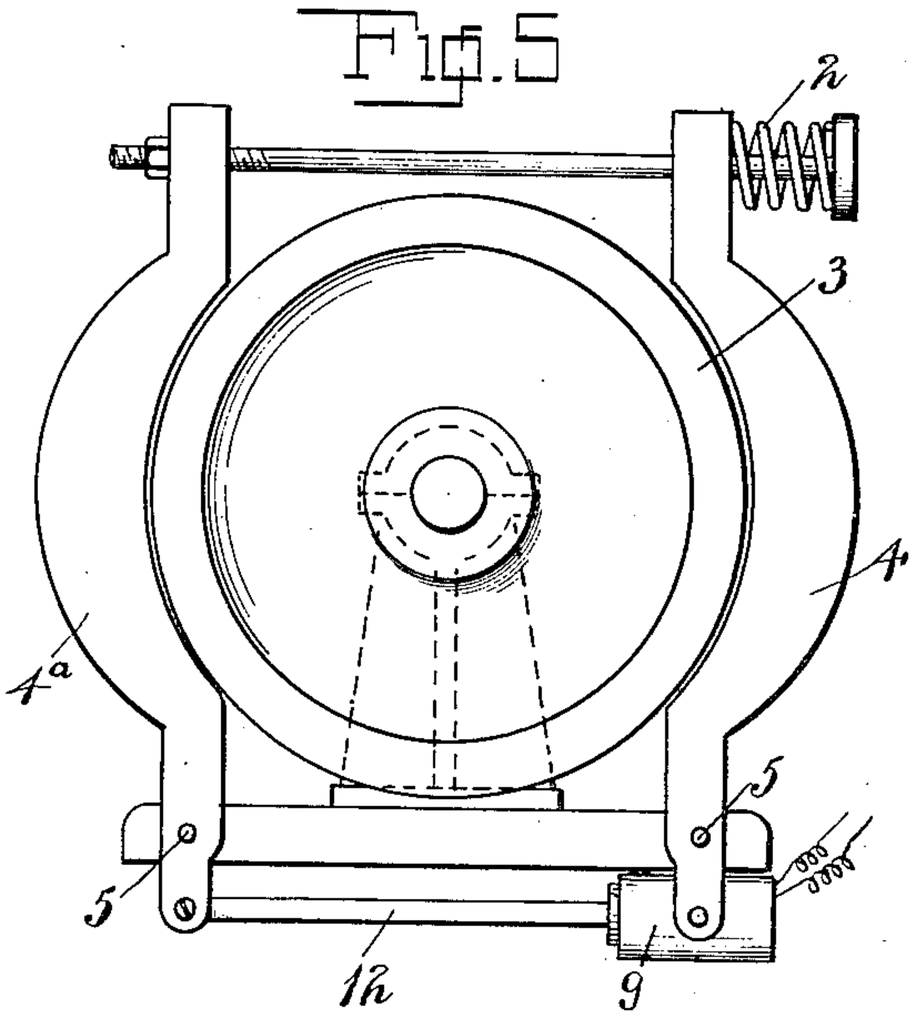


Fig. 5



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ELECTRIC BRAKE MECHANISM FOR CARS, ELEVATORS, CRANES, AND OTHER PURPOSES.

APPLICATION FILED MAR. 22, 1905.

4 SHEETS—SHEET 4.

FIG. 5

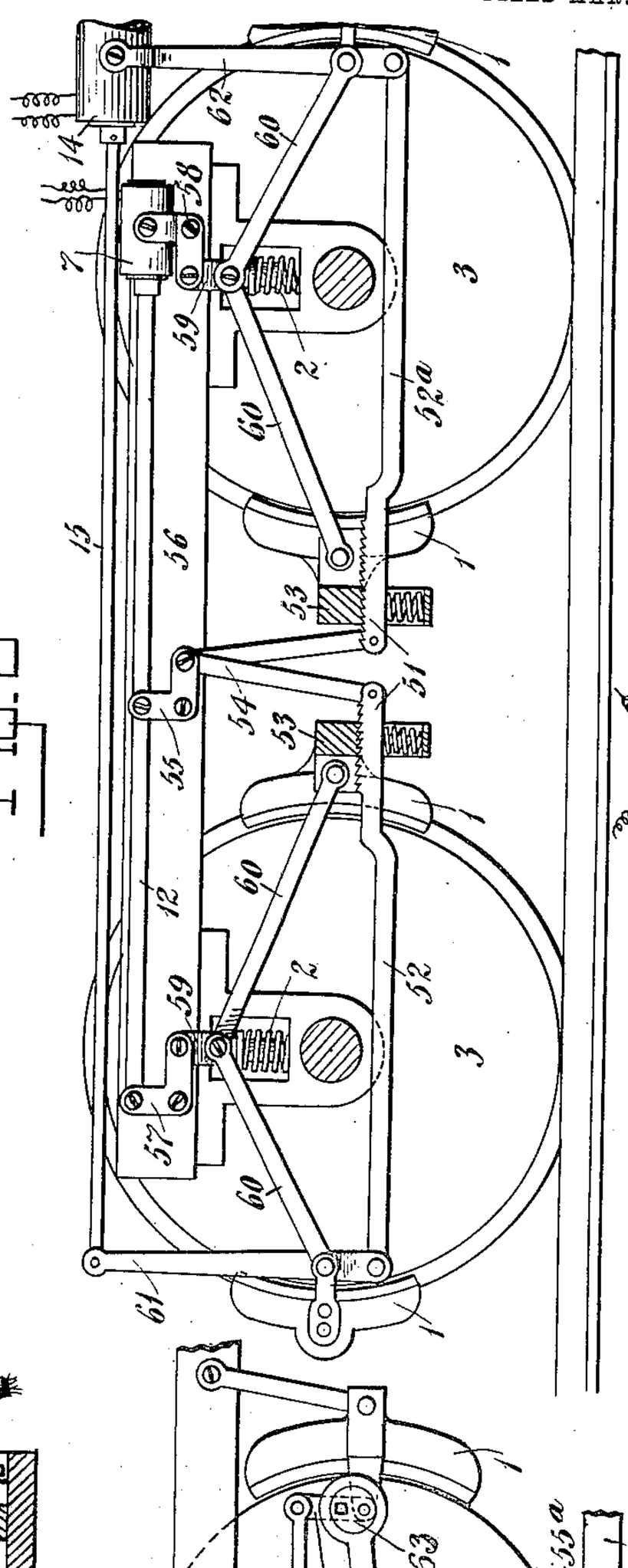

FIG. 6

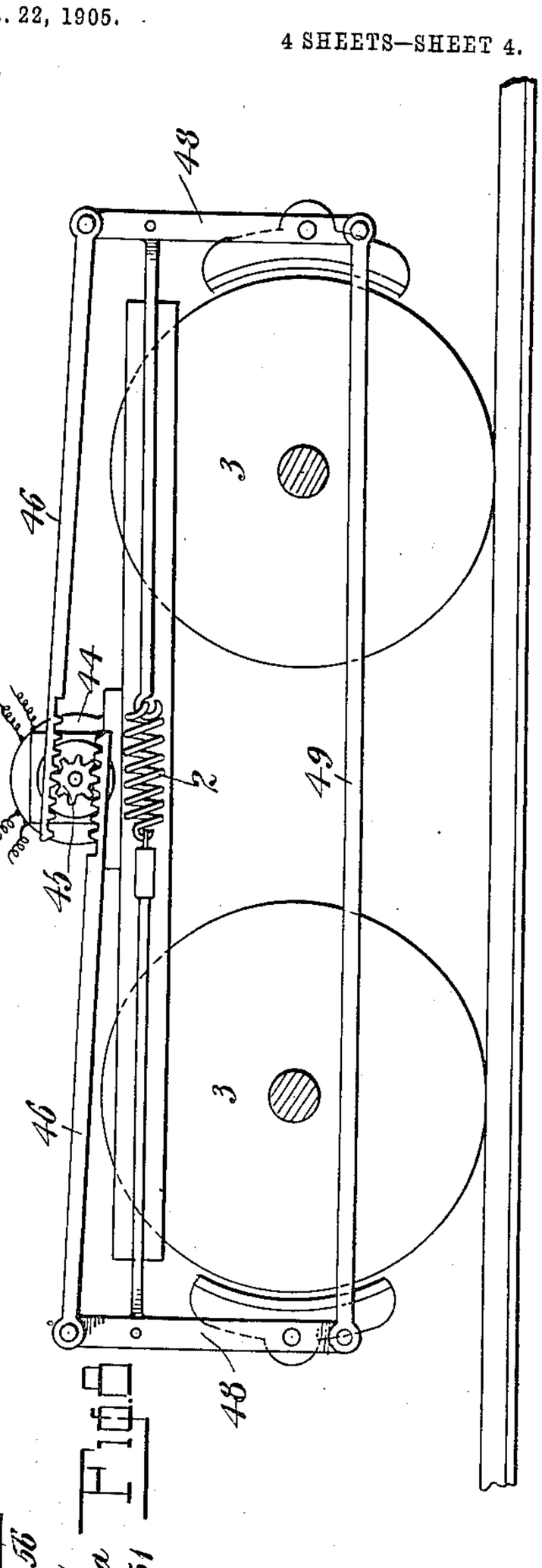

FIG. 12.

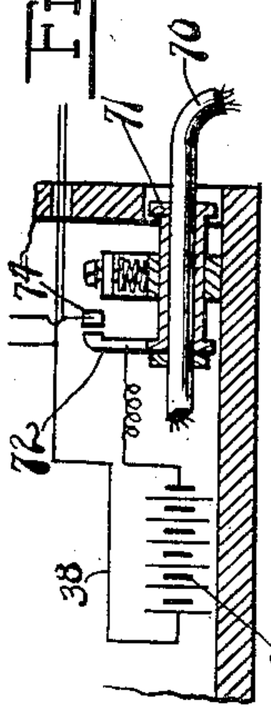

FIG. 11

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ELECTRIC BRAKE MECHANISM FOR CARS, ELEVATORS, CRANES, AND OTHER PURPOSES.

No. 891,632. Specification of Letters Patent. Patented June 23, 1908.

Application filed March 22, 1905. Serial No. 251,517.

To all whom it may concern:

Be it known that I, MICHAEL E. NEENAN, a citizen of the United States, and resident of the borough of Manhattan, in the city and State of New York, have invented certain new and useful Improvements in Electric Brake Mechanism for Cars, Elevators, Cranes, and other Purposes, of which the following is a specification.

My invention consists primarily in combining with a brake-mechanism in which the brakes are released or retracted by an electro-magnetic or motor appliance, a supplementary electro-magnet or motor mechanism adapted and employed to apply pressure to the brakes and preferably operating in conjunction with the brake pressure springs or equivalent pressure means in opposition to which the brake retracting magnet or magnets or motor work. In operation the brake-springs seat the shoes on the brake-wheel in customary manner and the supplementary magnet or motor then serves to apply any additional pressure which may be required.

My invention further consists in means by which the brake releasing mechanism, when permitted to work in overcoming the pressure of the brake applying springs, automatically throws out of action the fulcrum of the electric magnet brake applying lever, thereby removing the resistance which the quick movement of the magnet-core connected with said lever would otherwise offer to the retraction on the brakes. A very important result is that the core of said magnet is always in its most effective and powerful position.

My invention further consists in means by which the effective force of an electric brake-applying mechanism is placed in control of an operator on the car so that he may apply the brakes with greater or less pressure according to the load so as to avoid shock by too sudden stopping when the load is light and, on the other hand, prevent slipping of the brakes when the load is heavy.

My invention further consists in mounting a releasing magnet on a brake-shoe-lever, working on a fixed fulcrum and connecting the core or core-rod of said magnet with an opposed brake-shoe-lever as hereinafter described. Also in a combination of levers and connections by which the retracting movement of the brake levers automatically throws out of action the fulcrum of a lever through which the brake applying magnet operates in applying the brakes; with the result before mentioned. Also in other details of construction hereinafter described and claimed.

In the accompanying drawings, forming part of this specification, Figure 1 is a front view of an electric brake mechanism illustrating my invention, Fig. 1ª is a detail view of a modification. Fig. 2 is a partial side view of the mechanism shown in Fig. 1; on a smaller scale. Fig. 3 is a front view of an electric brake mechanism of more simple form, also embodying the invention. Fig. 3ª is a detail side view of a fulcrum tripping device, shown in Fig. 3. Fig. 4 is a plan view of the removable fulcrum mechanism shown in elevation in Figs. 3 and 3ª. Fig. 5 is a partial front view of an electric brake mechanism in still more simple form, illustrating another mode of mounting a retracting magnet on one of the brake-levers. Fig. 6 is a diagrammatic side view (partly in section) of the controlling apparatus shown in front view in Fig. 3, and which in practice is carried on the car. Fig. 6ª is a front view of a controller of modified form. Fig. 6ᵇ is a side view of the same, partly in section. Fig. 7 is a front view of an apparatus embodying parts of my invention, and in which a reversible rotary motor is employed in place of two magnets applying and retracting the brakes. Fig. 8 is a side view illustrating the same device applied to a railway car brake. Fig. 9 is a side elevation partly in section showing the invention embodied in a car brake apparatus, in conjunction with a take-up device to compensate for wear of the brake-shoes. Fig. 10 illustrates a modification of the take-up device. Fig. 11 illustrates another form of take-up device. Fig. 12 is a diagram of a device for automatically closing the circuit of the brake-applying magnet in the event of accident.

Referring to Fig. 1; 1, 1 represent a pair of brake shoes drawn by springs 2, 2 into contact with opposite sides of the brake wheel 3; 4, 4ª are levers keyed respectively on one end of short fulcrum-shafts 5, 5ª (Fig. 2) turning in bearings 6 on the stationary frame. On the other end of each of the fulcrum-shafts 5, 5ª is keyed a downwardly projecting lever-arm 7, which arms are piv-

oted by their lower ends at 8, to the central part of the respective brake shoes 1. The combined parts 4, 5, 7 or 4^a, 5^a, 7 thus constitute a lever of the first order turning on the fulcrum 6, so that when the upper ends of the said levers are drawn together their lower ends force apart the brake shoes 1, retracting them from the brake-wheel, in opposition to the tension of the springs 2. This drawing together of the levers 4, 4^a to retract the brakes is effected by an electro-magnet 9 mounted by trunnions 10 in a yoke formed in the lever 4, and whose core-armature 11 is mounted on a rod 12 of brass or other non-magnetic metal pivoted at 13 to the lever 4^a.

14 represents an electro-magnet acting to apply additional and variable brake-pressure after the shoes have been seated on the brake wheel by the springs 2. For this purpose the core rod 15 of said brake applying magnet 14 is pivoted to the lower end of a lever 16, fulcrumed by its upper end at 16^a to the brake-shoe-lever 4, and pivoted at 17 to a jointed fulcrum bar 18, which is pivoted by its opposite end at 19 to the lever 4^a, and is constructed in its central part with a knuckle joint 20 so formed that when said bar 18 is depressed to the straight position shown in Fig. 1, it presents a rigid fulcrum-bearing for the lever 16 and when the jointed center of said bar 18 is raised, the fulcrum bearing is destroyed. A longitudinal slot in the fulcrum bar 18, in which the pivot 17 works, permits the independent flexing movement of the bar 18, while affording a firm bearing for the fulcrum when said bar 18 is straight.

The purpose of this mechanism is to automatically throw the leverage of the brake applying magnet 14 out of action whenever the brake retracting magnet 9 is rendered active by the electric current to withdraw the brake-shoes from the brake-wheel. To this end the brake lever 4 in which the magnet 9 is mounted is formed at its upper end with a rigid L-shaped extension 4^b to the elbow of which the upper end of the brake applying lever 16 is fulcrumed at 16^a. A jointed rod 21 is pivoted by its ends at 22, 23 to the upper ends of the lever 4^a and the L-extension 4^b of lever 4 respectively and the central joint 24 of said rod is connected by a link 25 to the knuckle joint 20 of the fulcrum-bar 18. The jointed rod 21 rests normally in the upwardly bent position shown in Fig. 1, so that when the brake levers 4, 4^a are drawn together by the action of the brake retracting magnet 9, the first effect is to apply an inward thrust to the ends of the jointed and bent rod 21, thereby throwing up its center and by means of the link 25 drawing up the knuckle joint 20 of the bar 18. This operation and effect will be more apparent by considering the arc movement of the pivot 23 at the extremity of the lever 4 upon its axis 5 and the movement thereby imparted to the attached end of the jointed rod 21. The lever extension 4^b and jointed rod 21 will be seen to constitute a toggle-joint imparting a quick upward thrust to the jointed center 24 of the rod and throwing up the knuckle joint of the bar 18. This movement of the bar 18 is permitted by the pivot and slot connection 17 and instantly deprives the brake applying lever 16 of a fulcrum on which it might act to resist the approach of the levers 4, 4^a in retracting the brake.

When the current is cut off from the brake retracting magnet 9, the action of the springs 2 in applying the brakes instantly restores the fulcrum bar 18 to its effective straight position in readiness for the action of the brake applying magnet 14. The braking movement being applied to the shoe primarily by the springs 2, the core of the magnet 14 is practically stationary and always in position of strongest effectiveness. The office of this magnet is not to move the shoes into contact with the brake wheel, but to graduate the degree of pressure applied to the brake-wheel by the shoes when they are already in contact therewith. There is, therefore, scarcely any movement of the core of the magnet 14 and no perceptible movement of the brake-shoes effected thereby and hence the whole force of this magnet may be applied through the very powerful leverage connections illustrated in Fig. 1. For the same reason no sudden jar occurs when the magnet 14 is brought into action.

In the modification shown in Fig. 1^a, instead of the knuckle jointed fulcrum bar 18, rigid bar 18^b is pivoted at 17 to the magnet lever 16 and formed at its other end with a notch 19^a to engage a stud 19^b on the lever 4^a. A stud 25^a on the link 25 engages beneath the fulcrum bar 18^b so as to lift its free end clear of the stud 19^b and thus deprive the magnet lever 16 of its fulcrum as already described with reference to Fig. 1.

The magnet 9 being mounted by trunnions on one of the brake-levers, as described and connected with the other pulls them together with an equalized effect and the necessity for a bracing support for the magnet is dispensed with.

The core of the magnet 9 is relieved of friction by rollers 26 on which it rests at each end. When the magnet 9 has released the brake in opposition to the tension of the springs 2, the magnet-core or armature is in its most powerful position. At this point the magnet does not require as much current as when it started to release the brakes. In order, therefore, to reduce the current through the magnet in proportion to the requirement that is to reduce the current-consumption to a minimum, a regulating device

is employed, which may consist, as shown in Fig. 3, of a vibrating lever 27 fulcrumed at 28 on the shell of the magnet, pivoted at 29 to the core and carrying at its free end one of the conducting wires and traveling over a rheostat or resistance coil 30, so as to cut in greater resistance as the core approaches the inner limit of its movement. In elevator service the conducting wires 41 of the brake-retracting magnet 9 are connected in the usual manner to the driving power of the elevator (not shown) and to a controller 32 carried in the car, so that when the power is cut off to stop the car, the brake retracting magnet is also cut out.

The wires 38 of the brake applying magnet 14 extend from the end thereof to the controller lever 32 and to a separate battery 33, which may be carried in the car. It is not necessary to have the battery 33 carried by the car, but it should be used for the sole purpose of supplying current to the magnet 14 because in the event of the current from the brake retracting battery failing there would otherwise be no current to supply regulated supplemental pressure to the brake-shoes.

In elevator service the springs 2 should be just strong enough to stop the car without jar, with a light load, which is the customary way of adjusting the springs in electric brakes now in use in elevators, and hence slipping commonly occurs with an increased load compelling the operator to apply the brakes at a greater distance before the desired stop is reached and causing very unsatisfactory results in high speed elevator service. The magnet 14 overcomes this difficulty and the operation of the same is as follows: When the current is shut off from the magnet 9, permitting the springs 2 to apply the brakes, the force of the said springs represents the primary braking force, which, if the car is lightly loaded will be sufficient; but if the car is heavily loaded the operator can, as he sees fit, apply the secondary force of the magnet 14, which force he can graduate according to the weight of the load. This graduation of force applied by the magnet 14 is effected by a resistance coil 34 in the circuit 38 in connection with which the controller lever 32 operates.

The controller lever 32 is fulcrumed at 35 (Figs. 3 and 6) and jointed at 36 a short distance above its fulcrum to permit a slight motion back and forth at right angles to its arc movement, and is normally held in vertical position by springs 37. When the said lever is brought up to the center of its arc movement, as shown in Fig. 3, to cut out the driving power and the retracting magnet 9, if the secondary force is not needed a slight outward pressure on the said lever 32, *i. e.*, to the left in Fig. 6, will suffice to keep the circuit 38 of magnet 14 open. If the secondary force is needed to a moderate extent, the lever is allowed to assume its normal vertical position in which it closes the circuit 38 through the resistance coil 34, as illustrated in Fig. 6. If more force be required, the lever 32 is pressed inward, *i. e.*, to the right of Fig. 6, the effect of which is to cut out or short circuit the resistance coil 34, causing the full current to pass through the circuit 38 and magnet 14 and apply the maximum force to the brakes. It will thus be readily seen that these adjustments can be made to meet the maximum and minimum requirements of the brake service.

In railroad service the springs 2 need only apply sufficient force to bring the shoes in contact with the brake-wheel and cause the fulcrum-bar 18 to assume its fulcrum position. Then when the current is turned on through the magnet 14, the brakes are applied with any necessary force.

In practice the strength of the releasing magnet 9 and its connections is, of course, adjusted relatively to that of the springs 2 and the said springs and magnet may be of any desired strength.

In order to equalize the action of the brake shoes 1 on the wheel 3, set screws 39 are provided, tapped into stationary bearings on the stationary frame and limiting the outward movement of the respective ends of the shoes.

The construction and operation of the structure shown in Fig. 3 is similar in principle and effect to that shown in Fig. 1, but reversed in mechanical operation. In Fig. 3 the levers $4^{\times}$ and $4^{a\times}$ fulcrumed at $6^{\times}$ apply the brake when drawn together by pressure of springs $2^{\times}$ bearing directly against the lever $4^{\times}$ and through the rod on the lever $4^{a\times}$. The magnet $9^{\times}$ applies a thrust to the non-magnetic core rod $12^{\times}$ to force the brake levers apart and retract the brake shoes and in doing so strains the jointed rod $21^{\times}$ toward a straight position applying an upward pull to the link $25^{\times}$ which is formed with an upward end as shown in the detail view Fig. 3^{a} adapted to engage with the underside of the knuckle jointed fulcrum bar $18^{\times}$, so as to trip the same and throw it up into ineffective position. When not so tripped the bar $18^{\times}$ in the straight position shown in Fig. 3, furnishes an effective fulcrum for the lever 16 of the brake applying magnet $14^{\times}$, which operates through connections shown in detail in Fig. 4, to draw together the upper ends of the brake levers $4^{\times}$ and $4^{a\times}$. These connections consist of a tension bar 44 pivoted by one end at 45 to the lever $4^{\times}$ and by the other end at 46 to the short upper end of the lever $16^{\times}$ and another tension bar 47 pivoted by one end at 48 to the fulcrum bar $18^{\times}$ and by the other end, at 49, to the lever $4^{a\times}$. As before, the lever $16^{\times}$ acts on the fulcrum-bar $18^{\times}$ through a pivot and slot connection $17^{\times}$,

so as to permit the tripping movement of the jointed bar 18×.

Fig. 5 shows the brake levers 4, 4ª each formed in one piece with the respective brake shoes, and an electro-magnet 9 pivoted on the lower end of the lever 4 and connected by its core-rod with the lower end of the other lever 4ª so as to retract the brakes in opposition to the pressure of the brake-applying springs 2, the said levers being mounted on fixed fulcrums 5 intermediate of the ends.

In the modification shown in Fig. 7, a reversible rotary magneto electric motor 44 serves the several purposes of the magnet 9, holding the brakes in retracted position in opposition to the pressure of the springs 2 and the magnet 14 for applying the supplementary brake pressure. The armature shaft of said motor 44 carries a pinion 45 gearing with a pair of rack bars 46, each pivoted at one end to the respective brake levers 4, 4ª and guided at its free end between rollers 47. As in the other illustrations, the spring 2 forces together the upper ends of the levers 4, 4ª to seat the brake-shoes 1 on the wheel 3 and the regulated supplementary pressure is then applied by closing the circuit through the motor 44 in the proper direction.

Fig. 8 shows the same device applied to an ordinary system of car-brake-levers 48 connected by fulcrum-rods 49. Figs. 7 and 8 also indicate the separate positive and negative wire connections for the armature and the field. The ordinary power connections with the controller for running the car in either direction, at regulated speed, are indicated in Figs. 6, 6ª, 6ᵇ, at 65 and 65ª.

In Figs. 6ª and 6ᵇ, I have shown diagrammatically and merely for illustration one manner of wiring, and controller connections, by which the reversible motor may be operated for retracting and applying the brakes.

66, 66ª may indicate the positive and negative armature supply connections.

When the controller lever is in central position and the power off, the brake motor circuit is closed through the positive contacts 66, 67, or 67ª, *i. e.*, either through the resistance 34 or by short circuit cutting on the same, as already described, and negative contacts 68, 66ª in proper direction to apply the brakes. When the controller lever 32 is deflected to either side so as to run the car in either direction, the brake motor circuit is automatically closed in the opposite direction from the positive contact 66 to 69 and from 69 to the negative contact 66ª.

Fig. 9 illustrates an embodiment of my invention in a car brake apparatus provided with a ratchet take-up connection 51 between the fulcrum rods 52, 52ª and the brake beam 53 on which the inner brake-shoes 1 are mounted, said ratchet connection serving also to disconnect the fulcrum rods from the brake beams and thus destroy or eliminate the fulcrum of the brake-applying magnet 14, by the first action of the magnet 9 in releasing the brakes. To this end the adjacent ends of the fulcrum rods 52 52ª are suspended by pendent rods 54 pivoted by their upper ends to the horizontal arm of a bell crank 55, fulcrumed by its elbow on the truck-frame 56 and whose vertical arm is pivoted to the central part of the pull rod 12 of the magnet 9. Bell cranks 57, 58 are also fulcrumed on the truck-frame 56 and are pivoted by their vertical arms respectively to the extremity of the pull rod 12 and to the shell of the magnet 9. The horizontal arms of the bell cranks 57, 58 are pivoted to vertical slides 59 pressed upward by the brake springs 2 and connected by toggle links 60 to the respective members of each pair of brake-shoes 1, so as to draw the said shoes into contact with the wheels 3 by the upward pressure of the springs 2. In this illustration the supplementary brake-pressure is applied to the shoes by levers 61, 62, pivoted respectively by their upper ends to the free ends of the pull rod 15 of the magnet 14 and to the shell of said magnet. These levers are pivoted by their lower ends to the respective fulcrum rods 52, 52ª and are pivoted intermediately to the outer brake-shoes 1.

In the device shown in Fig. 10 the same effect is produced by a ratchet tooth dog 51ª sliding in the brake beam 53 and engaging with the ratchet teeth 51 of the fulcrum rod 52. With this device the reversed position of the bell-crank 55ª compared with that shown at 55 in Fig. 9 causes the brake retracting pull of the magnet rod 12, by means of the connecting link 54ª to raise the ratchet tooth dog 51ª out of engagement with the teeth 51 of the fulcrum rod 52. In each case the setting of the brakes by the springs 2, when the electric circuit of the magnet 9 is broken, draws the brake beam over as many of the ratchet teeth as may be necessary to seat the shoes on the wheel and as the shoes are retracted to a uniform extent each time by the magnet 9, the ratchet take-up automatically compensates for the wear of the shoes.

Fig. 11 shows eccentric fulcrum connections 63 between the brake shoes 1, fulcrum-bar 52 and levers 61, 61ª together with a connecting rod 64 between the levers 61 and 61ª. The eccentric 63 at each movement of the levers in applying the brakes compensate automatically for the wear of the brake shoes and limit to the proper extent the retracting movement of the shoes.

In the event of accident, causing the separation of cars in a train, the device illustrated in Fig. 12 will cause the instantaneous and automatic application of the brakes by the agency of the magnet 14 and battery 33 therefor carried on every car. This safety

device consists of sliding sleeve 71, through which the power coupling cable 70 is introduced into each car. The cable 70 may contain, in addition to the power conductors, conducting wires for the brake retracting magnets 9, wires for heating, lighting or other purposes. The sliding sleeve 71 has an arm 72 carrying a contact plate, which, when the sleeve is slid outward by the pulling out of a cable 70 is brought in contact with a second plate 74, so as to close the circuit 38 of the local battery 33 and brake-applying magnet 14 independently of the controller, so that on emergency these magnets will automatically supplement the power of the brake springs in applying the brakes on each car.

Having thus described my invention, the following is what I claim as new therein and desire to secure by Letters Patent:

1. The combination of a brake-wheel, a brake-shoe, a spring seating the brake-shoe on the brake-wheel, an electro-magnet, and means for controlling the same and connections between said magnet and the brake-shoe operating to apply braking pressure when the shoe is seated on the brake-wheel by its spring, substantially as set forth.

2. The combination of a brake-wheel, a brake-shoe, a spring seating the shoe on the wheel, an electro-magnetic apparatus and suitable connections retracting the shoe from the brake-wheel in opposition to the spring pressure and a supplementary electro-magnetic apparatus and suitable connections applying additional pressure to the shoe when seated on the brake-wheel, substantially as set forth.

3. The combination of a brake-wheel, a pair of brake-shoes operating on opposite sides of said wheel, a pair of levers on fixed fulcrums on which levers the shoes are mounted, a spring applying braking pressure to the said wheel through the medium of said levers and shoes, and a retracting magnet mounted on one of said levers and connected with the opposite lever so as to completely withdraw the shoes from the wheel in opposition to the spring pressure, substantially as set forth.

4. The combination of a brake-wheel, a brake-shoe, a spring and suitable connections applying braking pressure on the shoe, an electro-magnet and suitable connections applying additional pressure to the brake-shoe when seated on the wheel, an electro-magnet and suitable connections retracting the brake shoe in opposition to the spring pressure and separate electric circuits controlling said brake applying and brake retracting magnets, substantially as set forth.

5. The combination of a brake-wheel, a brake-shoe, a spring and suitable connections applying brake pressure to said shoe, a magnet retracting the shoe in opposition to the pressure of the spring, a supplemental magnet applying additional pressure to the brake-shoe when seated on the wheel, and a separate source of electricity for said brake applying magnet, substantially as set forth.

6. The combination of a brake-wheel, a brake-shoe and brake-shoe lever, a brake applying magnet, suitable mechanical connections between said magnet and brake-shoe lever for applying the braking pressure, a brake retracting magnet connected with the brake-shoe lever operating to release the brake and a tripping device in the mechanical connections between the brake applying magnet and brake-shoe lever, actuated by the said lever and automatically throwing the brake applying mechanism out of action when the brakes are to be released, substantially as set forth.

7. The combination of a brake-wheel, a brake-shoe and brake-shoe-lever, a brake applying magnet and lever actuated thereby, connected with the brake-shoe-lever to apply the brake, a bar constituting a fulcrum on which said magnet lever operates, means for retracting the brake-shoe-lever and a tripping connection actuated by the brake-shoe lever in its retracting movement tripping the fulcrum bar and automatically disconnecting the brake applying magnet from the brake-shoe lever, substantially as set forth.

8. The combination of a brake-wheel, a pair of levers carrying brake-shoes engaging with opposite surfaces of said wheel, means for applying brake-pressure through the medium of said brake levers and a brake retracting magnet mounted in oscillatory position on one of said brake-levers and having its core connected to the other brake-lever so as to retract the brake by an equalized movement, substantially as set forth.

9. The combination of a brake-wheel, a pair of levers carrying brake-shoes bearing against opposite sides of said wheel, a brake applying spring and tension rod mounted on said levers and forcing them together to apply the brakes and a brake retracting magnet and its core pivoted respectively to shorter arms of said levers beyond their fulcrums so as to retract the brake-shoes from the wheel, substantially as set forth.

10. The combination of a brake-wheel, a brake-shoe, an electro-magnet and a spring with suitable connections applying braking pressure to said shoe, an electro-magnet and suitable connections operating to retract the brake-shoe in opposition to said spring and a controlling device and electric connections for actuating the brake applying and brake retracting magnets respectively, substantially as described.

11. In an electric brake apparatus, the combination of a brake wheel, a brake-shoe adapted to apply pressure thereto, a car, a source of electro-motive force external to the

car and suitable electric connections therefrom for retracting the brake-shoe, a separate source of electricity carried on the car for applying the brake and a circuit closing device on the car released by the mechanical separation from the car of the external source of electricity so as to automatically apply the brakes, substantially as described.

12. The combination of a brake wheel, a brake shoe, a spring seating the brake shoe on the brake wheel, electro-magnetic means adapted to apply braking pressure when the shoe is seated on the brake wheel by its spring, and also adapted to act in opposition to said spring to release the brake shoe.

13. The combination of a brake wheel, a brake shoe, a lever acting on said brake shoe, a spring acting through the medium of said lever and shoe to apply braking pressure to the wheel, an electro-magnet and its core mounted horizontally, one of which is connected to said lever and adapted to retract the shoe from the wheel in opposition to the spring pressure and antifriction rollers for the core of said magnet, substantially as set forth.

14. The combination of a brake wheel, a pair of brake shoes operating on opposite sides of said wheel, a pair of levers on fixed fulcrums, on which levers the shoes are mounted, a spring applying brake pressure to the said wheel through the medium of said levers and shoes, and the retracting magnet mounted on said levers so as to withdraw the shoes from the wheel in opposition to spring pressure, substantially as set forth.

15. The combination of a brake wheel, a pair of levers carrying brake shoes bearing against opposite sides of said wheel, a brake applying spring and tension rod mounted on said levers and forcing them together to apply the brakes and a brake retracting magnet and its core mounted respectively on shorter arms of said levers beyond their fulcrums so as to retract the brake shoes from the wheel, substantially as set forth.

16. The combination with a brake wheel, a pair of levers on fixed fulcrums, brake shoes mounted on opposite sides of said wheel on said levers, a spring applying braking pressure to said shoes, a retracting magnet to act against said spring pressure and a stationary projection engaging each end of each shoe so as to adjust and limit the movement of said shoes from said wheel, substantially as set forth.

17. In a brake apparatus, the combination of an electro-magnet having a single winding, a mechanism mechanically operated by said magnet, an electric circuit energizing said magnet, a graduated regulating means in said circuit and a connection from a moving member of the magnet to the said regulating means whereby the relative movement of the magnet members gradually reduces the current through the magnet as the armature approaches its most effective position, substantially as set forth.

18. The combination of a brake-wheel, a brake-shoe, automatic initial pressure means and a releasing device therefor seating the brake-shoe on said wheel, a motor and means for controlling the same, and a connection between said motor and the brake-shoe operating to apply braking pressure when the brake-shoe is seated on the brake-wheel by the initial pressure means, substantially as set forth.

19. The combination of a lever, means to operate the same, a mechanism in connection therewith which the lever acts upon, and a fulcrum tripping means operating to trip the fulcrum of said lever, substantially as set forth.

20. The combination of a brake-wheel, a pair of brake-levers and brake-shoes carried thereby operating on opposite sides of said wheel, a spring, applying pressure to the brake-wheel through the medium of said levers and shoes, and an electro-magnetic retracting device effecting the complete withdrawal of the brakes, the said electro-magnetic device which effects the complete withdrawal of the brakes being mounted and supported on the said brake-levers.

21. The combination of a brake-wheel, a pair of brake-shoes operating on opposite sides of said wheel, a pair of levers of the second order on which the brake-shoes are mounted, a support for the fulcrum-ends of said levers, a spring applying braking pressure to the brake-wheel through the medium of said levers and shoes, a brake-retracting magnet mounted on the power-end of one of said levers and a thrust rod connecting said magnet with the power end of the other lever whereby the power-ends of said levers are pushed apart to retract the brakes, substantially as described.

The foregoing specification signed this 21st day of March 1905.

MICHAEL E. NEENAN.

In presence of—
W. P. HAMMOND,
S. J. HOEXTER.