July 29, 1941. W. C. BARNES 2,250,458

FLAW DETECTOR MOUNTING

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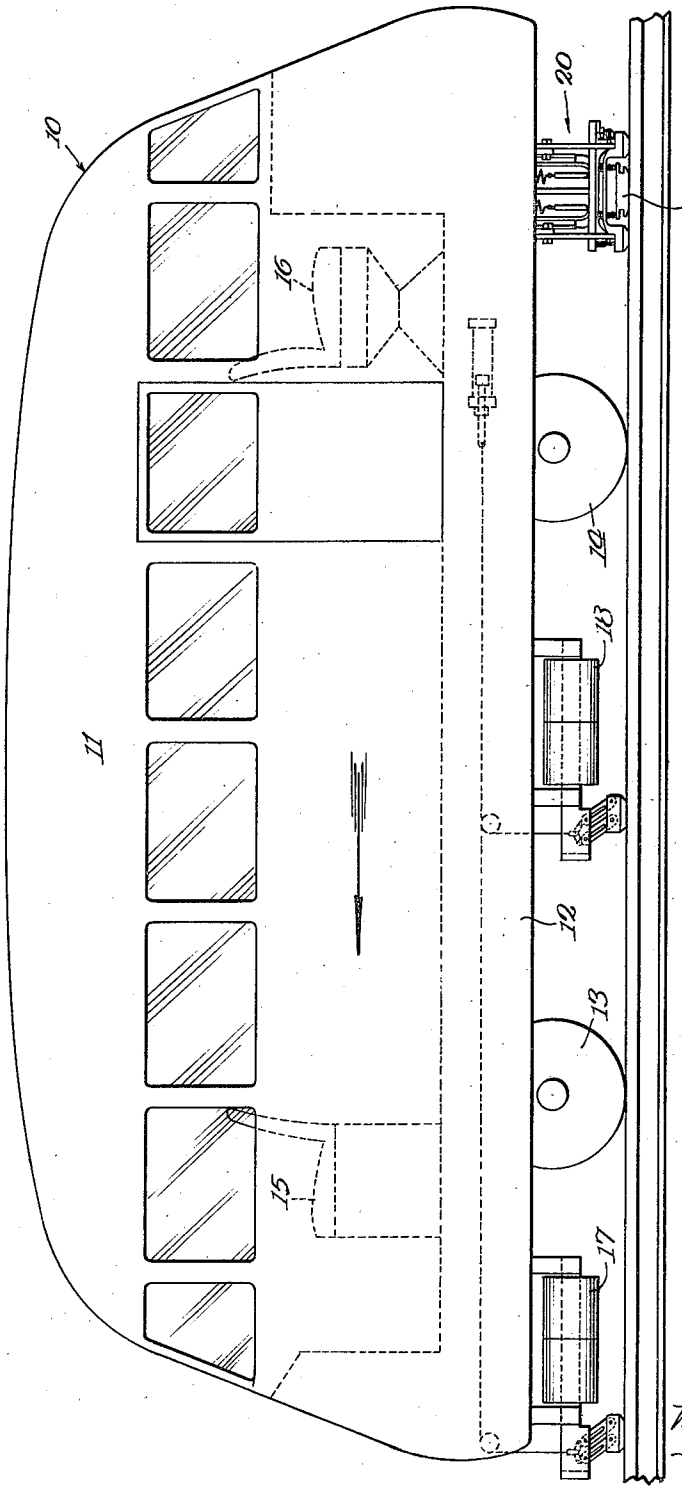


Fig. 1

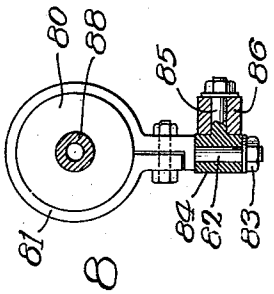


Fig. 8

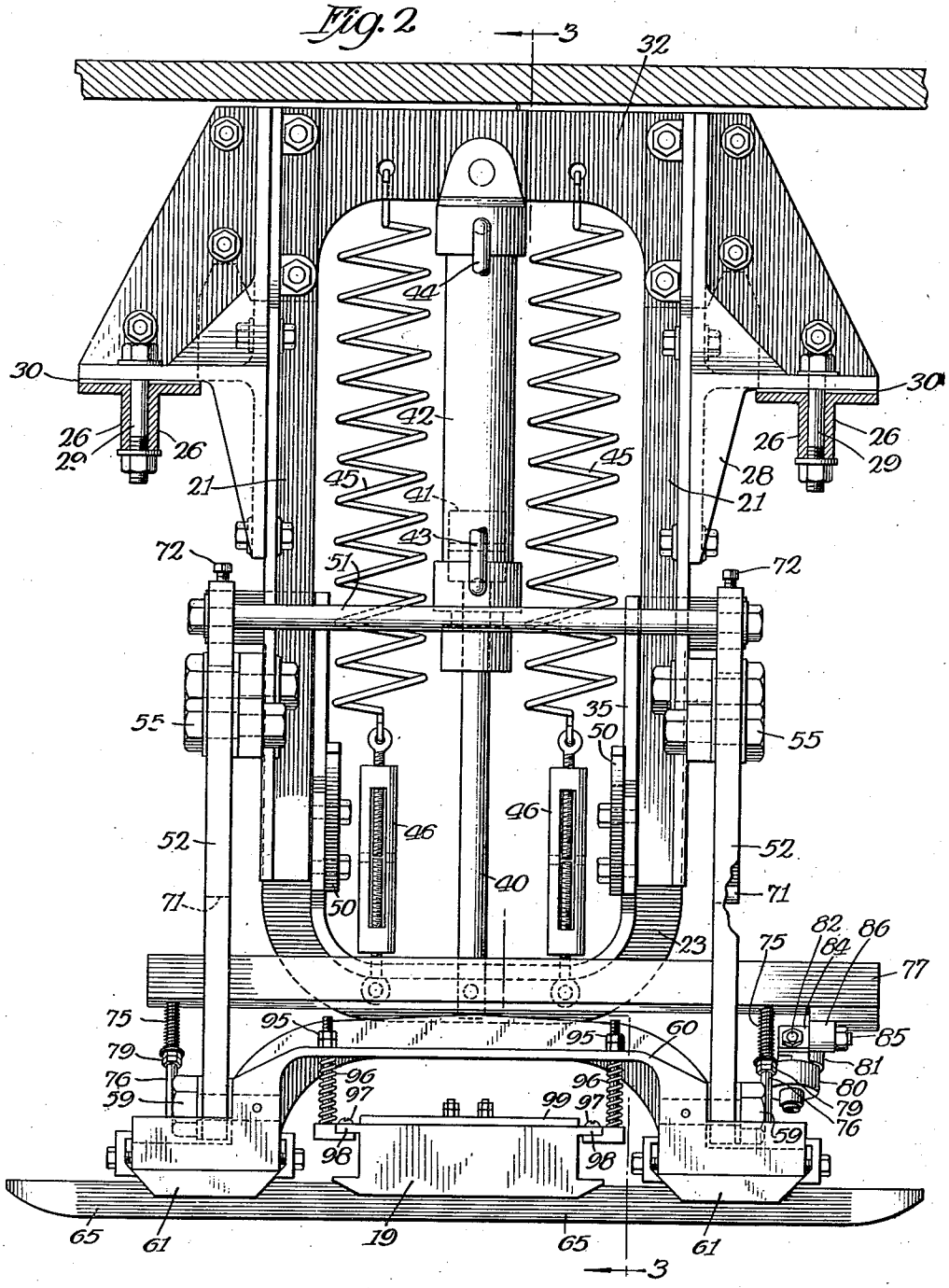
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Fig. 2



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Fig. 3

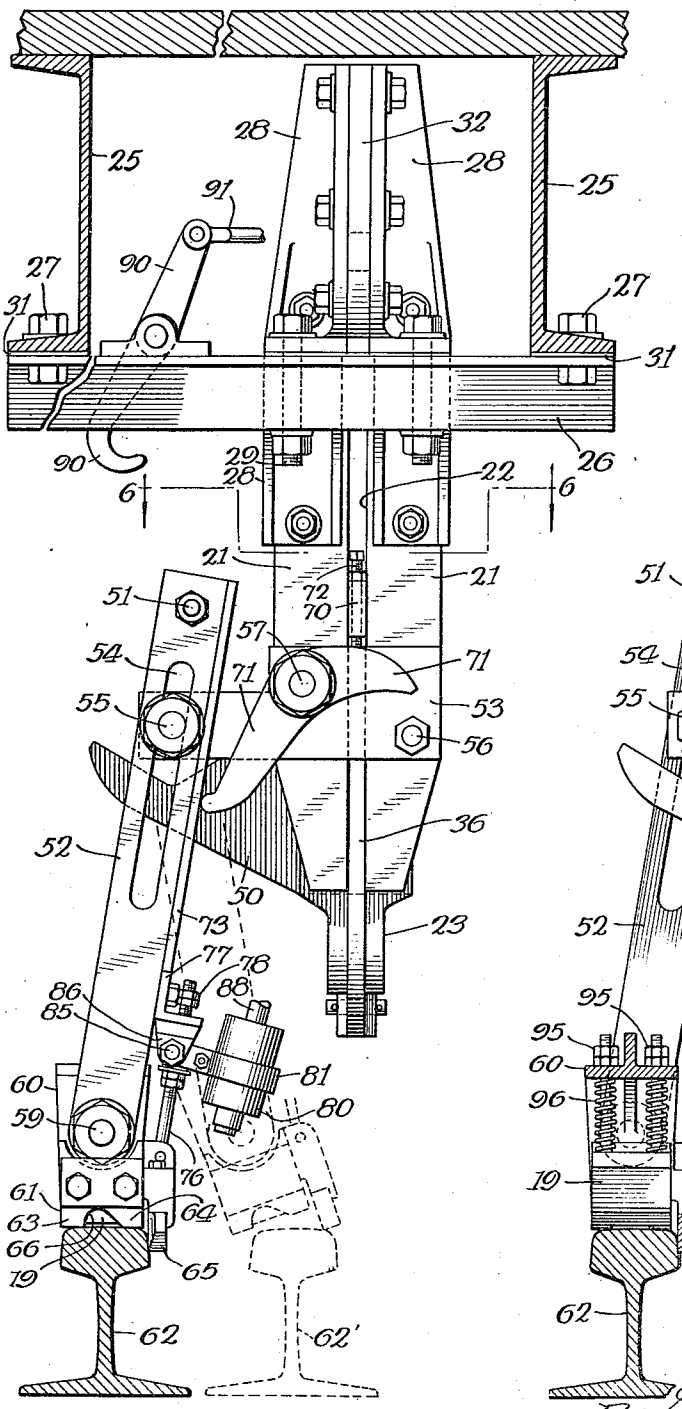
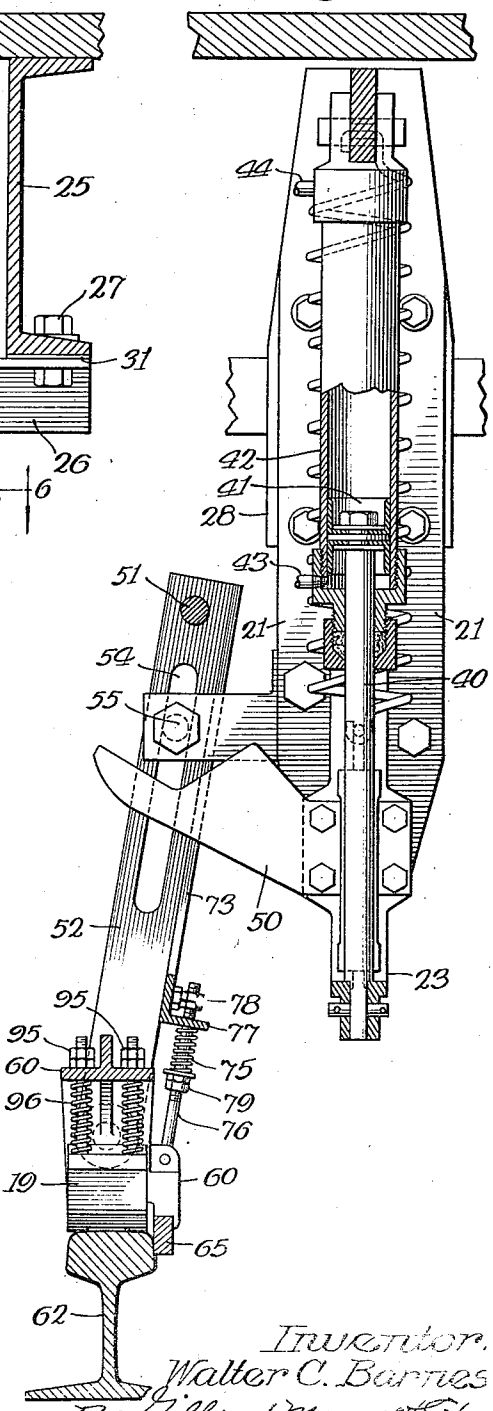


Fig. 4



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FLAW DETECTOR MOUNTING

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Fig. 5

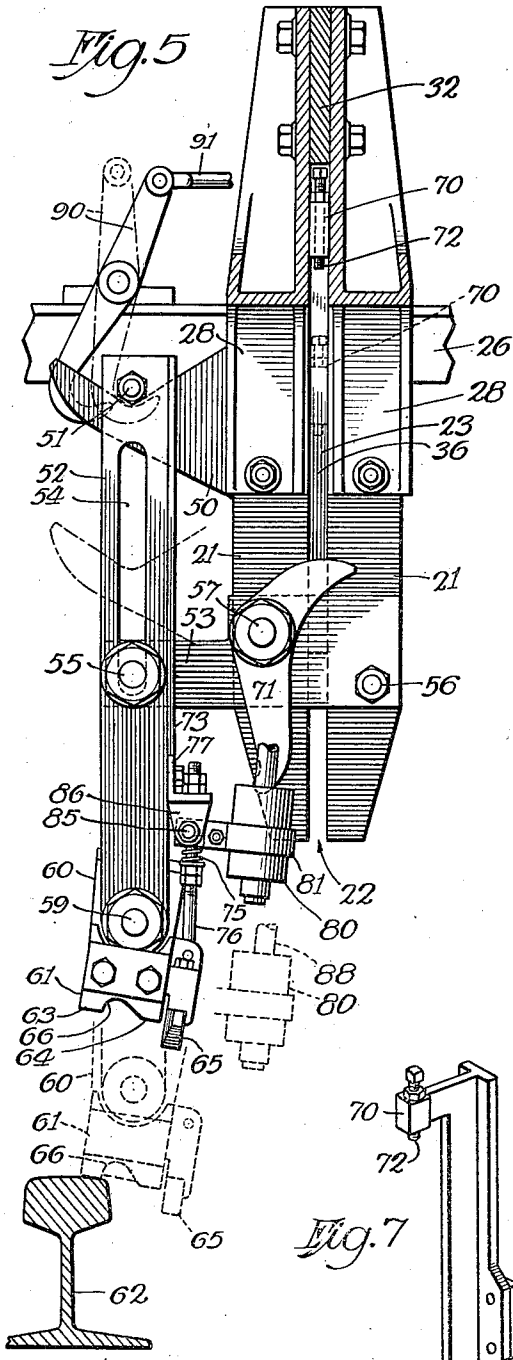


Fig. 6

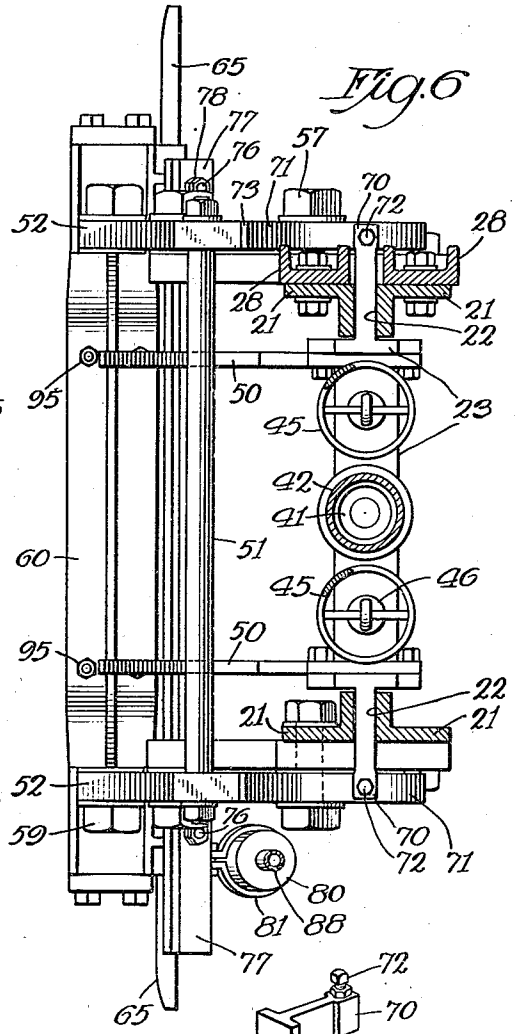
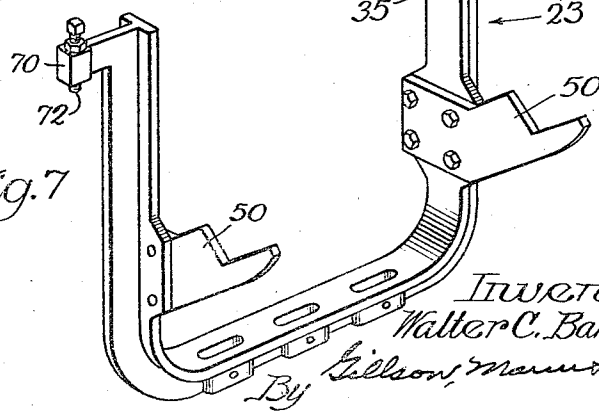


Fig. 7



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2,250,458

UNITED STATES PATENT OFFICE

2,250,458

FLAW DETECTOR MOUNTING

Walter C. Barnes, Lake Bluff, Ill.

Application July 15, 1937, Serial No. 153,803

16 Claims. (Cl. 175—183)

In testing rails for flaws from a moving car, a detector unit is used which travels on or close to the rail under test. In going to and from a place of test when the detector unit is not being used, the car is said to be traveling light and the detector unit is raised a substantial distance above the rail so that the car may travel at high speeds without danger that the unit or its mounting will become fouled in switches, frogs and the like.

The principal object of this invention is to provide a detector unit mounting which not only enables the unit to be raised from and lowered to the rail in the customary manner, but also insures that the unit will properly engage the rail when the unit is lowered, and maintain its position on the rail, adapting itself to differences in track gauge, high and low spots in the rail, excess wear on the edge of the rail, and other track conditions which are commonly encountered.

The improved mounting and positioning of the paint gun also constitutes an object of this invention, and as the disclosure proceeds, still further objects and advantages will become apparent as the description is read in conjunction with the accompanying drawings, in which:

Fig. 1 is a side view of a typical test car embodying the present invention.

Fig. 2 is a side view of the pick-up control apparatus chosen for illustration of the invention.

Fig. 3 is a rear elevation of the same.

Fig. 4 is a sectional view taken approximately on line 3—3 of Fig. 2 with the air cylinder partly broken away.

Fig. 5 is a view similar to Fig. 3 but showing the apparatus in raised position, the dotted lines also showing the position in initially striking the rail.

Fig. 6 is a sectional view taken substantially on line 6—6 of Fig. 3.

Fig. 7 is a perspective view of the elevating frame.

Fig. 8 is a detail sectional view showing the universal mounting of the paint gun.

A preferred embodiment of the invention has been shown in the drawings and will hereinafter be described, all as required by Sec. 4888 of the Revised Statutes, but the appended claims are not to be limited by the specific disclosure unless required by the prior art.

The application of the detector unit and mounting of this invention to a test car is shown in Fig. 1, in which the car is indicated generally at 10 and comprises a house body 11 mounted on an under-frame 12 having front and rear wheels 13 and 14, respectively. The car normally operates in the direction indicated by the arrow with the car driver sitting in a seat 15 at the forward end of the car, and the engineer in charge of tests sitting in a seat 16 at the rear of the car.

Since this invention is concerned only with the detecting unit and its support, it is sufficient to say that suitable means are provided on the car for preparing the rail under test for the detecting unit, which preferably includes one or more induction coils. In the embodiment of the invention shown in Fig. 1, electromagnets 17 and 18 are provided for conditioning the rail and serve to polarize the faces of fissures in the rail so that when the detector unit passes over the fissure, the magnetic field surrounding the rail adjacent to the fissure produces an electrical impulse in the detecting coils which is suitably amplified and recorded for observation by the engineer in charge of tests.

The detector unit 19 is supported by a mount generally indicated at 20, which includes angle irons 21 forming a slideway 22 in which an elevating frame 23 operates. The elevating frame 23 is seen best in Fig. 7, and its function is to raise the detector unit 19 from the rail when not in use or to lower it onto the rail when the rail is to be tested.

Adjustable attachment of the mount

As seen best in Fig. 3, the entire apparatus of this invention is preferably supported by the longitudinal sills 25 of the car. To these longitudinal sills two pairs of spaced angle irons 26 are secured as by bolts 27, the spacing of the angle irons being seen best in Fig. 2. The mount is suspended from the angle irons 26 by hangers 28 which rest on the angle irons 26 and are secured thereto by bolts 29 extending between the angle irons of each pair. Before the bolts 29 have been tightened it is apparent that the mounting may be slid along the angle irons 26 for adjustment in a direction transverse to the rails. The entire unit may be adjusted downwardly by omitting shims 30 between the hangers 28 and the angle irons 26 or upwardly by omitting the shims 31 between the angle irons 26 and the longitudinal sills 25. This manner of attachment makes replacement of the entire mount quite simple, and the adjustability facilitates fitting the mount properly to any car to which it is applied.

Elevating structure

The angle bars 21 are secured directly to the hangers 28. Both the angle bars 21 and the

hangers 28 may be spaced apart at their tops the distance desired for the slideway 22 by means of a top plate 32 to which the hangers 28 and the angle bars 21 may be firmly bolted.

The elevating frame 23 is of U-shape, the legs of the U being of T-shape in cross section. The head of the T forms an inner flange 35 and the leg of the T forms a slide flange 36 operating in the slideway 22.

The elevating frame 23 is operated in its upward and downward movement by a piston rod 40 secured to a piston 41 in a double acting air cylinder 42. Compressed air may be admitted to the bottom of the cylinder through a hose 43 to raise the elevating frame 23, or to the top of the cylinder through a hose 44 to lower the elevating frame 23. The frame is adjustably counterbalanced by coil springs 45 stretched between the top plate 32 and the bottom of elevating frame 23. The tension of the springs 45 may be regulated by turnbuckles 46 for a purpose described below.

The elevating frame 23 carries a pair of elevating arms or hooks 50 which, when the elevating frame 23 is raised, raise the detector unit 19 through any suitable intermediate structure such as a swinging frame or upper carriage including cross bar 51 and swing bars 52, seen best in Fig. 2, and raised by hooks 50 to the position shown in Fig. 5. The swing bars 52 are mounted on brackets 53 by means of a slot 54 in each swing bar and a bolt 55 in the bracket 53. Bolts 56 and 57 secure each of the brackets 53 to both of the angle bars 21 near the lower ends thereof, thereby serving not only to support the bolt 55 but also to space the angle bars 21 apart rigidly to form the slideway 22. The elevating arms 50 are formed in the shape of hooks having the lowermost point of the seat thereof in a vertical plane passing through the bolts 55 with the result that when the elevating hooks 50 are lowered the swing bars 52 are lowered directly downwardly in a line perpendicular to the plane of the track.

Detector carriage

The main or lower detector carriage 60 is pivotally secured to the lower ends of the swing bars 52 in any suitable manner as by bolts 59. This carriage has its ends provided with sleds 61 or equivalent devices which are adapted to ride on the head of the rail 62, being tested, the bolts 59 permitting the carriage 60 to tilt to accommodate itself to variations in rail contour. The test position of the carriage 60 is seen best in Fig. 3. The sled 61 is formed of wear resistant material, such as stainless steel, and is longitudinally slotted to form parallel runners 63 and 64. A gauge runner 65, of considerable length, is fastened to the two ends of the carriage 60 and slides on the gauge (inner) side of the rail 62 to position the detector unit 19 laterally with respect to the rail. The separation of the rail head runners 63 and 64 by a wide longitudinal slot or groove 66 insures stability of the carriage 60 by causing it to rest on the rail head along two widely spaced lines. It should be understood that the rail head is somewhat convex in contour, and therefore if the groove 66 were not provided the resulting single runner would be likely to contact the rail along only one line about the center of the rail with the result that the carriage 60 would rock from side to side about this line, thereby increasing the chances of false indications.

Two-movement engagement

In some cases heretofore the mechanical control means has moved the sled in a downward and outward direction so as to press it simultaneously against both the top and the gauge side of the rail. This has required undesirable accuracy in designing and positioning the apparatus and there was danger that the sled would not strike the rail properly if it were lowered while the car was on a curve. According to the present invention the movement in a downward and outward direction has been dispensed with, and the sled is first lowered in a perpendicular direction until it strikes the rail with sufficient lateral tolerance to avoid the necessity for extreme accuracy and to prevent trouble on curves, and it is then pressed outwardly until the gauge runner strikes the gauge side of the rail. Thus, as the hooks 50 lower the swing bars 52 and the detector carriage 60 thereon, the carriage 60 will normally strike the rail in approximately the dotted line position shown in Fig. 5, the position of the hooks 50 at this instant also being shown in dotted lines.

It will be observed that there is no attempt to shift the carriage in a downwardly and outwardly direction directly toward the rail with the resultant danger of missing the mark. As a matter of fact, it is preferred that the lateral position of the mounting be so adjusted before tightening bolts 29 that the gauge runner 65 may be initially positioned an inch and a half inside of the average position of the gauge side of the rail head. Furthermore, the sled 61 is of such width that the runner 63 will overlap the rail by at least an inch and a half when the runner strikes the rail. Thus, there is provided an inch and a half tolerance in either direction which is enough to take care of all ordinary variations in track condition, such as may be found especially along curves in the track. Of course, larger or smaller tolerances may be used if desired. The detector mounting should be positioned closely enough to a wheel so that its lateral movement with respect to the rails as it goes around curves will be a minimum. Furthermore, it will be observed that the elevation of the curves does not adversely affect the meeting of the detector carriage 60 and the rail 62 since the entire car and likewise the detector mounting shifts in accordance with the elevation of the curve. In other words, the hook 50 drops the swing bars 52 in a direction perpendicular to the plane of the track, whatever this plane may be due to curve elevation.

After the hooks 50 lower the swing bars 52 and carriage 60 to the position shown in dotted lines in Fig. 5, the hooks 50 continue downwardly with the elevating frame 23 so as to permit a free swinging movement of the swing bars 52. After the elevating frame 23 has continued its downward movement for a given distance, lateral extensions 70 thereon engage cam or bell crank levers 71 (preferably through an adjustable screw 72) rotatably carried by the bolts 57 on the brackets 53 and rotate these levers 71 until they engage the swing bars 52 or wear plates 73 thereon, and swing the swing bars 52 outwardly to slide the detector carriage 60 from the position shown in dotted lines in Fig. 5 to the position shown in Fig. 3, in which position the gauge runner 65 strikes the gauge side of the rail and prevents further movement. The groove 66 is shaped with a sufficiently gentle slope on the side

adjacent to the runner 64 so that the lateral movement of the sled 61 into its test position is facilitated.

Adjustment of lateral force

The lateral force applied to the sled 61 through the cam levers 71 can be regulated by adjusting the tension on the counterbalance springs 45, this tension being adjusted by means of the turnbuckles 46. As a matter of practice at the present time it is preferred to provide two sets of springs 45 which can be interchanged and which with the adjustment provided by the turnbuckles 46 will cause the cam levers 71 to press the sled 61 outwardly with a force of anywhere from about 1.3 to 11 pounds so as to provide plenty of leeway for satisfactory adjustment. Of course, the strength required in the springs to provide a given lateral force will depend on the weight of the parts and on the amount of air pressure utilized in the cylinder 42, 90 pounds being a common pressure.

As the lateral force applied to the swing bars 52 increases it is necessary to make some provision to prevent this force from sweeping the sled 61 off of the rail 62, it being observed that a sufficient force exerted laterally on the swing bars 52 could simply push them further outwardly from the position shown in Fig. 3, the carriage 60 overturning or tilting sufficiently about the bolts 59 to permit the gauge runner 65 to clear the rail head. The carriage 60 must be capable of pivoting to accommodate itself to the rail but it is restrained against such overturning by springs 75 which, as seen best in Fig. 4, exert a pressure on the carriage 60 through rods 76 which slide in a bracket 77 against which the springs 75 react. The bracket 77 is rigidly secured to the swing bars 52. Nuts 78 on the upper ends of rods 76 may be adjusted to limit the movement of the carriage 60 under the influence of the springs 75. Thus, when the carriage 60 is not resting on the rail it will assume a slightly tilted position as shown in Fig. 5. The strength of the springs 75 can be adjusted by nuts 79 screwing on the rods 76 and should be adjusted for proper operation with whatever lateral force is exerted on the swing bars 52. In other words, the springs 75 should be sufficiently strong to prevent the carriage 60 from being tilted away from the rail by swing bars 52 and should be weak enough so that these springs will not themselves tilt the carriage 60 away from the rail in the opposite direction. Furthermore, the forces should be so balanced that the gauge runner will engage the rail head with as even pressure as possible so as to minimize wear on the runner. The downward force exerted through the swing bars 52 of course gives a great deal of leeway in this respect, and so it is easy to adjust the springs 75 so as to insure a steady, firm contact between the sliding carriage 60 and the rail.

It will be observed that the two bolts 72 may be adjusted independently of one another so as to equalize the lateral forces exerted on the two swing bars 52 by the bell crank levers 71. There is enough play between the elevating frame 23 and the angle irons 21 for the frame 23 to tilt sufficiently to maintain pressure on both ends of the gauge runner 65 even when going around curves. There is, however, some reduction of pressure due to the semi-rigidity of the swing frame including the swing bars 52 and the cross bracket 77. In other words, when the rail departs from parallelism with the car, the bracket 77 tends to hold the gauge runner 65 in parallelism with the car so that the actual pressure of the two ends of the gauge runner on the rail becomes unequalized. This reduction in lateral pressure tends to prevent pressing the forward end of the runner behind a slightly open switch point, as has happened quite frequently in the past. Such occurrences are further prevented by providing an elongated runner as seen clearly in Fig. 2. A single gauge runner preferably spans the distance between the two sleds 61 and even extends beyond each of them. In the past the practice has been to use a shorter runner with independent lateral pressure on the two ends thereof with the result that the runner would turn out of parallelism with the car very readily, permitting its front end to duck into a slight recess in the rail adjacent a switch point or the like and hence run behind or catch on the switch point if it should not be absolutely tight against the rail.

Paint gun mounting

It is desirable to provide a paint gun 80 for shooting a spot of paint on the rail to mark it whenever a flaw is detected. According to the present invention this paint gun 80 is mounted in close association with the detector carriage 60, being carried by the bracket 77. It is desired that the gun 80 be fully adjustable so as to permit it to be so directed as to position the paint spot accurately on the rail to indicate the position of the flaw and to be visible to the engineer riding in the seat 16. It should be understood that there is necessarily a slight time lag between the impulse that is initiated when the detector unit 19 passes over a flaw and the actual operation of the paint gun. Careful adjustment of the aim of the gun 80 in a forward or rearward direction will compensate for this lag. Such forward and rearward adjustment, however, may require a vertical adjustment in order to insure that the paint spot will be visible from the car. This universal adjustment is accomplished best as seen best in Fig. 8. The gun 80 is carried by a split ring clamp 81 which is provided with a spindle 82 which, upon loosening of nut 83, permits rotation of the gun 80 to spray forwardly or rearwardly along the track. The spindle 82 operates in a knuckle bracket 84 having a spindle 85 which permits rotation of the gun about the axis of the spindle 85 to spray at a higher or lower position on the rail. The spindle 85 operates in a bushing 86 which is rigidly mounted on bracket 77. The paint gun is supplied with compressed air through a hose 88, and the paint which is thus maintained under pressure may be released by magnetically operated valves, not shown.

One advantage of mounting the paint gun 80 adjacent to the detector carriage is in assuring accuracy of the location of the paint spot on the rail. There is no chance for variation inasmuch as the carriage rests directly on the rail and is accurately positioned with respect thereto by the runners 63, 64 and 65. Another advantage of this mounting of the paint gun is that when the detector carriage is raised while the car travels light, the paint gun will also be raised so that both will be out of the way. The weight of the paint gun may tend to cause some irregularities in the operation of the mount and, if so, it may be counterbalanced by an equal weight positioned at the opposite end of the bracket 77.

It may be mentioned at this point that the detector carriage and the paint gun may both be

held in the raised position, when desired, by hooks 90 carried by the angle irons 26 and operated by the rod 91. The hook 90 is so positioned that when the elevating hooks 50 raise the bar 51 to its uppermost position, this bar may be engaged by the hook 90 so that the air pressure may be released from the cylinder 42 without danger that the mechanism will drop. With hook 90 in the position in which it is shown in Fig. 3, the detecting apparatus may be raised and lowered, as when passing over a switch, without being engaged by the hook 90. However, when the car is running light from one testing position to another, the detecting apparatus may be latched in raised position by moving the hook 90 in a counterclockwise direction (Fig. 3) by actuation of the rod 91.

Freedom of movement

One very important advantage of the construction shown in the freedom with which the swing bars 52 and the carriage 60 carried thereby may swing inwardly or outwardly as rail conditions may require. Thus, if the gauge runner 65 should catch on a switch point, a frog or the like, it can swing the movable portion of the detector assembly as far as necessary in either direction to pass over the rail which it has erroneously followed. It is then merely necessary to operate the cylinder 42 to raise the apparatus approximately to the position shown in Fig. 5 and then lower it again onto the rail.

If the frog or switch point carries the unit outwardly it is obvious from inspection of Fig. 3 that there is nothing to obstruct the outward movement, and in fact after the detector swings back over the rail it has followed, it will be held safely outside of the rail on which it belongs by the bell crank levers 71, thus protecting it from injury. Even if the rail which the gauge runner 65 follows runs inwardly from the proper rail there is sufficient freedom of movement since the swinging parts can swing into the dotted line position shown in Fig. 3, at which point the tops of slots 54 will strike the bolts 55 and, although further swinging movement would be permitted, the carriage 60 will now be held sufficiently high to clear the rail 62' which it has erroneously followed. If necessary, the sides of the sleds 61 may be tapered at their ends to prevent their catching on any obstructions on the inside of the rail as the carriage swings down against the rail on which it belongs.

Adjustment of detector unit

The detector unit 19 may be accurately positioned a slight distance above the rail by means of nuts 95 which limit the downward movement of the unit 19. The unit 19 is normally held at the limit of its downward movement by the springs 96 but it may be pressed upwardly against these springs in the event of encountering an irregularity on the rail surface. The nuts 95 may be adjusted independently to position the unit 19 with the desired parallelism with respect to the rail. Lateral adjustment of the unit 19 with respect to the rail may be accomplished by loosening screws 97 which extend through slots in the flanges 98 of the housing of detector unit 19.

Preferred materials

It is desirable that the materials used in the mount be of such nature that they will not form a magnetic path between the longitudinal sills 25 of the car and the rail. In other words, they should be non-magnetic or of such low permeability that the flux passing through them will be negligible. To this end it is preferred that either bronze or brass be used wherever they are strong enough and that stainless steel be used elsewhere, and furthermore that there be no continuous path even through stainless steel from top to bottom. The frame 23 and the carriage 60 may be cast bronze. The sleeve members of the turnbuckles 46 may be formed of brass as may be the box 19 of the detector unit since it does not ordinarily touch the rail and is therefore free from wear. The swing bars 52, the bracket 77, the angle bars 21 and the hangers 28, and if desired even the angle irons 26, may all be made of stainless steel.

Although the sleds 61 are formed of stainless steel, the gauge runner 65 is preferably formed of phosphor bronze, the wear thereon being considerably less since it does not have to support the weight of the carriage 60 and associated parts. The cover 99 of the housing of the detector unit 19 will of course be formed of some such insulating material as "Bakelite" to insulate and support the terminals extending therethrough, or insulating bushings may be used with a cover of some other material.

Operation

Assuming the apparatus to be in the position shown in full lines in Fig. 5 with the hooks 90 unlatched, air may be admitted to the top of cylinder 42 by manual control exercised within the car. The compressed air in cylinder 42 lowers the elevating frame 23 with its hooks 50, thus permitting the swing bars 52 and the detector carriage 60 to drop to the position shown in dotted lines in Fig. 5. Further movement of the frame 23 under the influence of the compressed air first lowers the hooks 50 to a position well below the cross bar 51 so as to permit freedom of movement of this bar and of the swing bars 52. The further movement of frame 23 operates through its extensions 70 and the adjustable screws 72 to rotate the bell crank levers 71 from the position shown in Fig. 5 to the position shown in Fig. 3, thus pressing the swing bars 52 outwardly and shifting the carriage 60 laterally on the rail until the gauge runner 65 strikes the gauge edge of the rail, as seen in Fig. 3.

It will be observed that no component of the force as applied to the carriage 60 is upward, and hence there is no force tending to cause the carriage 60 to jump a rail. It will also be observed that the carriage is free to rock laterally by pivoting about the bolts 59 so that the spaced runners 63 and 64 will cause it to slide firmly along the rail. The flexibility of the swinging frame including the swing bars 52 and the cross bracket 77 will permit a slight longitudinal rocking of the carriage 60 to enable it to ride over slight rail irregularities as smoothly as possible. The application of the downward pressure by the swing bars 52 near the ends of the carriage 60 minimizes any longitudinal rocking of the carriage due to bouncing of one end thereof.

Because of the use of the relatively long gauge runner 65 and because of the mounting which tends to prevent such runner from departing too far from parallelism with the car, the gauge runner 65 will almost always keep the detector carriage 60 on the right rail. In case the runner 65 should follow the wrong rail, however, no injury to the apparatus will develop because the swing bars 52 are free to swing in either di-

rection as far as necessary to follow the rail until, as the result of the upper end of the slot **54** coming to rest on the bolt **55**, the downward movement of the swing bars is arrested with the result that the carriage **60** is enabled to clear the top of the rail as seen in dotted lines in Fig. 3. It is then merely necessary to reset the carriage onto the rail by admitting air to the bottom of cylinder **42** to raise the movable portions of the apparatus and again admitting air to the top of cylinder **42** to lower the carriage **60** onto the rail and laterally thereon as before. When air is admitted to the bottom of cylinder **42**, it raises the elevating frame **23**, which first releases the bell crank levers **71** by removing the bolts **72** therefrom, and then raises the elevating hooks **50** into engagement with the cross bar **51**, which slides to the bottom of the upper side of the hook **50**, thus shifting the swing bars **52** to the vertical position. Further movement of the frame **23** and hooks **50** raises the swing bars **52** and carriage **60** to approximately the position shown in Fig. 5. If the car is going to travel light for a considerable distance, the hook **90** will be operated by the connecting rod **91** to hook under the cross rod **51** and hold the swing bars **52** and carriage **60** in its raised position independently of the compressed air.

The paint gun **80**, which is operated automatically to mark the rail when a flaw is detected, is raised and lowered with the carriage so that it is accurately positioned jointly therewith and so that it is raised to a safe position when the car is traveling light.

I claim:

1. In a device of the class described a rigid support structure adapted to be secured to the under side of the car, an elevating unit slidably carried by the support structure, means for vertically reciprocating the elevating unit, a swing frame also slidably carried by the support structure and adapted to be engaged and lifted by the elevating frame, track engaging means carried by the swing frame and adapted to rest on a rail substantially inside of the normally expected position as the swing frame is lowered by downward movement of the elevating frame, and means operated by the elevating frame after further downward movement to press the swing frame laterally, and additional rail-engaging means adapted to strike the edge of the rail and limit the lateral movement to properly position the first named rail engaging means with respect to the rail.

2. A device of the class described including support means adapted to be secured to the under side of a car, elevating means vertically movable on said support means, a swing frame also vertically movable on said support means and adapted to be raised and lowered by the elevating means, track engaging means pivoted to the swinging means at the bottom thereof, and means operated by the elevating means after it has lowered the swinging means to the track to press the swinging means laterally.

3. A device of the class described including support means adapted to be secured to the under side of a car, elevating means vertically movable on said support means, a swinging means also vertically movable on said support means and adapted to be raised and lowered by the elevating means, track engaging means pivoted to the swinging means at the bottom thereof, means operated by the elevating means after it has lowered the swinging means to the track to press the swinging means laterally, and adjustable means for regulating the lateral pressure exerted on the swinging means.

4. A device of the class described including support means adapted to be secured to the under side of a car, elevating means vertically movable on said support means, a swing frame also vertically movable on said support means and adapted to be raised and lowered by the elevating means, track engaging means pivoted to the swinging means at the bottom thereof, and means operated by the elevating means after it has lowered the swinging means to the track to press the swinging means laterally, adjustable means for regulating the lateral pressure exerted on the swinging means, and adjustable means between the swing means and the track engaging means for opposing the tendency of the lateral force on the swing means from overturning the track engaging means and sweeping it off of the rail.

5. In a device of the class described rigid support means adapted to be secured to the under side of a car, a swing frame mounted thereon and movable with respect thereto, both vertically and with a lateral swing movement, a detector unit carried by the swing frame and adapted to be positioned adjacent to a rail, and reciprocating means carried by the rigid support means and adapted to engage the frame to raise it and lower it and to move sufficiently far from the frame to permit it to swing.

6. In a device of the class described, track engaging means, an intermediate means carrying the track engaging means and supported for both vertical and lateral movement by a suitable support structure, means for limiting the downward movement of the intermediate means; the lateral movement of the intermediate means being sufficiently unrestricted so that if the track engaging means follows the wrong track it may ride over said track when it reaches the limit of its downward movement.

7. In a device of the class described, a detector unit, a carriage for the detector unit adapted to rest on the rail to position the detector unit vertically with respect to the rail and including spaced sleds in front of and to the rear of the detector unit, and a single elongated gauge runner spanning the distance between the sleds and extending forwardly and rearwardly thereupon and adapted to engage the edge of the rail for positioning the detector unit laterally with respect thereto.

8. In a device of the class described, a detector unit, a carriage unit including runners adapted to engage the head and gauge side of a rail to position the detector unit adjacent the rail, one of the runners being a single gauge runner extending a substantial distance forwardly and rearwardly from the detector unit, means effective at points in front of and behind the detector unit for thrusting the carriage laterally, with the pressure at both points normally balanced, and means tending to maintain the carriage in parallelism with the car from which it is supported in spite of minor variations in the rail.

9. In a device of the class described, a detector unit, a carriage unit including means adapted to slide on the rail ahead of and behind the detector unit, and pressure means carried by a car and engaging the carriage unit at spaced points in front of and behind the detector unit and effective at said points for exerting a pressure on the carriage unit toward the rail for minimizing bouncing of the carriage unit, the

pressure means including a frame through which pressure is exerted at both of the spaced points having sufficient rigidity so that pressure is shifted toward either of said points which is raised above the other point as when one end of the carriage is bounced from the rail.

10. In a detector carriage of the class described, an upper carriage, a lower carriage adapted to ride upon a rail, means for raising both carriages from the rail, and an inclined resilient connection between the two carriages for transmitting a downward and outward force to the lower carriage on a line intersecting that portion of the rail head lying on the gauge side of the rail center line.

11. In a detector carriage of the class described, an upper carriage, a lower carriage, an inclined resilient connection between the two carriages for transmitting a downward and outward force to the lower carriage, and an arm on the upper carriage adapted to engage the rear part of the lower carriage for pushing the latter carriage along the rail.

12. In apparatus for detecting flaws in rail, a car, a detector carriage adapted to ride on the rail, said carriage including an upper carriage and a lower carriage, means for supporting the detector carriage for lateral movement relative to the rail, means cooperating with said supporting means for locating the detector carriage for downward movement toward the rail, means controlling said supporting means for locating the detector carriage in its operative position on the rail, and resilient means acting between the upper carriage and the lower carriage and opposing said controlling means for holding said detector carriage laterally in its operative position on the rail under pressure.

13. Apparatus for detecting flaws in rail, a car, a detector carriage, means for mounting the detector carriage on the car whereby it may be raised from and lowered to the rail, said carriage comprising an upper carriage, a lower carriage, means for joining the upper and lower carriages including a resilient element between the two carriages, and means for applying a lateral force to the upper carriage and transmitting it through said joining means to the lower carriage to urge the latter against the gauge edge of the rail.

14. A detector car, a carriage having a gauge runner adapted to locate it with respect to the rail, means for movably supporting the carriage on the car, means for raising and lowering the carriage, means for moving said supporting means outwardly to move the gauge runner against the gauge edge after the carriage is lowered, and means for moving said supporting means outwardly an additional amount whereby a resultant downward and outward force is applied to the carriage.

15. In combination with a rail car, a carriage adapted to be suspended on the car and moved along the rail surface, said carriage comprising an upper carriage and a lower carriage, and means for transmitting a lateral force outwardly toward the rail from the upper carriage to the lower carriage, said means including a stop for limiting the lateral angular relationship between the upper and lower carriages.

16. Apparatus of the class described, a car, a detector carriage mounted on the car and being capable of lateral movement with respect to the car, means for raising the carriage from and lowering it to the rail, said carriage including spaced front and rear sleds with a detector unit suspended from the carriage intermediate to the sleds and an elongated side runner attached to the carriage and curved at its end upwardly and away from the gauge rail edge, said runner having its rail engaging surface of substantially greater length than the combined rail engaging surfaces of the sleds.

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