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AUTOMATIC TRAIN CONTROLLING DEVICE FOR PREVENTING COLLISIONS.

APPLICATION FILED FEB. 24, 1913.

1,399,100. Patented Dec. 6, 1921.

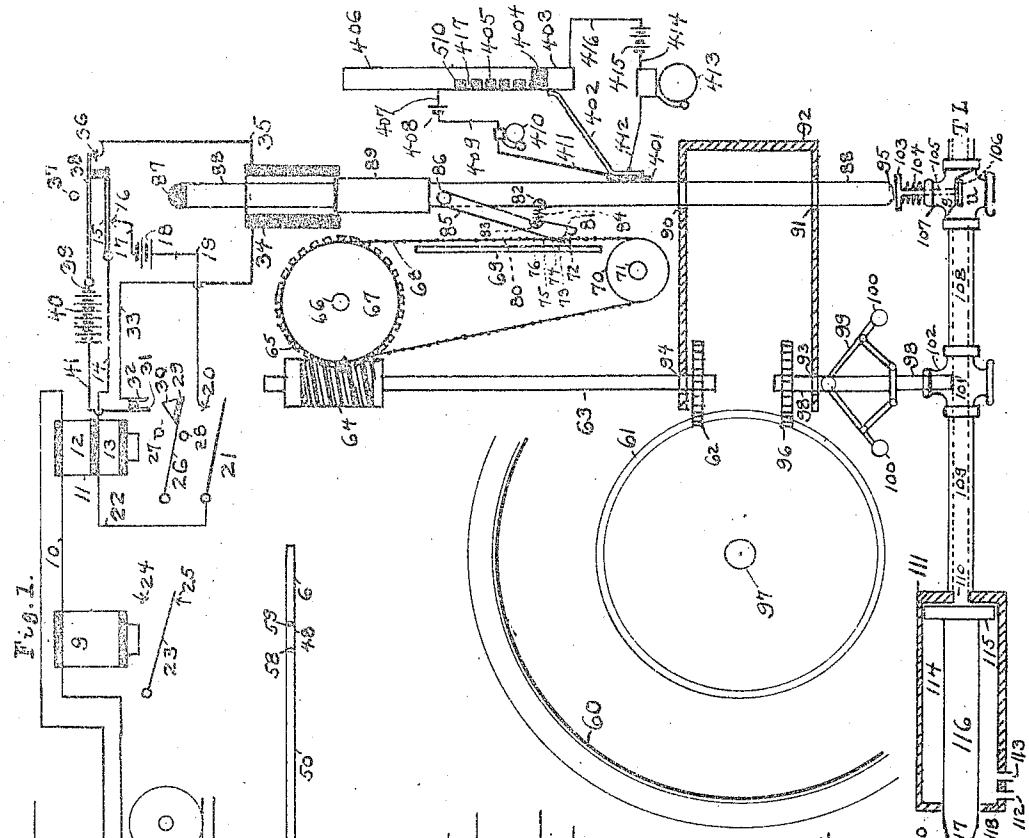


Fig. 1.

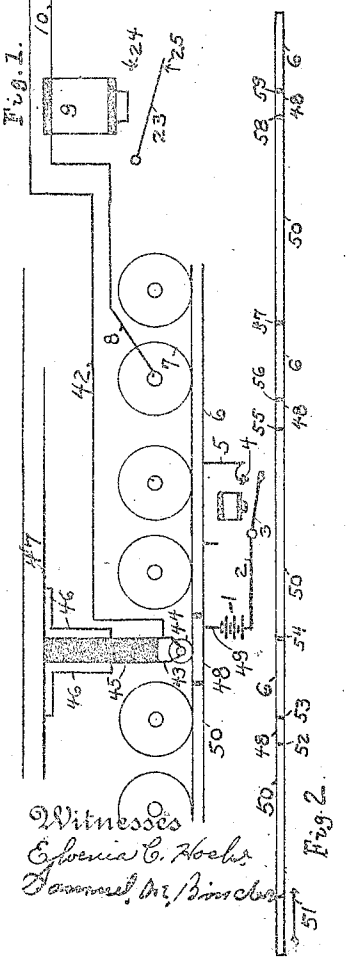


Fig. 2.

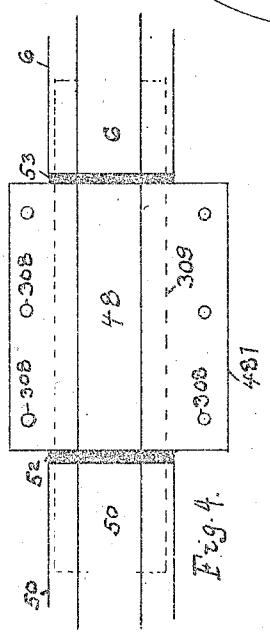


Fig. 4.

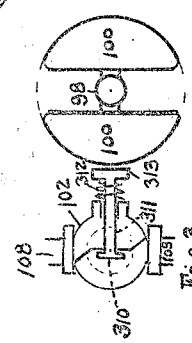


Fig. 3.

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UNITED STATES PATENT OFFICE.

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AUTOMATIC TRAIN-CONTROLLING DEVICE FOR PREVENTING COLLISIONS.

1,399,100. Specification of Letters Patent. Patented Dec. 6, 1921.

Application filed February 24, 1913. Serial No. 750,275.

To all whom it may concern:

Be it known that I, ABRAM L. BOWER, a citizen of the United States of America, and resident of Boyertown, in the county of Berks and State of Pennsylvania, have invented a new and useful Improvement in Automatic Train-Controlling Devices for Preventing Collisions, of which the following is a specification.

This invention relates to devices which utilize the movement of the train itself to control brake operation, making the brake application light and slow when the speed of the train is low and heavier and more rapid when the train is running at a high speed.

An electric circuit is utilized to maintain the devices in operative condition when no cause for stopping the train exists. This circuit is connected to and controlled by blocks of nearly equal length throughout the system.

Gears connected to a wheel or axle are used to operate a governor which controls a valve connected to another valve, the latter being connected to the train line brake pipe. The first valve is adjusted to be opened by the raising of the governor shaft but not until a speed of six or ten miles per hour has been attained. As the speed increases the valve is automatically opened wider.

The gears also operate a sprocket or gear wheel which supports a perforated strip, ribbon or ladder chain which in turn supports a weight below. This weight is constantly lowered when the train runs but is also adapted to be raised by a solenoid which draws up a core mounted above the weight but attached to the weight when the electric circuit is complete thus energizing the solenoid either directly or by means of a relay contact and extra battery.

Further an alarm is used which notifies the engineer a moment before the valves will be opened automatically by the device. If he heeds the alarm and reduces speed sufficiently he can proceed at reduced speed until he reaches a position where the electric circuit again operates. The weight above mentioned operates directly upon the second named valve. However the weight may break a contact of an electric circuit which latter may control the valve. This is described and claimed in my serial application No. 511,818 filed Aug. 7, 1909.

The entire device is well adapted to be used in connection with the cab signal systems described and claimed in patents granted to me numbered and dated as follows: Number 788,513, dated May 2, 1905, Number 832,652, dated Oct. 9, 1906, and Number 1,036,552, dated Aug. 27, 1912.

Further the air let out of the train line is fed into a cylinder containing a piston and mechanical connection with the locking dog and arm of the throttle lever for the purpose of shutting off steam automatically, in fact before the brakes are fully operated automatically.

With this and other objects in view, I have shown in Figure 1 a complete operating device, in Fig. 2 a section of track and in Fig. 3 a modification of the valve controlled by the governor. In Fig. 4 is shown an improved manner of securing a short insulated contact rail.

The axle 97 of wheel 60 has a worm gear 61 mounted thereon. This worm gear 61 engages and operates gear wheels 62 and 96. A vertical shaft 63 carries wheel 62 below and another worm gear 64 above. The latter engages a gear or sprocket wheel 67 which carries a ladder chain 68 which is held taut by a wheel 70 below. This chain moves downward vertically in front of a vertical plate 69.

Although I have shown the chain operated by a gear wheel which also engages the worm gear 64, it will be understood that the gear wheel 67 may operate a shaft to which a sprocket wheel is attached, the sprocket wheel supporting the ladder chain. A square rod 88 whose weight is sufficient to open a valve 107 mounted just below the rod, is supported in a vertical position in front of the ladder chain. The rod should not be round. It should pass loosely through one or more holes 90 and 91 in a boiler plate frame. The holes should be of the same shape as the rod. The square rod can rise and descend through the holes without binding or turning.

Rod 88 carries a pawl 85 whose lower notched end engages the cross wires in the ladder chain and this pawl is pushed toward the chain and plate 69 constantly by a spring 84. The rod is supported on the

cross wire by the pawl. The rod slides upward carrying the pawl with it with ease. The downward motion of the chain carries the pawl and rod with it until the rod has fully opened valve 107 after which the chain wires slide past the notched end of the pawl.

The upper end of the rod 88 is made of brass and it passes through a solenoid 34. An iron core 89 is attached to the rod just below the solenoid. This core fits loosely into the solenoid and is designed to be drawn into the solenoid when the solenoid is energized. The extreme upper end 87 of the rod is insulated and had two contact arms 38 and 15 in its path. The upward movement of the contact arms and the rod 88 is also limited by a pin 37.

An insulated spring contact 402 is mounted on the side of rod 88. A metallic plate 406 is supported in a vertical position along the path of the end of the spring contact. The plate 406 has a number of segments of insulation on the side where the spring contact slides. The lower end 403 of the plate is insulated from the plate and is connected to a battery 415 by a wire 416. The battery is connected to a loud ringing alarm 413 by a wire 414. The alarm is connected to the contact 402 by wire 412. Plate 406 is connected to a battery 408 by wire 407. A small single stroke bell 410 is connected to contact 402 by wire 411 and to the battery 408 by wire 409.

A governor 99 and gear wheel 96 are mounted on a shaft 98 supported vertically. A plunger of valve 102 is carried up to open the valve when the balls 100 of the governor rise. A slight raise of the balls will not open the valve but a train speed of six or ten miles per hour will cause the governor to begin to open the valve.

As the drawing shows, the complete movement of rod 88 downward requires about ten rotations of the worm gear 64 corresponding to about three hundred revolutions of the car wheel 60. In practice, the gears are so designed as to cause rod 88 to descend far enough to open the valve only after the vehicle has traveled fully as far from the point where relay 12 and solenoid 34 were energized as the length of a block, that is, past the insulated rail section 48 ... the next succeeding block. Opportunity was given at the latter point for the current of a track battery to energize the relay 12 and cause the restoration of the rod before the valve was opened.

If necessary to reduce the speed of wheel 67 and the governor, additional gears may be used and if desired the gears shown in serial application 511,818 may be used to prevent the turning of wheel 67 in the contrary direction as would occur when the engine runs backward.

Valve 107 is held closed by a spring 104, which spring just balances the pressure of the air on the part 106 tending to open the valve. This valve is connected on one side to the train line brake pipe and on the other side to valve 102 which is connected to a cylinder 111 having a piston 115 inside, the piston being connected by an arm 116 to the locking dog connection on the throttle lever 225. The cylinder and piston are designed to operate the throttle lever and shut off the steam when a pressure of twenty pounds or over of air enters the cylinder. Two vents 112 and 113 permit the air on the left hand end of the cylinder to escape. Vent 113 also permits the air from the train line T L to escape freely after the piston has passed to the left of vent 113.

The structure of governor 99 and valve 102 may be modified as shown in Fig. 3. The balls 100 are flattened and when spread out, they strike the plunger 313 of valve 102 and permit the air to escape in successive puffs, the volume and rapidity of the puffs being regulated by the speed of the governor and the train. Valve 102 in Fig. 3 is constructed similar to valve 107 of Fig. 1.

Solenoid 34 may be energized directly by a circuit connected to any form of train carried contact which engages a suitable stationary contact having a battery or dynamo connection under block control. However the wiring shown in Fig. 1 is preferred.

An arm or switch 3 controlled manually or automatically is provided with a contact above connected by wire 5 to the rail 6. A battery 1 is connected by wire 2 to the arm and by wire 49 to an insulated track rail 48 or other contact adapted to engage a brass or copper wheel 44, carried with suitable springs and bearings below an oak plank supported by brackets 46—46 attached to the floor or beams of the engine or tender or car. Rubber or fiber insulation may be substituted for the oak plank or an insulated tire, wheel, axle, truck or car may be substituted for the insulated brass wheel. The brass wheel should have a face six or more inches wide to insure a positive connection with the rail on curves.

It is preferred to have rail 48 short—even less than twelve feet long. A special rolled rail section 481 shown in Fig. 4 may be used. It is provided with holes 308—308 for the insertion of spikes driven into the sills. The fiber insulation and steel plates 309 bolted on the sides may be longer than the insulated rail section which is entirely inclosed on its sides.

The bearing 43 of the brass wheel 44 is connected by wire 42 to one winding 12 of a relay 11 in a circuit which also includes wires 10 and 8 and a relay 9 and terminates in wheel 7 of the engine or car. Relay 9 operates the cab signals if they are used. For

the details see Patent Numbers 788,513 and 832,652 above mentioned.

Relay 11 operates two arms 26 and 21 at some distance from the core to prevent any residual magnetism from sticking the armature fast to the core end. A second winding 13 on relay 11 is connected to arm 21 by wire 22 also by wire 14 to arm 15 in the path of the upper insulated end of rod 88. A contact 16 on the lower side of arm 15 is connected by wire 17 to a battery 18 which is connected by wire 19 to a front contact 20 in the path of the free end of arm 21.

Arm 26 carries an insulated wedge shaped copper contact adapted to connect two thick front contacts 31 and 32. Contact 32 is connected by wire 33 to solenoid 34 which is also connected by wire 35 to a contact 36 below arm 38 which is connected by wire 39 to battery 40. Wire 41 connects battery 40 to contact 31.

Three blocks of a track rail are shown in Fig. 2. The diagram in Fig. 1 shows the devices in the position assumed when the contact device 44 is over rail 48 at some considerable distance from the end 54 of the block. The train is approaching point 54. Rail 6 constitutes the overlap which is very desirable in a system of this kind. The engineer gets the danger signal soon after he enters the overlap. His duty is to reduce speed and prepare to stop at point 54. If he fails to stop the train will stop itself by its own movement. It is presumed that the block ahead is occupied.

The connection of battery 1 to the rail section 48 is broken at point 4. The rail section is dead and the circuit to relays 9 and 11 is broken. The device is set to open valve 107 at some distance to the right of insulation 53 (Fig. 2) in the overlap.

We assume that the train is traveling at high speed contrary to signals. The governor opens valve 102 wide. Valve 107 is closed. The gears are operating; chain 68 permits rod 88 to descend by its own weight. Contact 402 has just slipped past insulation 404 and now connects with contact 403 and completes the following circuit: through wire 416 contact 403, contact 402, wire 412, alarm 413, wire 414 and battery 415 operating the alarm. The engineer disregards this alarm.

Rod 88 now presses on the plunger 103 of the valve and opens it gradually at a rate proportional to the train speed. Train line air pressure escapes through valve 107, through valve 102 into the cylinder 115, shutting off the steam and then escapes freely through vent 113.

The train slows down to five miles per hour. The balls 100 drop and close valve 102. Then the engineer restores the train line pressure with his engineer's brake valve and opens the throttle. Should the speed increase above five miles per hour, valve 102 would open slightly, permitting train line air pressure to shut off the steam supply and apply the brakes. The engineer should go slowly.

The train ahead goes off on a siding or disappears and the track is clear. A number of ladder chain cross wires pass the notched end of the pawl but the rod 88 rests on valve 107.

Finally the train reaches the next insulated rail section 48 between insulations 55 and 56. This rail section is charged because the track is now clear. Relays 9 and 11 are energized and the solenoid is energized attracting the core and raising the rod. The circuits are as follows:—from battery 1, to wire 2, arm 3, contact 4, wire 5, rail 6, wheel 7, wire 8, relay 9, wire 10, relay 11, wire 42, bearing 43, wheel 44, insulated rail section 48 and wire 49. From battery 18, to wire 19, contact 20, arm 21, wire 22, winding 13, wire 14, arm 15, contact 16 and wire 17. From battery 40, to wire 41, contacts 31, 30 and 32, wire 33, solenoid 34, wire 35, contact 36 and arm 38 to wire 39.

As rod 88 slides up, the spring contact 402 slides up to insulation 510 making five successive connections to the contact plate 406 and making five strokes with alarm 410. The circuit is as follows:—from battery 408, to wire 407, plate 406, contact 402, wire 411, alarm 410 and wire 409.

In the absence of signals operated by relay 9, these five strokes of alarm 410 will notify the engineer to resume full speed.

When the rod 88 struck contact arms 38 and 15 above, the circuits to the solenoid and to winding 13 of relay 11 were broken and the solenoid was deënergized but the pawl caught in the ladder chain and supported the rod in its upper position. Before this was fully accomplished, the train contact 44 moved off the insulated rail breaking the circuit to relay-winding 12 and deënergizing relay 11 as soon as rod 88 struck contact arm 15. The gears and chain again lower the rod and as the spring contact 402 strikes each of the five bare surfaces of plate 406 between the insulations, the alarm 410 makes one stroke and the engineer knows that the device is working properly. On a clear track at high speed, these strokes are regular occurring at intervals of about fifteen seconds and furnish low toned music to the engineer's ear.

When the rod drops a short distance, arms 38 and 15 drop also and rest on their contact posts. The circuit to winding 13 of relay 11 does not close now because arm 21 is down, keeping the circuit open.

If the track remains clear, the train may proceed at full speed for any distance because rod 88 never drops far enough under such conditions to open valve 102 before bat-

tery 1 again energizes the circuits and draws up the rod.

Various modifications may be made without departing from the spirit and scope of the invention.

I claim,

1. In a train controlling device, a geared device operated downward by the train, a brake valve, a weight adapted to open the brake valve, an electrical device for raising the weight, the gear device supporting the weight.

2. In a train controlling device, a geared device operated downward by the train, a brake valve, a weight adapted to open the brake valve, an electrical device for raising the weight, the gear device supporting the weight, together with a signal operated by said weight.

3. In a train controlling device, a geared device operated downward by the train, a brake valve, a weight adapted to open the brake valve, an electrical device for raising the weight, the gear device supporting the weight, together with an alarm operated by the weight, for the purpose of warning the engineer.

4. In a train controlling device, the combination of a train axle, a geared device connected thereto, a sprocket wheel connected to the geared device, a ladder chain supported by the sprocket wheel, a pawl and upright rod supported by the chain, a solenoid, a block controlled electric circuit for operating the solenoid, a core attached to the rod below the solenoid, a brake valve below the rod, the rod being adapted to open the brake valve and stop the train.

5. In a train controlling device, a geared device operated downward by the train, a brake valve, a weight adapted to open the brake valve, an electrical device for raising the weight, the gear device supporting the weight, together with an electric circuit controlled by the geared device, said circuit operating an alarm.

6. In a train controlling device, a brake valve, a weight to operate the valve, an electrical block controlled device to raise the weight, and a geared train operated device to lower the weight.

7. In a train controlling device, a geared device operated downward by the train, a brake valve, a weight adapted to open the valve, a solenoid and core for raising the weight, means whereby the geared device lowers the weight, a train relay, an arm and contact and circuit controlled by the relay and controlling the solenoid.

8. In a train controlling device, a geared device operated downward by the train, a brake valve, a weight adapted to open the valve, a solenoid and core for raising the weight, means whereby the geared device lowers the weight a train carried block controlled relay, an arm and contact and circuit controlled by the relay and controlling the solenoid.

9. In a train controlling device, a geared device operated downward by the train, a valve adapted to be opened by the geared device, a block controlled device operating to close the valve, a fluid pressure device cooperating with the geared device to close the valve, the fluid pressure operating the train lever.

10. In combination, a railway vehicle, a speed responsive device thereon, means on the vehicle arranged to change gradually toward an ultimate condition, vehicle-governing apparatus controlled by said device and by said means, devices located in the trackway and arranged to restore said means away from said ultimate condition, said means being adapted to automatically resume its change toward said ultimate condition after each restoration.

11. In combination, a railway vehicle, a warning signal and a valve in control of an air vent carried thereon, means on the vehicle adapted to be constantly driven toward an ultimate condition whereby the warning signal will be operated and the valve will be opened successively upon reaching said ultimate condition, together with devices located in the trackway for causing said means to be restored away from said ultimate condition.

12. In combination, a railway vehicle, means on the vehicle adapted to be driven constantly toward an ultimate condition, a warning signal and a controlling device on the vehicle controlled successively by said means upon reaching said ultimate condition, together with devices located in the trackway and responsive to clear track conditions ahead for causing said means to be restored away from said ultimate condition.

13. In combination, a railway vehicle, means thereon arranged to change gradually toward an ultimate condition, a warning signal and valve-opening apparatus on the vehicle, controlled successively by said means upon reaching said ultimate condition, and devices located in the trackway for causing said means to be restored away from said ultimate condition, said means being adapted to automatically resume its change toward the said ultimate condition after each restoration.

In witness whereof, I have signed this specification in the presence of two subscribing witnesses, this 22nd day of February, 1913.

ABRAM L. BOWER.

Witnesses:

ELVENIA C. HOCK,

MARY B. FREED.