(No Model.)

3 Sheets—Sheet 1.

# R. RANDOLPH.

## AUTOMATIC CAR BRAKE.

No. 332,944. Patented Dec. 22, 1885.

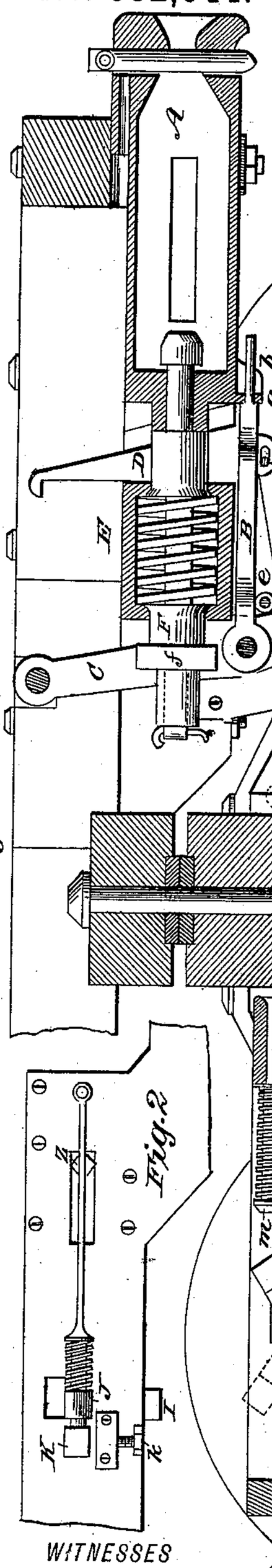

Fig. 1.

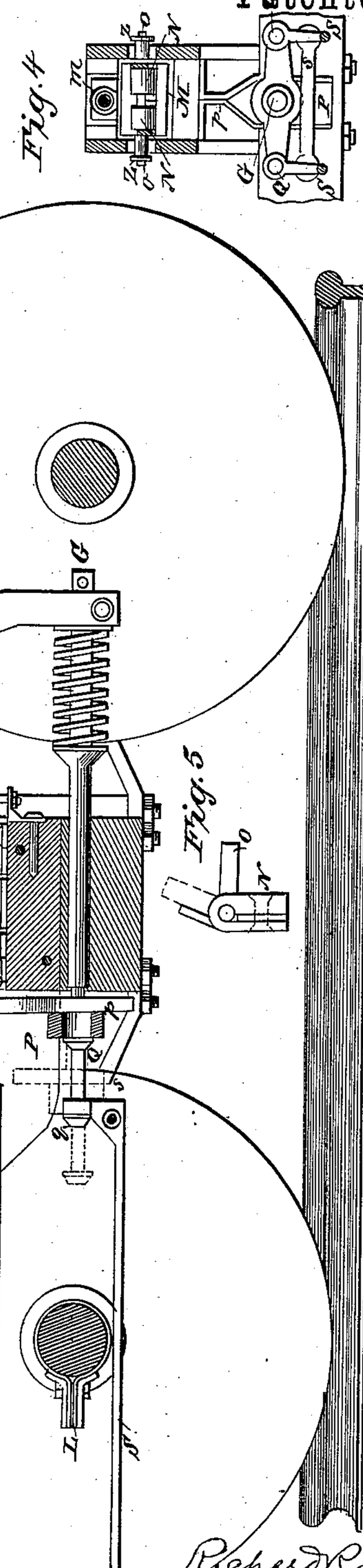

Fig. 5.



Fig. 4.

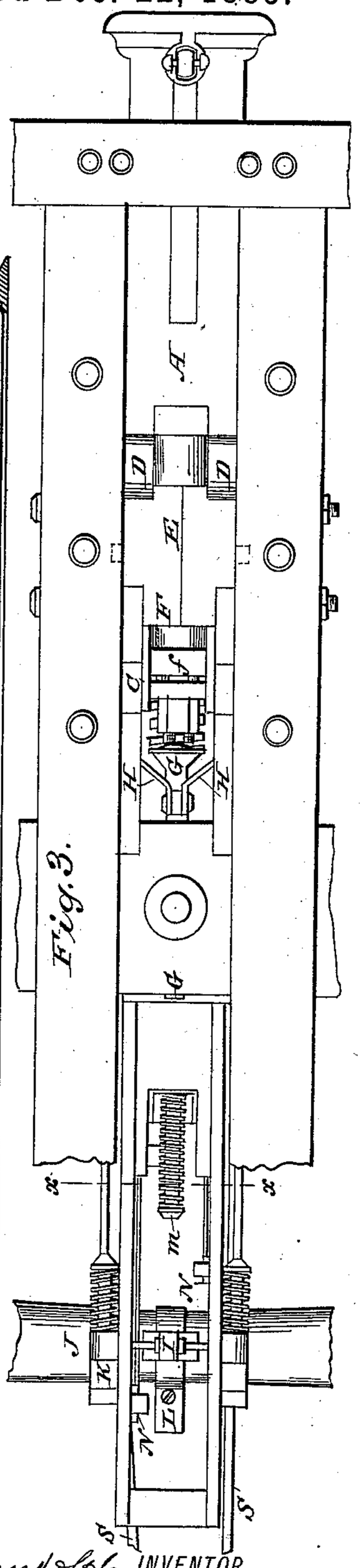

Fig. 3.



Fig. 2.

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Fig. 6.

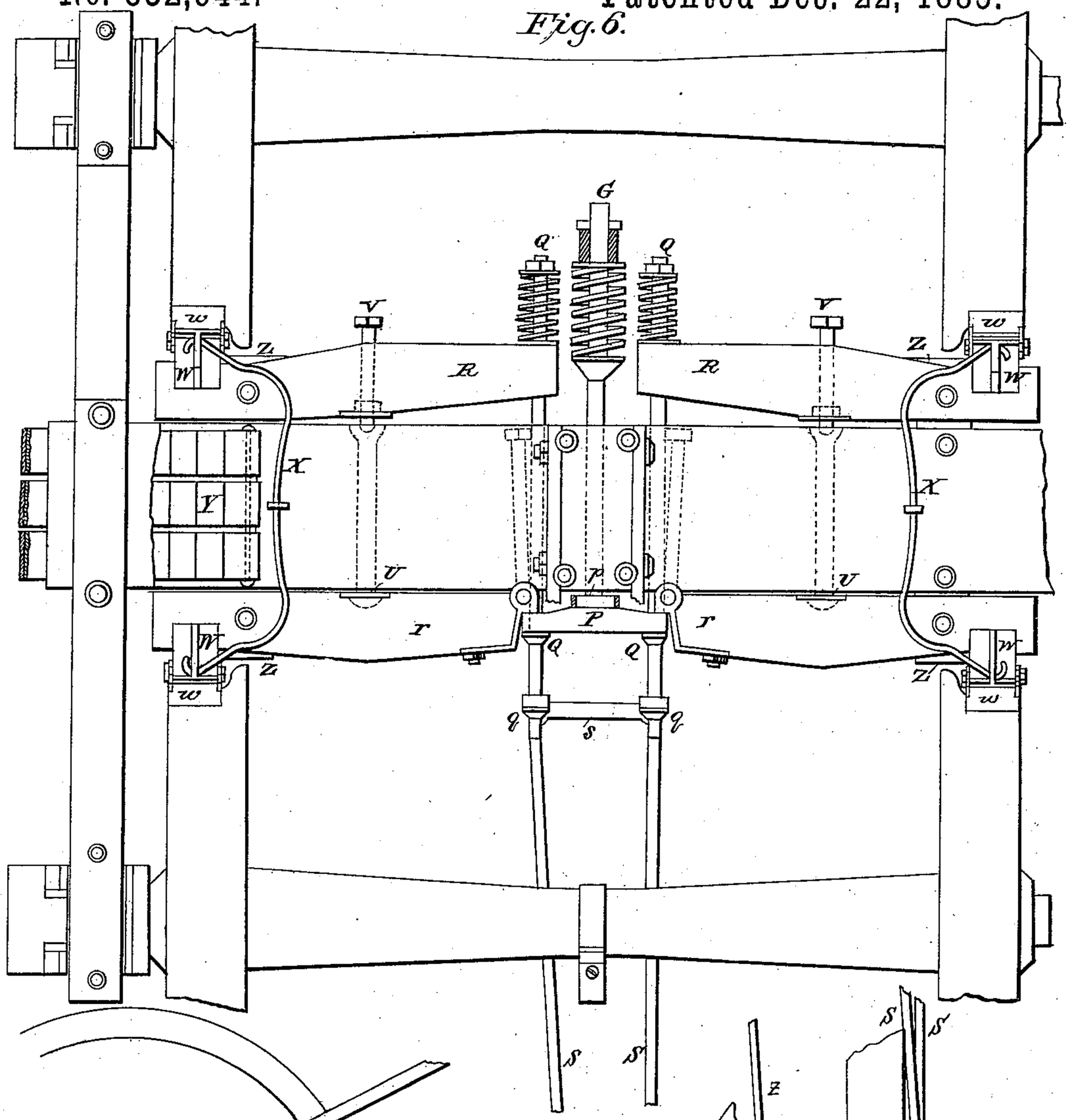


Fig. 7.

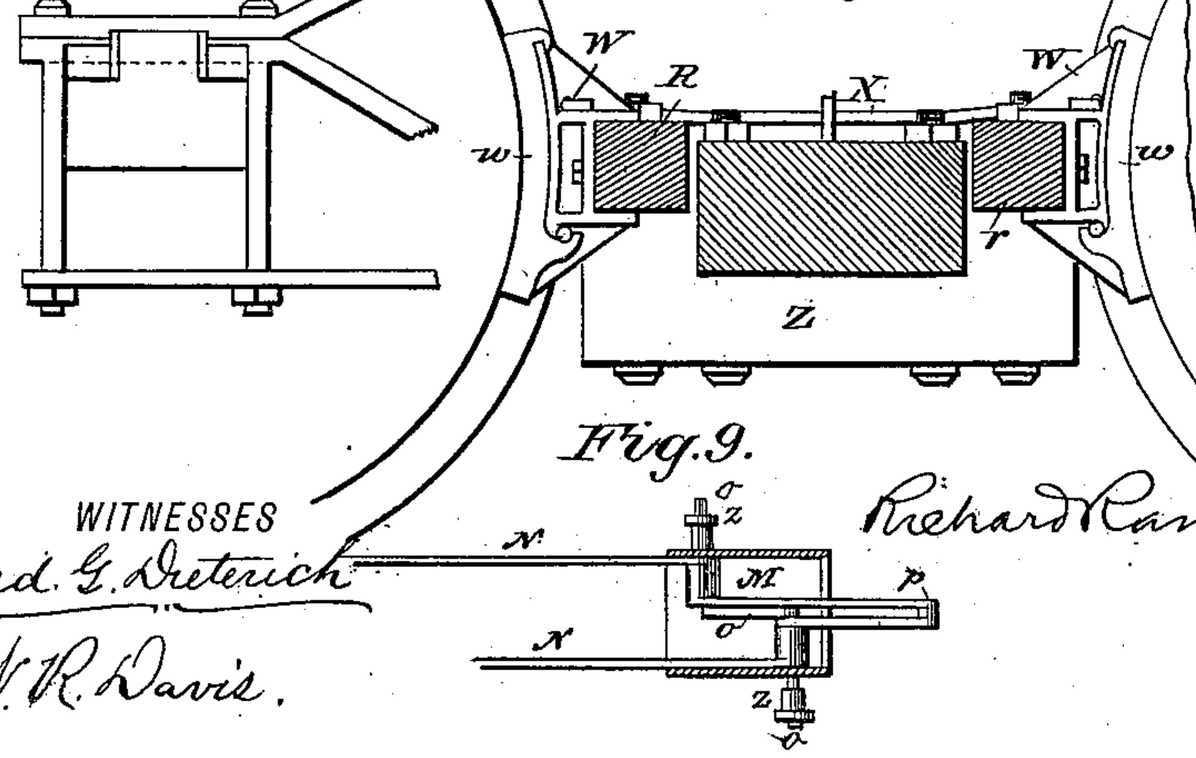


Fig. 8.

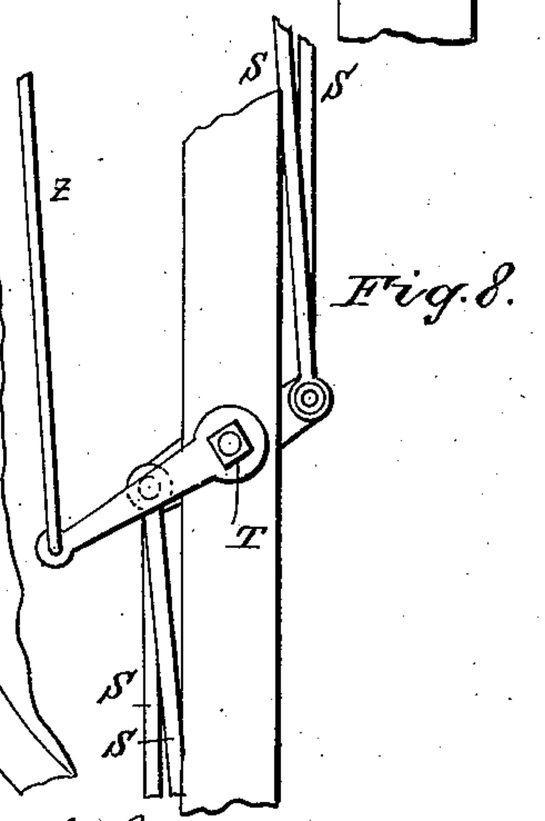


Fig. 9.

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## AUTOMATIC CAR BRAKE.

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Fig. 10.

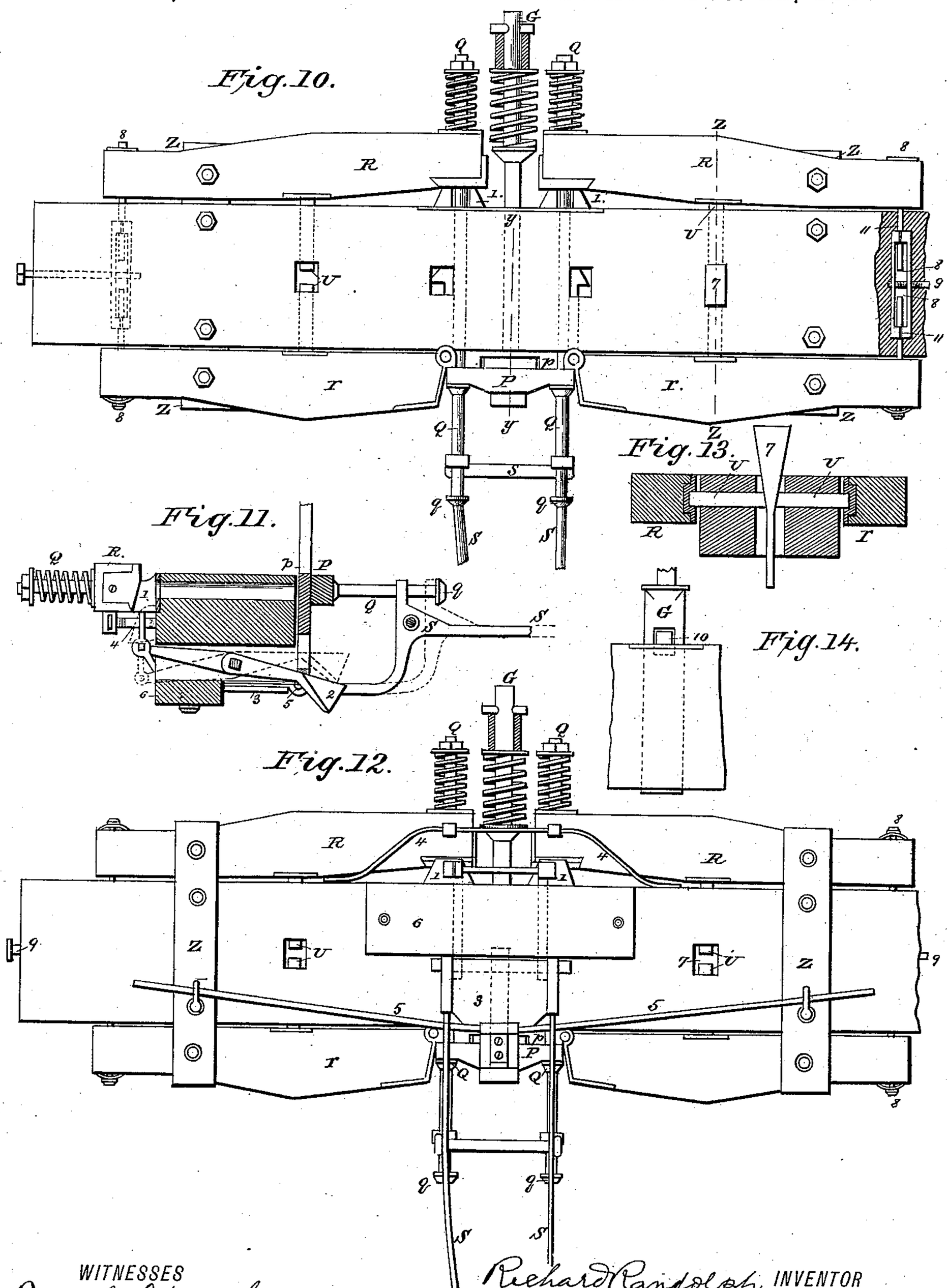


Fig. 13.




Fig. 11.




Fig. 14.




Fig. 12.




WITNESSES

Fred. G. Dieterich

W. R. Davis.

Richard Randolph INVENTOR

# UNITED STATES PATENT OFFICE.

RICHARD RANDOLPH, OF ROCKVILLE, MARYLAND.

## AUTOMATIC CAR-BRAKE.

SPECIFICATION forming part of Letters Patent No. 332,944, dated December 22, 1835.

Application filed February 10, 1885. Serial No. 155,489. (No model.)

*To all whom it may concern:*

Be it known that I, RICHARD RANDOLPH, a citizen of the United States, residing at Rockville, in the county of Montgomery and State of Maryland, have invented a new and useful Automatic Brake for Railroad-Cars, of which the following is a specification.

My invention relates to improvements in car-brakes that are operated by the pressure between the cars from the momentum of the train when a resistance is created at the head of the train by reversing the engine, or otherwise; and the objects of my improvements are, first, to limit the automatic action to the period between the attainment of the speed which renders it desirable and the first action of the brakes or backing of the train afterward; second, to allow the brakes to be operated by hand-power on each car at all times without reference to the automatic arrangement; third, to apply a uniform and determined pressure to all the wheels of the same car; fourth, to proportion the pressure of the brakes upon the wheels to that of the wheels upon the rails; fifth, to avoid the resistance of the buffer-spring; and, sixth, to reduce the lost motion of the brake-levers to a minimum by an automatic compensation for the wearing of the shoes. I attain these objects by the mechanism illustrated in the accompanying drawings, in which—

Figure 1 is a vertical longitudinal mid-section of one end of the car and of the truck at that end. The plane of section passes midway between the two central floor-timbers and the draft-timbers attached to the under sides of them. It intersects the end sill, the draw-head, the casting containing the spring of the buffer, the two axles of the car-truck, the sill upon which the floor-timbers rest, the bolster upon which this sill is pivoted, and which rests upon the car-springs, and the lower or truck sill which supports the springs. It also passes midway between the two parallel sides of the frame which supports the apparatus for determining the automatic action, and which are fastened to the upper side of the truck-sill. The plane intersects the block filling the space between the frame-pieces over the sill, to which they are fastened, and three other blocks filling the space between the sides of the frame at other points. It also passes through the center of the cross-head P, by which automatic action is communicated to the brakes, and the bar *s* which unites the rods S, by which the brakes are operated by hand. Fig. 2 is one of the sides of the frame of the automatic apparatus broken off near where it is fastened to the truck sill, to show the outside of the apparatus. Fig. 3 is a top view of the central part of the car through which the intersecting plane of Fig. 1 passes. Fig. 4 is a vertical transverse section of Fig. 3, and is viewed as looking toward the truck-sill. Fig. 5 is the end view of one of the levers of the automatic apparatus, to show the catch at the end of the lever upon which a weight is imposed to actuate the lever. Fig. 6 is a top view of the system of brake-levers working horizontally and attached to the truck-sill. Fig. 7 is a partial side view of Fig. 6. Fig. 8 is a top view of the vertical shaft placed at the center of the car to operate the brakes at both trucks by hand from one end of the car. Fig. 9 is a top view of the levers of the automatic apparatus and the sliding box to which they are attached by their fulcrums. Fig. 10 is a similar view to Fig. 6, but showing modifications and additions, in case it is found expedient to obviate the resistance of the buffer-spring. Fig. 11 is a section of Fig. 10. Fig. 12 is a bottom view of Fig. 10. Fig. 13 is a section of Fig. 10 on the line *z z*. Fig. 14 is a modification of the bar G, if the spring on that bar alone is made to act as buffer.

Referring to Fig. 1, on the under side of the draw-head A, at the back end, is formed a bracket, *a*, having a face and two supporting sides. Against the face of this bracket abuts the upper horizontal bar, B. This bar is pushed back by the draw-head, and operates the lever C. The two ends of the bar are wider than the rest, in order to fill the space between the two sides of the lever C and the space between the two wedges D. The face of the bracket *a* is perforated to admit the rod *b*, which is a continuation of the bar B. This is to support this end of the bar and to allow the draw-head to move forward with the draft. Attached to the under side of the bar, near the lever C, is a spring, *e*. (Shown in section.) This extends at right angles with the bar past

the draft-timbers on each side, where the ends are connected to the outer sides. This spring restores the bar and lever to their normal position in contact with the casting of the buffer E. The lever C is suspended from the highest practicable point of the car, immediately under the floor. It is formed of two parts with the space between them, which allows the back sleeve, F, of the buffer and the oblong washer *f* to play freely between. At the lower end the space between the sides of the lever is reduced to nearly the diameter of the lower bar, G, which plays between them. When in its normal position, the lever is in contact with a bolt behind it passing through the bar. The lower bar, G, is placed on the horizontal line connecting the centers of the truck-wheels, and passes through the lower truck-sill. At a certain distance from the sill a collar is formed upon the bar, behind which it passes through the coil of a spiral spring, which rests upon the collar and separates it from the lever C, so that when the bar is thrust forward against a resistance on the other side of the sill the pressure is graduated to the extent of the compression of the spring. Therefore the pressure is determined by the strength of the spring and the distance to which the lever moves toward the resistance. As the casting of the buffer E constitutes a dead-block, and the two solid wedges D are interposed between it and the back end of the draw-head, which on each side has a slope and thickness coinciding with that of the wedges, the movement of the lever C will depend upon the vertical position of these wedges, and which in turn depend upon the vertical deflection of the levers H, to the ends of which they are attached. These levers pass on the outer side of the wedges and support them on a rod, *d*, passing through slotted holes at the base of each, and connecting the two levers, which act as one. They are parallel until passing their fulcrums *h*, which are attached to pieces fastened to the inside of the draft-timbers. Near the center of the truck they unite, and connect by a rod to the lower truck-sill. As the fulcrums are attached to that part of the car which is above the car-springs, the levers must deflect vertically and the wedges descend when the car-springs are compressed by the loading of the car. Therefore the pressure exerted upon the brakes by the bar G will depend upon the amount of loading in the car, and as the traction upon the rails by the wheels is determined by the same cause it is important that the two should correspond. The object of this mechanism is to apply the force derived from the pressure between two draw-heads to the brakes only when the train has reached a velocity where the automatic operation is of an advantage and the force in question available, and to leave the operation by hand perfectly free and independent at all times, and the sole agent for such action after the first complete automatic action, and until the required velocity is again obtained. For this purpose the pendulum I is suspended from the frame of the automatic apparatus immediately over the center of the rear axle of the truck. It revolves upon a spindle, *i*, between collars formed upon it on each side of the pendulum, to retain it in position. The spindle passes through the sides of the frame at right angles and parallel to the wheel-axle. Outside of the frame each end of the spindle connects with a sleeve, J, Figs. 2 and 3. These sleeves slide upon the rods K, between their square heads at one end and a collar formed upon them at a certain distance from the head. Between the sleeve and the collar a spiral spring is coiled around the rod, forcing the sleeves carrying the spindle and pendulum to their normal position, should they be accidentally displaced in the direction where that is possible. These rods are horizontal and parallel with the frame, and are connected with it at the other end in such a manner that the rods may deflect upwardly, should the pendulum and spindle be accidentally forced above the normal position, to be restored to it by their own weight. The square openings in the sides of the frame admit of both of these movements. The heads of the rods K rest upon projections from the sides of the frame, or upon the screw *k*, which passes through them from below, in such a manner that the pendulum can be raised by turning the screw—an adjustment intended to compensate for the wearing of the brasses at the journals of the wheels, which would otherwise diminish the distance between the axle and pendulum. Immediately under the pendulum is a projection, L, from the axle of the wheel. This is formed of two pieces, connected each with the end of a circular band of thin steel, so that they may separate to admit the axle within the circle, the pieces coming nearly into contact on the line of the radius. A screw passing through both near the axle draws them together, thus producing a tension on the band around the axle, and causing the pieces to form a permanent projection from the axle coming in contact with the pendulum and causing it to oscillate. Resting upon one of the pieces connecting the two sides of the frame are two vertical plates, M, one nearly in contact with each side of the frame. They are connected for their entire length at the bottom, and partly so at the top and back end, thus forming a box, which slides longitudinally upon the piece upon which it rests. A projection from the top of the box is in contact with another block connecting the sides of the frame at the top and back end. Through this block a rod, *m*, passes, perforating the projection on the central line of the box, and extends a certain distance beyond, where it terminates with a head. Between this head and the projection a spiral spring is coiled around the rod, which allows the box to slide toward the pendulum, but restores it to its normal position when resistance is removed. The vertical plates forming the sides of the box are each perforated to allow the fulcrum-axle of the con-

tiguous lever to penetrate and be supported, so that the levers partake of the motion of the box. These levers N, Figs. 1 and 9, are united at the end next to the truck-sill by the pin which suspends the stop *p* between them at this point. The levers are of unequal length, one receiving the weight of the pendulum when the cars are moving in one direction and the other in the other direction. Their fulcrums are placed on the same horizontal plane, but at the distance apart requisite to bring their ends to the point where the same degree of oscillation in the two directions will impose the weight of the pendulum. The fulcrum-axles each pass through a spool or thimble forming a part of the lever, and their inner ends are connected at right angles, thus forming one piece, *o*, Fig. 9. Between the united ends of the levers and the thimbles they are separated only by the suspender of the stop *p* and that part of the bent axle connecting the two fulcrums; but from the thimbles to the other end of the levers they are contiguous to the sides of the frame, separated from it only by the plates supporting the fulcrums. That part passing through the plates is a sloping collar formed upon the axle, and the perforation, which is slotted vertically, is beveled to fit the collar in such a manner that when the tap *l* on the end of the axle is screwed down to the plate it will bind the axle without binding the lever. Thus the fulcrums may be adjusted to the desired position vertically. The end of each lever is provided with a catch, Fig. 5, the piece O formed with a trunnion on each side, which trunnions revolve in the eyes formed by a piece fastened to the outside of the lever, its upper part being slit into three. The middle is bent into the position which will prevent the catch from reaching the point of equilibrium, while the other two are curved around to form the eyes. When the catch is down in its normal position, it rests upon the upper edge of the lever-bar and projects at right angles from it. It is lifted by the pendulum, which rises above it and falls back to receive it on its return. Thus the weight of the pendulum is imposed upon the lever. The catch is of greater breadth on one lever than on the other, so that it will require the same horizontal movement of the pair of levers to free the pendulum from either catch. The elevation of the pendulum-axis above the wheel-axle is so adjusted that the velocity of oscillation imparted to the pendulum by the projection from the axle of the wheel is not sufficient to raise it to the point where it will catch upon the levers, unless the speed of the train is great enough to render automatic action desirable; but when that speed is attained the oscillation will be great enough to pass the catch, which will arrest the pendulum on the descent. Upon whichever catch the pendulum is thus caused to rest, the result is the same. The united ends of the levers rise, lifting the stop *p* suspended there, and closing the opening in the cross-head P, through which the bar G otherwise plays without resistance. With this opening closed the force of the bar is communicated to both the cross-head and the intervening stop, and both move with it. On each side the rods Q, operating the brake-levers R, pass through the truck-sill and through each end of the cross-head, where they resist the movement of the cross-head by the collars formed upon them, so that any movement of the cross-head by the advancing bar operates the brake-levers R. When the stop *p* is thus rigidly held between the cross-head and the bar, its movement forward is imparted to the pair of levers N through the point at which the stop is suspended, and the box M is made to advance, as the fulcrums are attached to its sides. In so doing it compresses the spring coiled around the rod *m*. When the bar G returns, the cross-head and stop are brought back by the springs upon the levers R; but as the pressure is removed from the stop the point where it connects the levers may not be completely restored, so to insure this the spring upon the rod *m* is provided. The end of the pendulum which rests upon the catch on the levers is wider than the rest, so that when the levers are pushed forward the pendulum will become disengaged, in the case of the shorter lever, as soon as the catch has passed the offset of the pendulum, and in the case of the longer one as soon as it has passed the end of it. The rods Q, by which the cross-head applies the brakes, extend beyond the collars, against which it presses for a certain distance, where they are terminated by heads *q*, or taps screwed on. For this distance the rods play freely during automatic action through the loops or eyes formed on the angular termination of the rods S, which have the form of knees at this end, in consequence of the axle of the wheel preventing a more direct connection. The two are here connected and braced together by the bar *s* between them. These rods S pass horizontally directly to and connect with one of the lower arms of a vertical shaft, T, Fig. 8, located at the center of the car. The other arm connects in the same manner with similar rods performing the same function at the other truck of the car. At the upper end of the shaft a single and longer arm connects with the rod *t*, which extends to one end and to one side of the car, to be there operated by hand, so that when the hand-power is applied to this rod the brakes at both trucks are operated. When the rods Q are drawn forward by the cross-head, they compress the spiral springs, through which they pass at the back of the levers R, Fig. 6. These springs will be entirely compressed when the pressure upon the brakes has reached that which is necessary for an empty car. Supposing the weight of the car, when loaded, to be three times that of the empty one, the spring upon the bar G is of such strength as to be one-third compressed when those on the levers are entirely so. So, when the greater spring is entirely compressed the pressure

upon the brakes is that necessary for the loaded car; but this compression cannot take place unless the draw-head is allowed to advance and deflect the lever C sufficiently—a motion which is regulated by the wedges D, interposed between the draw-head and the dead-block F. If the compression of the springs upon which the car rests is in proportion to the weight which they bear, the wedges will descend and the space allowed for the action of the lever increase in the same proportion. The normal position of the wedges is such that when the car is empty the lever C can move only far enough to fully compress the springs upon the levers R, and, incidentally, one-third of the spring on the bar G; but when the car is loaded the space is increased by the descent of the wedges sufficiently to enable the lever to entirely compress this spring. Thus the pressure upon the brakes is regulated to correspond with that between the wheels and the rail. Otherwise the capacity for arresting the train will be only partially employed, or else the wheels will be injured by their revolution being entirely stopped, which also diminishes the frictional resistance of the rails as the area of contact is increased by wear. When the pressure is applied to the levers R, it is transferred to the wheels through the fulcrums U. These fulcrums are the ends of bars passing through the truck-sill and play longitudinally. The other ends of these bars are the fulcrums of the levers *r* on the other side of the sill, where they are hinged to it, as near as practicable to the rods Q, which pass between the two eyes of the hinge, alongside of the bolt whose heads form the trunnions fitting in the eyes of the hinges. These serve also to fend the cross-head from the stop, so as to secure its vertical play between the cross-head and the sill. When the brakes are applied, the pressure on both ends of the lever R is sustained by the bar acting as its fulcrum. This bar being also the fulcrum of the lever *r*, the pressure is divided between the hinge and the wheel upon which this lever acts. As the fulcrums are at the same proportional distance between the points of pressure, that received by each of the wheels is the same. With the ordinary brake the pressure of one arm of the lever is applied to one wheel or pair of wheels, while that of the fulcrum, being that of both arms, is applied to the other wheel or pair of wheels; but this arrangement secures the same pressure upon all of the wheels. One end of the fulcrum-bar is rounded and fits in a socket formed on the bearing-plate of one of the levers. The other end is formed into a cup or socket in which fits the rounded end of a bolt, V, passing through the other lever. Where this bolt passes through the bearing-plate of this lever it screws through it, screw-threads being provided at that point. The other end is furnished with a head, to enable it to be turned by the hand or a wrench, so that when it is turned in the proper direction the distance between the lever R and lever *r* is increased at the fulcrums, and more so at the wheels. By this adjustment any wearing of the friction-irons on the shoe is compensated for, to avoid lost motion. On the under side of the truck-sill, and contiguous to the brake-shoe W, a piece of timber, Z, at right angles to the sill, is secured to it by two bolts. This extends from the sill on each side nearly to the flanges of the wheels. It is notched out to admit the sill sufficiently to bring the upper surface of the piece to the proper point for supporting the levers R and *r*. Through the middle of each lever and through the middle of the supporting-piece a bolt passes, to retain the levers when the friction of the wheels urges them upward. The holes through the timbers are reamed out in such a manner as to allow these bolts to deflect with the movement of the levers.

The brake-shoe W is a casting formed of a curved plate concentric with the wheel, having two plates extending back parallel with and equidistant from the plane of the axis of the wheel passing through the center of the arc formed by the curved plate. These are re-enforced by a rib in the middle of each, filling the angle on the outside. They are connected by a plate parallel with the chord of the arc at a short distance from the convex side of the curved plate. This receives the horizontal pressure of the lever when the brakes are applied, while the side plates receive that of the vertical tangential force of the wheels in revolution. A bolt passes through the center of the lever and through this plate, where it screws into a tap between it and the curved plate. At the upper angle a hole is made through the re-enforcing rib, for the purpose of connecting the shoe with the end of the curved spring X, fastened at the middle of the truck-sill on the upper side and behind the car-spring Y. The other end of this spring connects at the same point with the shoe on the other lever on the other side of the sill. The function of this spring is to withdraw the shoe from contact with the wheel after the brakes are released. The friction-iron *w*, or sole of the shoe, is a casting to be constantly renewed. It is a curved plate coinciding with the wheel, and somewhat wider than the shoe to which it is attached. The upper end is formed as a hook, which incloses the upper end of the shoe. On each side a hooked projection extends back and incloses the shoe between them, near the lower end. The inside of the hook is opposite to the angle of the lower re-enforcing rib, through which, at this point, a hole is made having a screw-thread. When the sole is inserted from above between the wheel and the shoe, the hooked portion at the upper end catches over the shoe when its proper position is reached. A bolt having a screw-thread on the middle then is passed under the lateral hooks and through the rib, screwing into it. Thus the two are fastened together at the least distance from the wheel.

So far the arrangement is made upon the supposition that there is sufficient power to be derived from the momentum of the train to both compress the spring of the buffer E and to operate the brakes; but in case it shall be found that the buffer-spring consumes too much of the available force of momentum, then the front sleeve of the buffer E will be removed, and the springs upon the bar G and the levers R will be made to act in the same capacity, to relieve the shock of collisions.

Heretofore the bar G was represented as passing through the opening in the cross-head P, when the automatic apparatus was not set, without affecting the brakes; but, now, as the cross-head is the medium of the action on the springs back of the levers R, the opening will be permanently closed and action on the brakes prevented by interposing blocks or wedges between the levers R and the truck-sill, to be removed only when the automatic apparatus is set. For this purpose a shaft is attached to the under side of the sill at right angles to the bar G, rocking in eye-pieces at each end, which are fastened between the sill and a piece of timber, 6, bolted to the sill. From the middle of this shaft one arm extends under the stop *p*, and on each side an arm extends in the opposite direction, carrying upon the end of each a block or wedge, 1, Figs. 11 and 12. The weight of these is partly balanced by the counterpoise 2 on the single arm at the middle. Normally the stop *p* is down, as before, but its weight is now imposed upon this middle arm, and which more than counterbalances the blocks on the other arms; but when the automatic apparatus is set it is lifted, and the counterpoise 2 not being sufficient to balance the two blocks they descend and allow the levers to act upon the brakes. I continue to call *p* the "stop;" but under this modification it no longer acts to obstruct an opening in the cross-head, but only to cause the vertical movement of the blocks, and to fill the space between the cross-head and the bar G. The cross-head now receives every pressure derived from the contact of the cars, transferring it to the springs upon the levers R, which now act as buffer-springs, in addition to their other duty. The two blocks 1 are rigidly connected by a rod passing loosely through eyes on the ends of the lever-arms which bear them. The center of gravity of the blocks is toward the sill; but to prevent them from being jarred back when they are below the levers R a projection below the eye will resist that movement by coming into contact with the piece 6. To insure the free vertical play of the blocks, the levers R are normally pushed back from the sill the required distance by the spring 4. In order to lower the blocks when the hand-power is applied, the terminations of the rods S extend downward from the point where they rest upon the rods Q, and, curving around, they continue horizontally on each side of the arm which bears the counterpoise 2 until the ends abut against the piece 6, where they are normally kept in contact with it by means of the spring 5, which is a flexible rod passing through eyes formed on these extensions of the rods S, and which is attached at each end to the supporting-pieces Z, Fig. 12. Between these eyes and the piece 6 the extensions of the rods S are connected by a thin plate which is bent around each and also around the spring-rod between, at which point the arm above the plate bearing the counterpoise 2 is bent downward, so that when the plate is drawn out the bent arm rises until its end rests upon it, at which elevation it is retained by the plate in its further movement. This ascent of the arm is just sufficient to lower the blocks on the other side enough to clear the levers R, and the end of the bent arm reaches this elevation just before the loops on the rods S, which slide on the rods Q, reach their heads *q*, so that the levers are not acted upon until the blocks are clear of them. When the brakes thus operated by hand-power are released, the spring 5 restores the parts attached to it to their normal position, when the bent arm supporting the weight of the stop *p* can descend, and thus again interpose the blocks. The loops on the rods S, when in their normal position, are at such a distance from the cross-head as to preclude any action upon them while the blocks are interposed. It may also be found desirable to obtain as much leverage as possible by placing the fulcrums closer to the wheels, which would require the distance between the wearing-surface of the shoe and the wheel to be reduced to a minimum, and maintained so during the wear. For this purpose an automatic adjustment of the fulcrums is provided. The fulcrum-bar U is now in two parts, which have a vertical wedge between their ends near the center of the truck-sill. In the constant jostling of the levers by the motion of the cars every movement toward the wheels will be followed up by the wedge descending of its own weight, while all movements in the contrary direction will be prevented by it. To prevent such jostlings from forcing the shoes into actual contact with the wheels, and at the same time to allow them to follow up the wearing of the shoe, the levers R and *r* are connected near their outer ends by extension-rods 8, Fig. 10, passing through the sill and through each lever, on the outer side of which each rod terminates with a head, between which and the lever is a small spring whose amplitude is the assigned distance between the wearing-surface and the wheel, and which is merely sufficient to avoid contact when the brakes are not applied. At the other end of these rods, which nearly meet at the center of the sill, they are connected and clamped by two pieces, 11, Fig. 10, one on each side, horizontally. These pieces clamp each rod at their ends, not being in contact with them between. The distance between the clamping-points is sufficient to afford a certain amount of elasticity in the pieces as they are drawn toward each other by a screw passing through both

at their center, so that the friction at the clamping-points will be a definite one. The screw 9, which thus determines the friction, extends slightly beyond the end of the sill, where it is provided with a head by which it may be turned. When by the wearing of the shoe the distance between its surface and the wheel is increased beyond the amplitude of the small spring under the head of the extension-rods, the friction of the clamping-pieces will be overcome by the next application of the brakes, and the rods connecting the levers permanently extended, while the wedge between the fulcrums will take up the slack caused by the extension by descending from its own weight.

In case it shall be found expedient to employ the spring upon the bar G alone as a buffer-spring, the blocks 1 and the arms of the rock-shaft which bear them will be dispensed with, and a single arm at the middle in the same direction bearing a wedge or block will be substituted. This block 10, Fig. 14, will be inserted in an opening through the modified bar G, Fig. 14, and removed by the same means, as in the case of the movement of the two blocks, which will render unnecessary the extensions of the rods S and the springs 5 and 4.

The features of this invention which I claim to be new and useful, and for which I apply for Letters Patent, are—

1. The combination of the bracket formed on the under side of the draw-head, the bar B, the lever C, abutting against the bracket, and the rod *b*, playing through a perforation in the face of the bracket, for the purpose of actuating the lever C from the lowest point of the draw-head, to avoid interference with the draw-bar and buffer, and to allow of the forward movement of the draw-head independent of that of the lever C.

2. The combination of the horizontal bar G, the springs interposed between the lever C which operates the bar and a collar formed upon it, the cross-head P, the plate *p*, suspended from the levers N and playing vertically between the bar and the cross-head, the rods Q, connecting the cross-head with the levers R, and the springs between these levers and the heads of the rods at this end, for the purpose of operating the levers by the lever C with a determined and graduated pressure, as described, and at the same time to move the levers N forward, so as to disengage them from the pendulum upon each complete action of the brakes.

3. The combination of the sloping projections on the sides of the draw-head A, the wedges D, having a corresponding slope and thickness and playing vertically between these projections and the buffer or dead-block behind the draw-head, and the levers H, supporting these wedges at their bases, having their fulcrums attached to the body of the car above the car-springs and their ends opposite to the wedges attached to the truck-sill below the car-springs, for the purpose of graduating the backward movement of the draw-head to the weight of the car with its load.

4. The combination of the projection L, the pendulum I, the levers N, the catches O, the plate *p*, suspended from the levers, and the frame attached to the truck-sill supporting the apparatus, the whole being adjusted and fulcrumed, as described, for the purpose of determining the automatic action of the brakes by the velocity of the car.

5. The rods K, deflecting vertically and having the sleeves J, to which the pendulum is attached, sliding upon them against spiral springs coiled around the rod, to allow accidental movements of the pendulum, both vertical and horizontal, to be made without injury, and to restore it to its normal position.

6. The combination of the sliding box M, carrying the bent fulcrum-piece *o*, the spring upon the rod *m*, the offsets upon the pendulum, and the catches on the levers, all so arranged that the pendulum will be disengaged from the levers by their forward movement with the cross-head, and the levers be restored to their normal position afterward.

7. The adjusting-screw *k* and the beveled shoulders and taps on the fulcrum-piece *o*, for adjusting the pendulum and levers vertically.

8. The combination of the pair of levers R on one side of the truck-sill, the pair of levers *r*, hinged at their inner ends to the opposite side of the same sill, and the movable fulcrums between the opposite levers, R and *r*, for the purpose of applying an equal pressure to all the wheels of the same truck by a force applied at the center of the system.

9. The wedge 7, in combination with the fulcrum-bar U, divided into two parts, and having the wedge inserted between them near the middle of the truck-sill, for the purpose of increasing the distance between the fulcrums automatically, as described.

10. The combination of the extension-rods 8, the springs between their heads and the levers through which they pass, the clamps 11, and the screw 9, connecting them, for the purpose of allowing the wearing-surface of the shoe to approach the wheel to within a certain constant distance when the brakes are not applied, the slack thus created to be taken up by the wedge 7 at fulcrum, as described.

11. The combination of the wedges or blocks 1, inserted between the levers R and the truck-sill, the rock-shaft under the sill having arms supporting the two blocks, and an arm at the middle of the shaft in the opposite direction bearing the counterpoise 2, and the plate suspended from the automatic apparatus whose weight is imposed upon this arm, as described, for the purpose of preventing the levers R from acting when the plate is down, and of leaving them free to act when the plate is up.

12. The combination of the wedges or blocks inserted between the levers R and the truck-sill, the rock-shaft under the sill with arms

bearing the blocks on one side and a counterpoise on the other, and the stop *p*, actuating the rock-shaft, as described, for the purpose of determining the automatic action of the levers by the vertical position of the stop, as described.

13. The combination of the extensions of the rods S under the sill, connected by the plate 3, the bent end of the arm of the rock-shaft bearing the counterpoise 2, and the spring 5, attached to the extensions of rods S, maintaining their ends in contact with the piece 6, for the purpose of freeing the levers R from the blocks before the hand-power is applied, and to restore the parts to their normal position afterward.

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Witnesses:

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