(No Model.) 2 Sheets—Sheet 1.

R. M. CURTISS.

ELECTRIC SAFETY DEVICE FOR ELEVATORS.

No. 266,107. Patented Oct. 17, 1882.

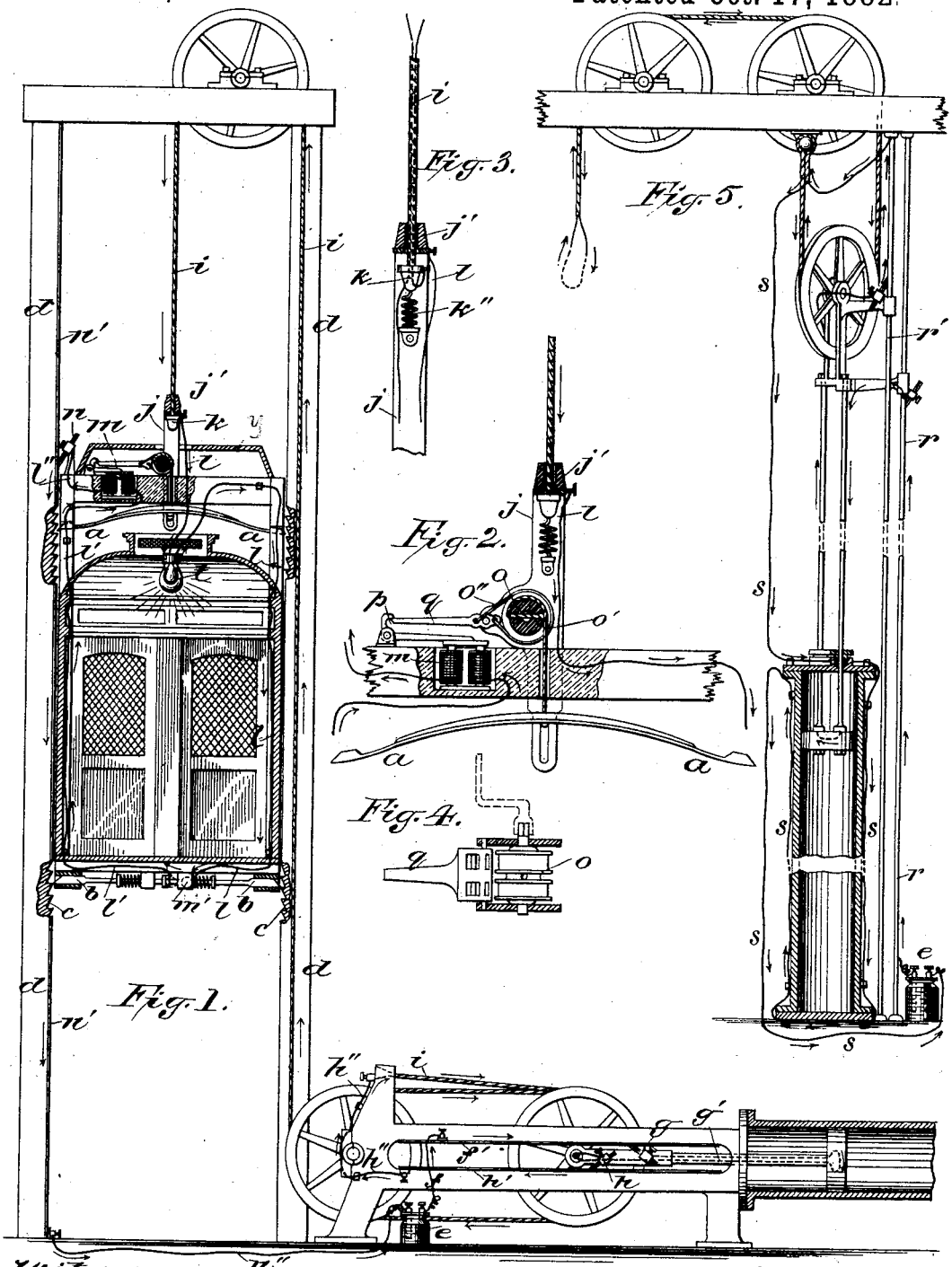

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Fig. 6.

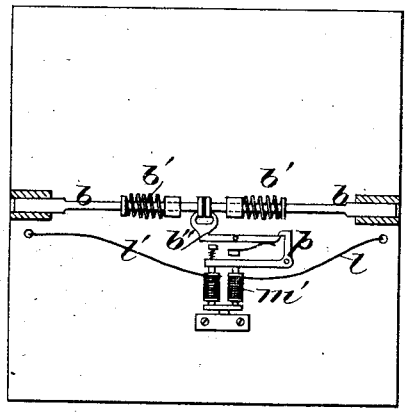


Fig. 7.

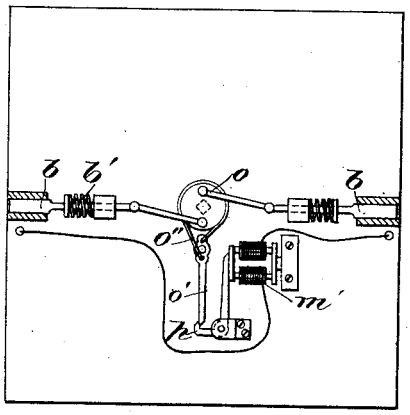
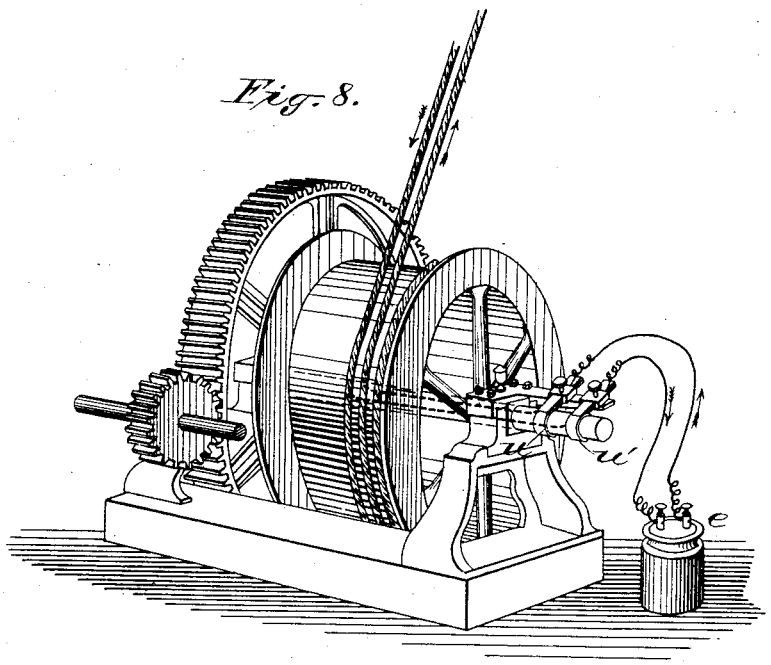


Fig. 8.



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ELECTRIC SAFETY DEVICE FOR ELEVATORS.

SPECIFICATION forming part of Letters Patent No. 266,107, dated October 17, 1882.

Application filed July 3, 1882. (No model.)

To all whom it may concern:

Be it known that I, ROBERT M. CURTISS, of Brooklyn, Kings county, New York, have invented certain new and useful Improvements in Safety Devices for Elevators or Hoists, of which the following is a specification.

My invention relates to safety appliances connected with the movable car or cage of elevators and with the hoisting machinery operating it, whereby the safety-catches of the car will be released against the guides to uphold the car in case the hoisting-cable or any part of the hoisting machinery should become strained or broken, or in case the cable should become slacked by the jamming of the car during the descending movement, even though no break or injury may have occurred in the machinery.

In a former patent issued to me June 3, 1879, No. 216,024, I employed an electric circuit passing through the cable and including an electro-magnetic detent in the car, which controlled the safety-catches, so arranged that on the breaking or straining of the cable the electric circuit would become broken, the magnetic detent relaxed, and the catches thereby instantly released to uphold the car. My present invention embodies this system, and is an improvement on my former patent. In my present improvement I extend a frangible electric conductor through the parts of the hoisting engine or machinery which are subjected to the working strain, and this conductor may also be continued through the hoisting-cable to the magnetic detent which controls the safety-catches, the conductor being of course arranged in a normally-closed circuit constantly energized by a battery or other electric source, so that if any part of the hoisting apparatus becomes strained or broken—such as the cable or the piston, cylinder, shafts, sheaves, or bearings of the hoisting engine—the frangible conductor which traverses these parts will become simultaneously broken, thus instantly opening the electric circuit, and thereby instantly relaxing the magnetic detent, and thus releasing the safety-catches to sustain the car before any damage can result to the car or its occupants by the breakage of any part of the hoisting apparatus. Furthermore, in my present improvement the end of the cable from which the car is suspended passes loosely through a socket in the hanger on top of the car, and a collar or shoulder fixed to the end of the cable seats against the under side of the socket, and thus suspends the car, and the electrical circuit is so arranged as to pass through the contact-faces of said collar and socket, so that in case the cable should ever become slacked during the descending movement by the jamming of the car in the guides these contact-faces will become relaxed or separated, thereby breaking the electric circuit and releasing the catches so as to safely sustain the car, and thus prevent the possibility of its becoming released and plunging down the shaft during the slack in the cable, as has frequently occurred heretofore with great damage.

My invention therefore consists mainly in the features here outlined, and also embodies several minor features in the special construction and arrangement of parts, as hereinafter fully set forth.

In the drawings, Figure 1 presents a sectional elevation of an ordinary elevating apparatus, including the car, hoisting-engine, &c., provided with my safety appliances. In this figure the hoisting-engine is presumed to be of the hydraulic kind, arranged horizontally at the base of the shaft, the piston of the engine being arranged to operate a series of movable sheaves of a compound pulley, over which the cable passes in loops and extends to the car in the well-known manner, which it is unnecessary to describe in detail. Any other kind of hoisting-engine, however, may of course be employed. Fig. 2 is an enlarged detail view of the top of the car to which the cable connects, and which is provided with the suspensory electric contacts, which separate on the slacking of the cable, and which also carries the safety catches or pawls to engage with the guides, and the electro-magnetic detent which holds them out of engagement while the circuit is closed and releases them when the circuit is broken. Fig. 3 is a detail of the suspensory contacts by which the cable connects with the car, showing the contacts separated, as occurs when the cable slacks. Fig. 4 is a detail of the safety-catches in plan view. Fig. 5 presents a sectional elevation of a vertical

form of hoisting-engine, showing my safety electric circuit applied thereto in a somewhat different manner from Fig. 1, the car being omitted in this view. Fig. 6 is a plan view of the under side of the car in Fig. 1, showing the arrangement of safety-catches and electro-magnetic detent thereon. Fig. 7 is a similar view with the mechanism slightly modified. Fig. 8 is a perspective view of an ordinary hoisting-drum of a winding-engine, showing my safety electric circuit applied to the shaft and cables thereof.

Referring to Figs. 1, 2, and 6, I have shown the car as provided with safety-catches *a a b b*, of ordinary form, respectively at the top and bottom, which, when released, will engage with the usual ratchets, *c*, on the guides *d* to sustain the car; but of course either the top or bottom set of catches may be used alone, if preferred.

In Fig. 1, *e* indicates a battery or other suitable source of electricity, one pole of which connects by the wire *f* to a conducting-strip, *f'*, which extends along the cross-head guides of the hoisting-engine, and is insulated therefrom. A brush, *g*, which is carried by the cross-head or piston-rod of the engine, bears on this conductor, and from this brush an insulated wire, *g'*, extends through the piston-rod into the piston-head, being laid in a suitable bore or groove therein, and returning similarly through the rod, as shown by the dotted line, connects to a second brush, *h*, which is carried by the cross-head and bears upon a second insulated conductor-strip, *h'*, parallel with the other one. From the conductor-strip *h'* a wire, *h''*, extends and passes around the journal-box of the fixed sheaves of the engine, and thence connects to the fixed end of the hoisting-cable *i*. The circuit thence continues through the hoisting-cable, either directly through the mass of the cable or through an insulated wire embodied therein, and the current thus flows toward the top of the car, as indicated by the arrows. Now, the suspending or car end of the cable passes loosely through a socket, *j'*, in the suspending loop or bail *j*, which rises from the top of the car, and the extremity of the cable is fixed in the holder or collar *k*, which seats against the under side of the socket of the bail *j*, so that the car is thus suspended by the contact of the collar *k* with the base of the socket *j'*. Now, these suspensory contacting faces are arranged in the electric circuit, for, as shown in Figs. 1 and 2, the current, in passing from the collar on the end of the cable, passes through the contacting face on the base of the socket, and a continuing circuit-wire, *l*, extends from this face, and, descending to the bottom of the car, as seen in Fig. 1, connects with the end of the coils of an electro-magnet, *m'*, on the bottom of the car, as seen best in Fig. 6. From the opposite end of these magnet-coils the circuit is continued by a wire, *l'*, up through the opposite side of the car, as seen in Fig. 1, and connects with one end of a second electro-magnet, *m*, arranged on the top of the car, (shown also in Fig. 2,) and from the opposite end of this magnet a wire, *l''*, leads to a brush, *n*, on the top of the car, which brush bears on a conducting-strip, *n'*, which extends up along the guides *d*, and by which the current returns to the opposite pole of the battery by the wire *n''*, which is connected to the base of the strip *n'*, thereby completing the circuit.

Now the upper safety-catch or pawl-spring, *a*, is flexed and held out of engagement, as shown best in Fig. 2, by the winding of a cord, *o'*, around the middle of a small winding or setting drum, *o*, Figs. 2 and 4, which drum is held stationary by the grasp of double brake-bands *o''*, which are tightened by the depression of the lever *q*. When the lever *q* is thus depressed it is there held by a detent-hook on an elbow-lever, *p*, which forms the armature, or is connected with the armature, of the magnet *m* in a manner similar to what is shown in my former patent. It will hence be seen that while the magnet is energized by a closed circuit its attraction will hold the parts in the set position shown, thereby holding the safety-catches out of engagement; but if the circuit becomes broken the magnet will become inactive, and thus release the parts and allow the catches to spring into engagement. In a similar manner the catches or bolts *b b* on the under side of the car (see Fig. 6) are held out of engagement against the stress of springs *b' b'* by the grasp of a forked lever, *b''*, which embraces collars on the meeting ends of the bolts, and this forked lever is held in its engaging position by the armature-detent *p*, which is retained by the attraction of the magnet *m'*, when in a closed circuit, in the same manner as that just described, so that on the breaking of the circuit the bolts *b b* will be released to engage with the guides, as will be readily understood.

It will therefore be seen that by my invention the entire elevating apparatus is, so to speak, enveloped in an electric safety web or circuit, which traverses all parts or most of the parts which are subjected to the working strain and wear, so that in the event of any of these parts breaking—for instance, if the piston-head should become separated from the rod or the rod severed, the cross-head detached or broken, the shaft or journal-boxes of the sheaves severed, or the frame-work of the engine fractured, or the cable rent—this electric circuit will become simultaneously broken and the safety-catches instantaneously released, and the car thus held safely in the guides, before any damage could result to the occupants by such break or injury. This invention hence presents a notable safety device, for it has often happened that while the cable has remained uninjured some part of the hoisting-engine has broken, and thus allowed the car to fall, while its cable and safety-catches remained unimpaired, for the common safety-catches act only by a great relaxation or breaking of the cable, and where there is sufficient

strain on the cable to keep the safety-catches out, yet not sufficient to stop or retard the car, as would be the case with a break in the engine, the safety-catch will not act and the car will fall disastrously, as has occurred on several occasions. This, however, is completely prevented by my improvement, for by its means a break in any working part of the hoisting-engine, as well as in the cable, will release the clutches and sustain the car with electrical quickness and certainty.

It will be noted on reference to Fig. 1 that the circuit also passes up through each side of the car from the bottom, and that the circuit controls safety-catches both on the top and bottom of the car. Hence, if the car should break apart in any manner, as not uncommonly happens, say if the top part should become torn away from the bottom, or vice versa, the circuit-wires will in either case become broken and the safety-catches on the bottom of the car instantly released, thus safely sustaining the floor of the car and the passengers which may be in the car. Now, on the other hand, although no part of the hoisting apparatus should break, assume that during the descending movement the car should become jammed in the guides from any cause, the cable would then of course continue to be paid out by the return-stroke of the engine, and thus form an extensive slack, and if the car should during this slack become again loosened in the guides it would suddenly plunge downward or fall, and thus be likely to do great damage. It will be seen, however, that my invention completely provides against the chance of this accident, for if any slack forms in the cable during the descent of the car the collar *k* on the end of the cable (see Figs. 2 and 3) will separate or recede from the under side of the socket *j'*, and thus break the electric circuit, and thereby release the catches and prevent the car from falling, thus providing against accidents under almost all circumstances.

In Fig. 2 the suspensory contacts are shown in contact, but are represented as separated in Fig. 3 by the formation of slack in the cable. In order to insure the certain separation of these contacts on the formation of slack, a strong spring, *k''*, fixed at one end to the cable and at the other end to the suspending-bail *j*, tends constantly to pull the collared end of the cable away from the socket *j*, which it will do as soon as the cable becomes relieved of the weight of the car. The weight of the slack cable would of course of itself tend to separate the contacts; but the spring *k''* assists this action and renders it more certain, as will be understood.

It may be noted that, if desired, the downward motion of the collar on the end of the cable when the cable becomes slacked might be arranged to close an electric circuit normally open, which when so closed would energize an electro-magnet to release the safety-catches, this being simply a reverse modification of that shown; but I prefer the close-circuit arrangement set forth.

In Fig. 1 the cable may, if desired, be omitted from the electric circuit and the circuit completed through the conductor-strips on the guides; or, again, the conductor-strips on the guides may be dispensed with, and the circuit may then be advanced and returned through the cable by advancing and returning wires insulated from each other, as shown in my former patent, and also illustrated in Figs. 3 and 5 of the present drawings. In Fig. 5 the current flows from one pole of the battery to a conducting-rod, *r*, on which slides an arm which projects from the cross-head, through which arm the current passes and descends through one piston-rod, thence crosses through or above the piston-head, rises through the second piston-rod, thence passes through the shaft of the movable sheave to a second brush carried by a second arm on the cross-head, and bearing on a second conducting-rod, *r'*, and from this rod the current flows through an insulated wire in the cable, passes through the magnet *m* or *m'*, or both, and returns through another wire in the cable, as indicated by arrows, which return wire, as indicated by *s* in Fig. 5, is extended from the fixed end of the cable, passes across the upper head of the engine-cylinder, down along one side of the cylinder, across the bottom head, up the opposite side of the cylinder, and thence connects to the opposite pole of the battery, thus completing the circuit. The circuit-wires should of course be covered or insulated throughout their course, and insulation should be introduced wherever necessary to insure the passage of the current, as described and indicated. The circuit is preferably continued through the piston-rods by means of insulated wires laid in grooves cut therein and covered up flush with the cylindrical surface of the rods. The circuit wires or conductors which traverse the parts of the car and hoisting machinery which are liable to become broken or fractured by the working strain should be stretched upon and fastened along the parts of the car or machinery along the course of the circuit, and while sufficiently large to convey the necessary current these wires should be sufficiently fragile so as to become easily broken by any stretch, strain, or fracture in the parts of the car or machine on which they are fastened. By this means I insure the breaking of the circuit and the releasing of the safety-catches, as described, when any dangerous stretch, strain, or fracture occurs in the car or machinery, although no actual break may have yet occurred, thus forming a most vigilant and valuable guard for the prevention of damage to the car or its contents.

In Fig. 1 I have represented an incandescent electric lamp, *t*, in the safety-circuit to light the car, and this may be extinguished and thrown out of circuit, when desired, by a switch, which will thus cut the lamp out of ac-

tion without breaking the safety-circuit. The lamp, however, is preferably placed in a separate circuit, which can be advantageously completed by brushes carried by the car bearing on conducting-strips on the guides, similar to what is shown at *n n'* in Fig. 1.

Fig. 7 shows a slight modification of the mechanism of Fig. 6 on the under side of the car. In this case the safety-bolts *b b* connect by clamps to crank-pins on a brake-disk, *o*, on which a brake-band is tightened by a lever, *q*, and held by the armature-detent, same as in Fig. 2.

Fig. 8 shows one way of applying my electric safety-circuit to an elevator which operates the car from a winding-drum. In this case two parallel cables are supposed to be used. The two poles of the battery connect with two brushes, which bear upon insulated conducting-rings *u u'* on the projecting end of the drum-shaft. Insulated wires extend through the shaft from the respective rings, and connect respectively with the fixed ends of the two cables, the circuit passing thence through a wire in one cable, through the detent-magnets on the car, as before described, and thence returning through the wire in the other cable, as indicated by the arrows.

I do not of course confine myself to the precise mechanical constructions shown in which my invention is embodied, as the mechanical form of the parts might be varied considerably without departing from the principle. I would also remark that I prefer to have the magnets which control the detents and safety-catches arranged upon the car, as shown; yet the magnets might be arranged apart from the car, but operatively connected with the catches on the car, if desired.

It will be seen that the conductor-strips *f' h'* and brushes *g h* in Fig. 1 form an extensible or movable conductor between the portion of the circuit in the movable part of the machine and the fixed parts. Any other form of extensible conductor might of course be used between these parts—for instance, a spiral spring or a toggle-loop of wire whose slack would be taken up at the middle by a pulley-weight.

Instead of the conductors being in the form of continuous or solid wires traversing the parts of the car or motor, which are liable to become broken, the conductor may be in the form of sectional strips, bearing on each other and adapted to become separated, so as to break the circuit when the parts traversed become broken; but a continuous fragile conductor is preferable.

A close hood or cover, *y*, is placed over the detent mechanism at the top of the car to protect it from dust or injury. The mechanism at the bottom of the car may be similarly covered.

What I claim is—

1. The combination, with a hoisting or elevating apparatus, of a frangible or separable electric conductor traversing portions of the hoisting machine or motor which are subjected to the working strain or wear, and arranged in a closed electric circuit including an electro-magnetic detent which controls safety-catches arranged to uphold the car, whereby the breaking of the parts of the motor so traversed will break the electric circuit, and thereby relax the magnetic detent and release the safety-catches to uphold the car, substantially as herein set forth.

2. In an elevating apparatus, the combination, with an engine constructed with a working-cylinder and a piston operatively connected with the car through the intervention of a pulley and cable, or their equivalent, of a frangible or separable electrical conductor traversing the piston-rod or other working parts of the engine, a closed electric circuit in which said conductor is included, an electro-magnet forming part of said circuit and arranged to control safety-catches to uphold the car, so arranged that on the breaking of the electric circuit the said magnet acts to release the catches to sustain the car, substantially as herein shown and described.

3. In a hoisting apparatus, the combination, with the car and the hoisting-cable or equivalent from which the car is suspended, and with safety-catches to uphold the car, of an electric circuit passing through the contacts by which the car is suspended from the cable, and an electro-magnet in said circuit arranged to control the safety-catches, whereby the slacking of the cable will separate said contacts, break the circuit, and release the safety-catches, substantially as herein set forth.

4. In an elevator, the combination, with the car and the hoisting-cable from which the same is suspended, and with safety-catches arranged to uphold the car when released, of an electric circuit and a magnet in said circuit controlling the safety-catches, with the end of the cable arranged loosely in the suspending-socket on the car and capable of play therein when slacked, and so connected with said electric circuit that the relaxation or movement of the cable end in the suspending-socket will make or break said circuit, and thereby operate said magnet so as to release the catches and sustain the car, substantially as herein set forth.

5. The combination, with an elevator car or platform provided with safety-catches arranged to uphold the car when released, of a frangible or separable electric conductor traversing the car or portions of the car, and arranged in a closed electric circuit, with an electro-magnet in said circuit arranged to control said safety-catches, whereby the breaking or straining of the car will break the electric circuit and release the safety-catches, and thereby hold or sustain the broken car, substantially as herein set forth.

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