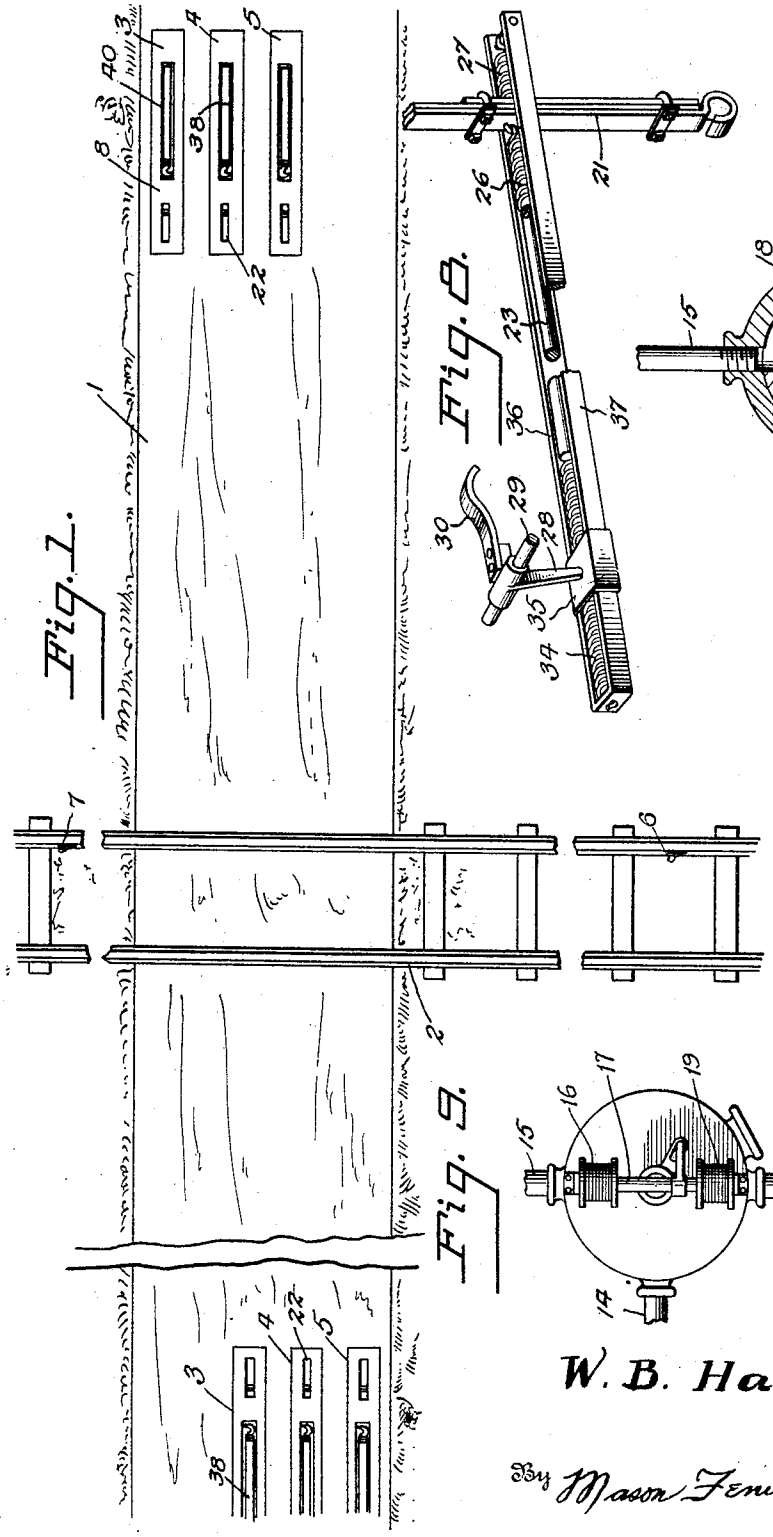
Feb. 14, 1933. W. B. HASTINGS 1,897,123

SAFETY APPARATUS FOR HIGHWAYS

Filed March 2, 1932 3 Sheets-Sheet 1



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SAFETY APPARATUS FOR HIGHWAYS

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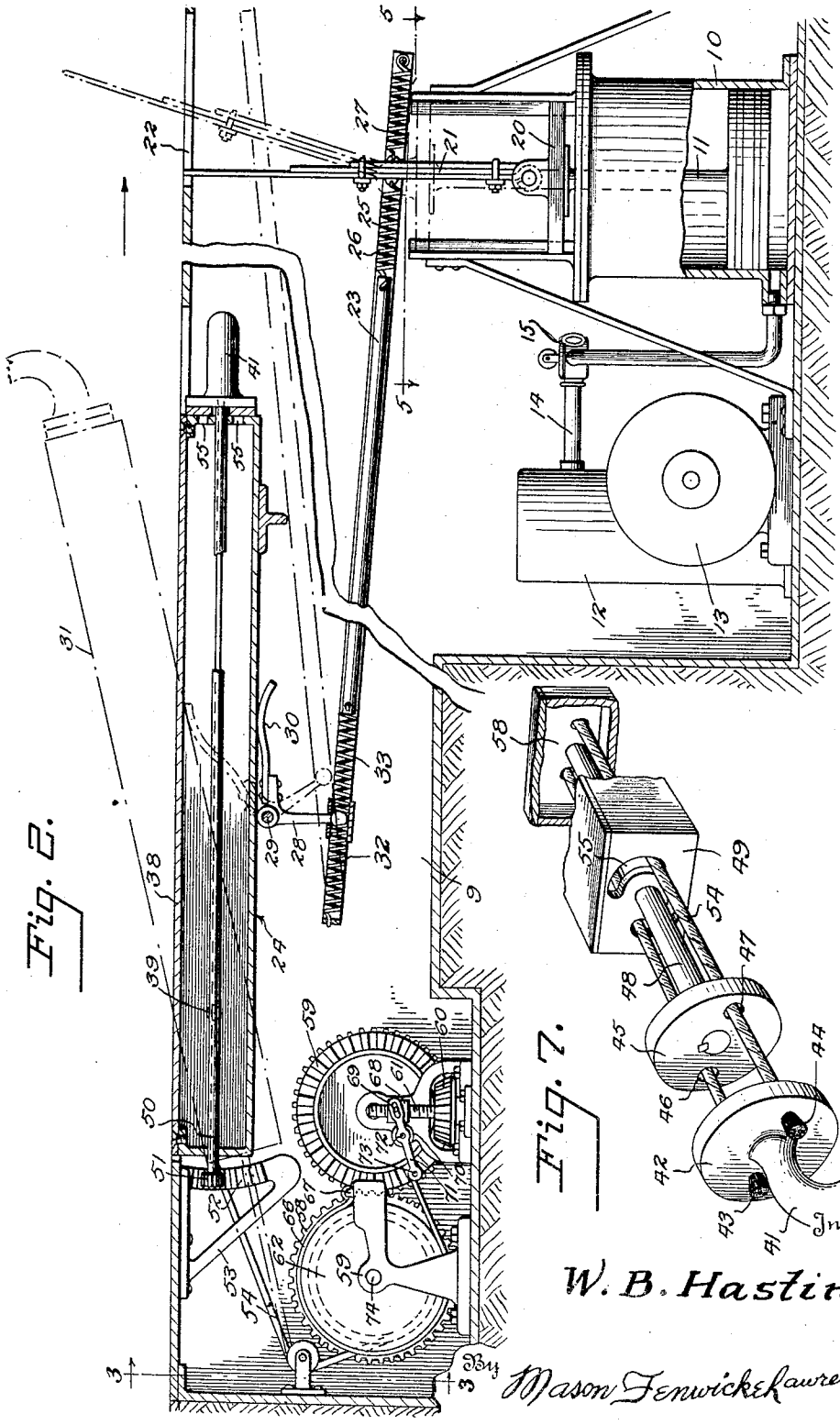

Fig. 2.

Fig. 7.

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SAFETY APPARATUS FOR HIGHWAYS

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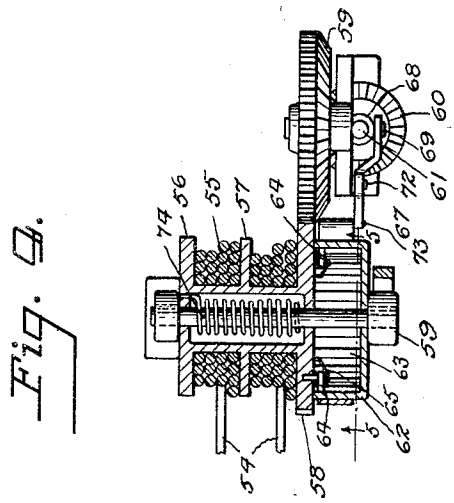

Fig. 4.

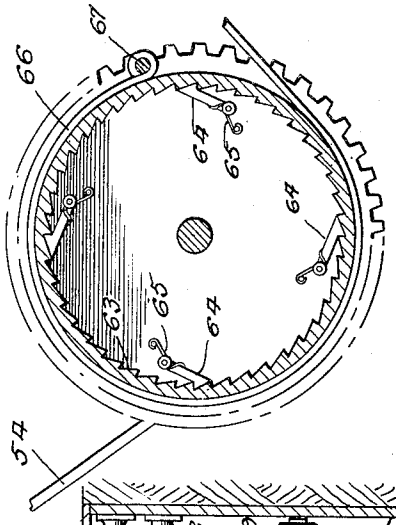

Fig. 5.

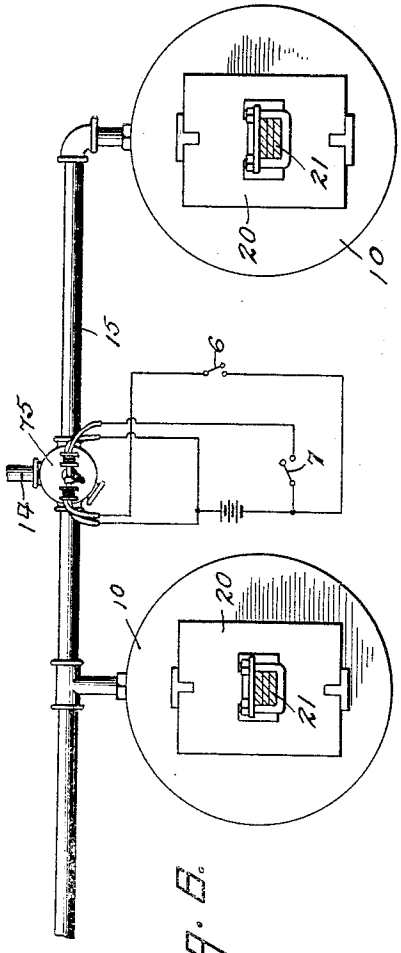

Fig. 6.

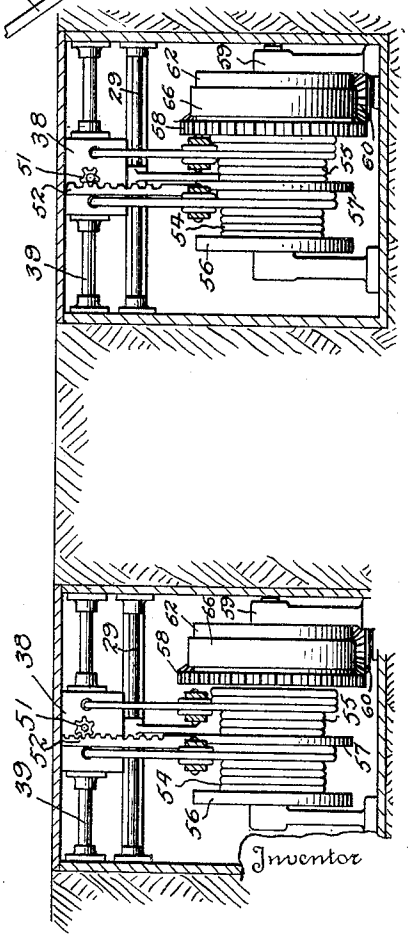

Fig. 3.

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UNITED STATES PATENT OFFICE

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SAFETY APPARATUS FOR HIGHWAYS

Application filed March 2, 1932. Serial No. 596,358.

This invention relates to safety apparatus for highways and has for its object the provision of means adapted to be set by an object which is a factor of a created danger, and actuated by an autovehicle upon its approach toward the point of danger, so as to catch and positively hold the autovehicle, bringing it to a standstill before the danger point is reached. For example, not infrequently, automobiles have been driven through open draw bridges or on to railway tracks at crossings when a train is approaching.

By the present invention, the opening of the draw or the approach of the train to a predetermined point sets the vehicle catching and holding means in position to respond to the approach of the autovehicle, and the engagement of an element of said catching and holding means by the moving vehicle causes it to act by rising into the path of the rear axle or other appropiate part of the vehicle catching hold of the same and gradually bringing the autovehicle to a standstill.

In the case of a railroad and highway intersection, the safety apparatus would be set by a train while yet at a safe distance from the highway, and be unset by the train after it has passed the highway.

One of the objects of the invention is the provision of an automobile catching and holding means of the character described which shall normally lie at or below the level of the highway when unset so as to present no impediment to traffic, but having means rising into the path of the automobile, when the apparatus is set, and adapted to be struck by the autovehicle, and when struck, activating a hooked device which rises into the path of the rear axle and becomes attached to the same, yielding retardatively to the inertia of the vehicle and bringing it gradually to a standstill before it reaches the danger point.

Another object of the invention is to provide apparatus of the class described in which the hooked element which engages the axle normally lies flat flush with the street surface, but in rising to axial engaging position it synchronously rotates through an angle of 90° so as to present the hook perpendicular with respect to the length of the axle.

A further object of the invention is to provide automobile catching and holding means which shall yield with the initial impact of the automobile so as to avoid damage to the latter as well as to itself, but which after the initial engagement shall quickly and progressively impose an increasing resistance to the momentum of the moving vehicle.

Other objects of the invention will appear as the following description of an exemplary embodiment thereof proceeds.

In the drawings which accompany and form a part of the following specification:

Figure 1 is a plan view of a portion of highway and an intersecting railroad track, illustrating a situation in which the invention may be employed;

Figure 2 is a vertical longitudinal section through apparatus embodying the invention;

Figure 3 is a transverse vertical section through two units of the autovehicle engaging apparatus;

Figure 4 is a horizontal section through the cable paying and rewinding mechanism;

Figure 5 is a side elevation, partly in section of the winding drum with the associated brake drum and uni-directional release mechanism;

Figure 6 is a plan view, the sweeps being shown in cross section, of two adjacent air cylinders, showing diagrammatically the electrical valve operating system;

Figure 7 is a perspective view of the hook elevating mechanism;

Figure 8 is a perspective view partly in section of one of the link bars which connects the sweep to the hook raising member;

Figure 9 is a plan view of the three-way valve and operating solenoids therefor;

Figure 10 is a vertical section through this valve; and

Figure 11 is a horizontal section through the valve.

Referring now in detail to the several figures, the numeral 1 represents a highway and 2 an intersecting railroad track. The object of the invention as applied to this situation is to positively catch hold of an automobile

speeding toward the railroad track when a train is approaching and to bring it to a standstill before it reaches the railroad track.

A set of three safety devices 3, 4 and 5 is arranged on the right side of the highway on each side of the railroad track at a suitable distance therefrom. Switches 6 and 7 are arranged along the railroad track, one on the approach side of the highway and one on the retreat side. The switch 6 as will be shown, is connected by suitable circuits with setting means in connection with the safety devices on both sides of the highway so as to set these devices into responsive position when the switch is actuated by a train. The switch 6 is of course, placed at a sufficient distance from the highway to assure the timely setting of the safety devices. The switch 7 which is on the retreat side of the highway is similarly connected to the safety devices and puts them in inert condition as soon as the train has passed the crossing. Normally, that is to say, when the safety devices are in inert state no portion of them rises above the surface of the ground and they normally offer therefore, no impediment to the passage of traffic.

Each of the safety devices comprises a trigger member or sweep adapted to be engaged by the front of the automobile, and in turn, when engaged, to cause the elevation of the automobile catching and holding element. The sweeps are raised to automobile engaging position by means responsive to the actuation of the switch 6 and they are returned to inactive or supine position by means responsive to the switch 7.

Referring to Figures 1 and 2, it will be observed that the safety devices each comprise a plate 8 which may be of cast iron, or other suitable material, set flush with the ground and forming the cover of a pit 9 which may be walled with concrete or sheet or cast metal. A compressed air cylinder 10 is mounted in said pit, in which cylinder works a plunger 11. Air under pressure is supplied to the lower face of said plunger from a reservoir 12 connected to an air compressing unit 13 and in communication by way of the conduit 14 with the cylinder 10. A three-way valve 15 which may be electrically operated controls this conduit. Figures 9, 10 and 11 show details of the valve in which solenoids 16 and 19 actuate an armature 17, the same being suitably connected to the valve 18.

When the switch 6 is closed the solenoid 16 is activated and the valve opened to permit compressed air to enter the cylinder 10 beneath the plunger 11. Said plunger is guided by a suitable cross head 20 and pivotally mounted on the outer end of the plunger and reciprocating therewith is a sweep 21 which in general has the form of a leaf spring.

The surface plate 8 is formed with a longitudinally disposed slot 22. Normally when the plunger is in its lower-most position the upper end of the sweep is flush with or below the upper surface of the plate 8 and in position to extend upwardly through the slot 22. As the sweep rises with the plunger 11, it extends above the surface of the street and in its final upward position, it is high enough to be engaged by the front axle or radius rod or some other part at the front of the automobile.

In Figure 2 the automobile is presumed to approach in the direction of the arrow and when the sweep is struck, it not only pivots backwards, but it also is flexible so as to yield to the shock and prevent damage both to the automobile and the sweep itself. An intermediate portion of the sweep passes through a slot 25 in a link bar 23 located in the pit and which bar connects the sweep to the hook elevator 24. The sweep is normally held in floating position between the ends of the slot 25 by a pair of springs 26 and 27 anchored to opposite sides of the sweep and to the link bar adjacent the ends of the slot. These springs yield to the impact of engagement of the automobile with the sweep and when the spring 27 has been sufficiently compressed, the link bar 23 is pulled to the right as viewed in Figure 2, oscillating a bell crank 28 on a shaft 29, the latter being mounted transversely in the sides of the pit and underlying the hook elevator 24.

When the bell crank 28 rocks, its free arm 30 raises the hook elevator to the position 31 indicated in broken lines. The connection between the link bar and the bell crank 28 is of yielding nature comprising a pair of springs 32 and 33 in a slot 34 in the link bar, said spring abutting opposite sides of the bell crank 28 and being anchored adjacent opposite ends of said slot. For keeping the springs in alinement in said slot, a sliding carriage 35 is provided which embraces the sides 36 and 37 of said link bar and receives the end of the arm of the bell crank 28.

It will be understood that the full line position of the link bar shown in Figure 2 represents its position of repose, and that when the sweep 21 rises into automobile engaging position, the link bar assumes the broken line position shown in this Figure.

Forethought has been given to the fact that an automobile may occasionally strike the sweep with its front tire while the rear wheel rests upon the hook elevator 24, thus rendering the device inoperative. The pairs of springs 25, 27, 32 and 33 as well as the resiliency of the sweep 21 itself, take care of this situation, permitting the sweep to be pushed flat to the ground while the hook elevator remains flat, without breaking any part of the apparatus.

The safety devices 3, 4 and 5 are spaced apart a distance less than the width of the automobile wheel base so that if the wheels on one side of the automobile collide with the sweep and hold the hook elevator down, the adjacent sweep and the adjacent hook elevator will still be active, and in position to engage and hold the automobile.

The hook elevator comprises an elongated box or casing 38 pivotally mounted at an intermediate point in its length on a transverse rod 39, the ends of which are fixedly secured in the pit. The upper face of the casing 38 normally fits and occludes a slot 40 formed in the plate 8. The hook 41 which engages the rear axle of the automobile is mounted at the forward end of said casing. Figure 2 shows in the full line drawing that the hook lies normally flat and parallel to the surface of the highway. It would, of course be impractical to have the hook in vertical position and projecting above the ground on account of the risk of tripping pedestrians or damaging the tires of automobiles. Therefore, while the casing 38 is rising to the broken line position shown at 31, provision must be made for rotating the hook through an angle of 90°, so that it is presented in a vertical plane in the path of the automobile axle.

It is of course, also impracticable for the hook to be made rigid with the casing 38 for either the automobile axle housing would be broken or the apparatus itself smashed by the impact of the moving vehicle. The connection of the hook 41 to the casing 38 is therefore indirect, being by means of cables which permit the hook to be drawn out from the casing immediately upon its being engaged by the automobile axle. The hook is therefore mounted upon a circular plate 42 shown in Figure 7, said plate forming the anchorage for the ends of cables 43 and 44. A second plate 45 abuts the plate 42 and the plate 45 is also independent of the casing 38. The cables pass through circular apertures 46 and 47 formed in the plate 45 at diametrically opposite points. The plate 45 is keyed to a shaft 48 which extends through a bearing in the front wall 49 of the casing 38 and through a similar bearing in the rear wall 50. The rear end of the shaft has a gear 51 which meshes with a toothed sector 52 on a bracket 53 rigidly mounted on the under side of the plate 8. When the hook elevator rises, oscillating about its axis rod 39, the gear 51 rolls along the sector, rotating the shaft 48 and with it the plate 45 through an angle of 90°.

The apertures 46 and 47 through which the cable passes and which are horizontal when the casing is in its supine position are thus turned to a vertical position. The forward wall of the casing is provided with arcuate slots 54 and 55 to accommodate the change in the position of the cables from a horizontal to a vertical plane. The plate 42 is normally kept pressed into contact with the plate 45 by the cable-winding means presently to be described, and thus when the plate 45 is rotated through an angle of 90° as described, the plate 42 is similarly rotated and the hook is changed from a horizontal to a vertical plane. This accounts for the provision of a pair of cables instead of a single cable. It is the cables anchored at the plate 42 and passing through the apertures 46 and 47 of the plate 45 which causes the plate 42 to follow the movement of the plate 45.

The cables 43 and 44 wind upon a drum 56 mounted in the pit, the two cables being shown in Fig. 3 as being kept separate by an intermediate flange 57 on said drum. One of the heads of said drum comprises a large gear wheel 58 which meshes with a large bevel gear 59, the latter meshing with a small bevel gear 60 at the base of a screw 61 and by means of which gear 60 said screw is rotated.

A brake drum 62 is mounted co-axially of the winding drum 56 and adjacent the outside face of the gear wheel 58. Said brake drum is provided on its interior periphery with ratchet teeth 63 appropriately shouldered in one direction and sloping gradually in the other. The face of the gear wheel 58 is provided adjacent the inner periphery of the brake drum with pawls 64 normally biased into engagement with the ratchet teeth 63 by suitably disposed springs 65. It is obvious that when the winding drum turns in a winding direction as indicated by the arrow in Figure 5, the brake drum 62 will be drawn around with it just as though the winding drum and brake drum were a unitary structure.

A brake band 66 surrounds the brake drum, being suitably anchored at one end to fixed means 67. The brake drum is actuated by means of a nut 68 traversing the screw 61 in one or the other direction according to the direction of the rotation of said screw, said nut having a pin 69 playing in a slot 70 formed in a rocking lever 71 intermediately pivoted at 72 and having its opposite end 73 secured to the free end of the brake band.

It is obvious that when the screw rotates in one direction the end 73 of the rocking lever will move upwardly, drawing the brake band tight against the brake drum, and that when the screw operates in the opposite direction the nut will travel upwardly moving the end 73 of the brake band downwardly and releasing the frictional pressure of the brake.

In operation, when the axle of the moving automobile strikes the hook 41 and is engaged thereby, the hook will be pulled out from the casing 38, unwinding the cables from the drum 56. At first there will practically be no resistance to the unwinding of the cables and consequently, the hook will yield almost completely to the inertia of the automobile.

As soon however, as the drum 56 begins to turn in an unwinding direction, the gear train of which said drum forms a part, will rotate the screw 61 and begin to apply the brake. Since while the drum 56 is unwinding, the brake drum moves unitarily therewith, the braking effect progressively applied by the said screw to the brake drum will be transmitted to the winding drum and to the cable gradually bringing the automobile to a standstill, just as though the brake drum and brake band were a part of the automobile mechanism. When the automobile has been brought to a position of rest, the driver must back it up before he can release the hook from the axle. Means are therefore, provided for re-winding the cable on the drum when the hook is relieved from the drag of the automobile by the backing of the latter. This means consists in the present exemplary embodiment of the invention of a spring 74 conveniently mounted within the hollow hub of the drum as shown in Figure 4, anchored at one end to a fixed support and secured to the drum at its opposite end. This spring is wound by the unwinding movement of the drum 56 and when the hook is relieved from the drag of the automobile, the spring 74 unwinds, rotating the drum in a winding direction and winding the cable thereupon.

It is obvious that the spring 74 need be made only sufficiently strong to rewind the maximum amount of cable that may ever be withdrawn from the drum by an automobile travelling at the maximum speed for which the apparatus is designed.

It will of course, be noted that at the moment when the hook is relieved from the drag of the automobile, the brake band is still strongly applied to the brake drum and ordinarily the effort of the spring 74 to rewind the drum 56 would be overwhelmed by the pressure of the brake band. However, immediately upon the release of the cables from the pull of the automobile, the pressure between the pawls 64 and the ratchet teeth 63 ceases and the spring 74 is enabled to rotate the drum 56 freely with respect to the brake drum 62, the pawls 64 slipping over the oblique faces of the ratchet teeth. As soon as the drum 56 begins to rewind, the nut 68 begins to traverse the screw in the opposite direction releasing the brake band and restoring the parts to their normal position in readiness for a repetition of the cycle of operation.

Regardless of what may be the position of the hook 41 when the driver of the auto vehicle releases it from his axle, it will always be drawn into flat position by the time it has been retracted to a position against the casing 38, by reason of the rotation of the plate 45 and the positions assumed by the apertures 46 and 47 as has been previous described.

When the train passes away from the switch 6, the solenoid 16 is deenergized, closing the valve 18, cutting off pressure from the cylinder 10, but at the same time maintaining the pressure that has already been acquired within said cylinder. When the train reaches the switch 7, the solenoid 19 is actuated, rotating the valve 18 to a position putting the conduit 15 into communication with atmosphere, releasing the pressure within the cylinder 10 and permitting the gravitational descent of the plunger 11 which withdraws the sweep 21 below the level of the street.

While I have in the above description disclosed an exemplary embodiment of the invention it is to be understood that the inventive concept resides in the broad combination of elements rather than in the specific details as illustrated and described for carrying out the purpose and functions of the invention, and that a scope of protection is claimed broad enough to include any means for carrying out the principles of the invention such as may be consistent with the breadth of the terms of the appended claims.

What I claim is:

1. Safety system for highways comprising automobile catching and holding means, and trigger means for raising said automobile catching and holding means into the path of the part of the automobile which is to be caught and held thereby, when said trigger means is engaged by the automobile, both said trigger means and said automobile catching and holding means being normally below the plane of the highway, said trigger means comprising a resilient sweep, a cylinder and piston, the latter reciprocating substantially vertically within said cylinder, said sweep being pivotally secured to said piston, a source of compressed air communicating with said cylinder beneath said piston, a switch actuated by an object which is a factor of danger intermittently created adjacent said automobile catching and holding means, for actuating a valve controlling the admission of compressed air to said cylinder, and a connecting link between said sweep and said automobile catching and holding means.

2. Safety system as claimed in claim 1, the connecting link being resiliently connected to said sweep.

3. Safety system for highways comprising automobile catching and holding means, trigger means for raising said automobile catching and holding means into the path of the part of the automobile which is to be caught and held thereby when said trigger means is engaged by the automobile, both said trigger means and said automobile catching and holding means being normally below the plane of the highway, said trigger means comprising a resilient sweep, a cylinder and piston, the latter reciprocating substantially vertically within said cylinder, said sweep being pivotally secured to said piston, a link

resiliently connecting said sweep to said automobile catching and holding means, a source of compressed air communicating with said cylinder beneath said piston, and switches arranged one at each side of said highway adapted to be successively actuated by the passage of an object which is the factor of danger intermittently created adjacent said automobile catching and holding means, the first switch actuated controlling the admission of compressed air to said cylinder for raising said sweep, the second switch when actuated exhausting said air and thereby causing the recession of said sweep.

4. Safety means for highways comprising automobile catching and holding means, and trigger means for raising said automobile catching and holding means into the path of part of the automobile which is to be caught and held thereby when said trigger means is engaged by the automobile, and means actuated by an object which is the factor of danger intermittently created adjacent said automobile catching and holding means, for elevating said trigger means into position to be engaged by an automobile, said automobile catching and holding means comprising a hook elevating member having the upper face thereof substantially flush with the plane of the highway, said hook elevating member being mounted on a horizontal axis extending transversely of said highway, a lever for operating said hook elevating member and a connection between said lever and said trigger means.

5. Safety system for highways as claimed in claim 4, the hook elevating member comprising a shaft extending longitudinally thereof, a plate on the forward end of said shaft having diametrically arranged apertures, cables passing through said apertures and said elevating member and being secured in winding relation on a winding drum, a hook having a base member abutting said plate, said base member having apertures alining with the apertures in said plate and having the cables secured in said apertures, and a gear on the opposite end of said shaft in mesh with a fixed rack bar, said gear rolling upon said rack bar when said hook elevating member pivots on its axis rotating said shaft and said hook through an arc of 90°.

6. Safety system for highways as claimed in claim 4, the hook elevating member including a shaft extending longitudinally thereof, a plate fixed to the forward end of said shaft, apertures in said plate at diametrically opposite points through which pass a pair of cables, a hook having a base member provided with apertures registering with the apertures in said plate, and in which the ends of the cables are fixed, means operable when said hook elevating member oscillates upon its axis to hook elevating position for rotating said shaft and hook through an angle of 90°, a drum on which said cables are wound, a brake operatively related to said drum, and means for gradually applying said brake as the cables are drawn out with said hook when the latter is engaged by a moving automobile for bringing said automobile gradually to a standstill.

7. Safety system for highways as claimed in claim 4, the hook elevating member including a shaft extending longitudinally thereof, a plate fixed to the forward end of said shaft, apertures in said plate at diametrically opposite points through which pass a pair of cables, a hook having a base member provided with apertures registering with the apertures in said plate, and in which the ends of the cables are fixed, means operable when said hook elevating member oscillates upon its axis to hook elevating position for rotating said shaft and hook through an angle of 90°, a drum on which said cables are wound, a brake operatively related to said drum, and means for gradually applying said brake as the cables are drawn out with said hook when the latter is engaged by a moving automobile for bringing said automobile gradually to a standstill, and means for automatically releasing said brake and rewinding said cables on said drum when said hook and cables are relieved from the draft of the automobile.

In testimony whereof I affix my signature.

WARREN B. HASTINGS.