Aug. 15, 1933. C. A. FOX 1,923,020

METHOD OF GRINDING TRACK RAILS

Filed Oct. 4, 1932 2 Sheets-Sheet 1

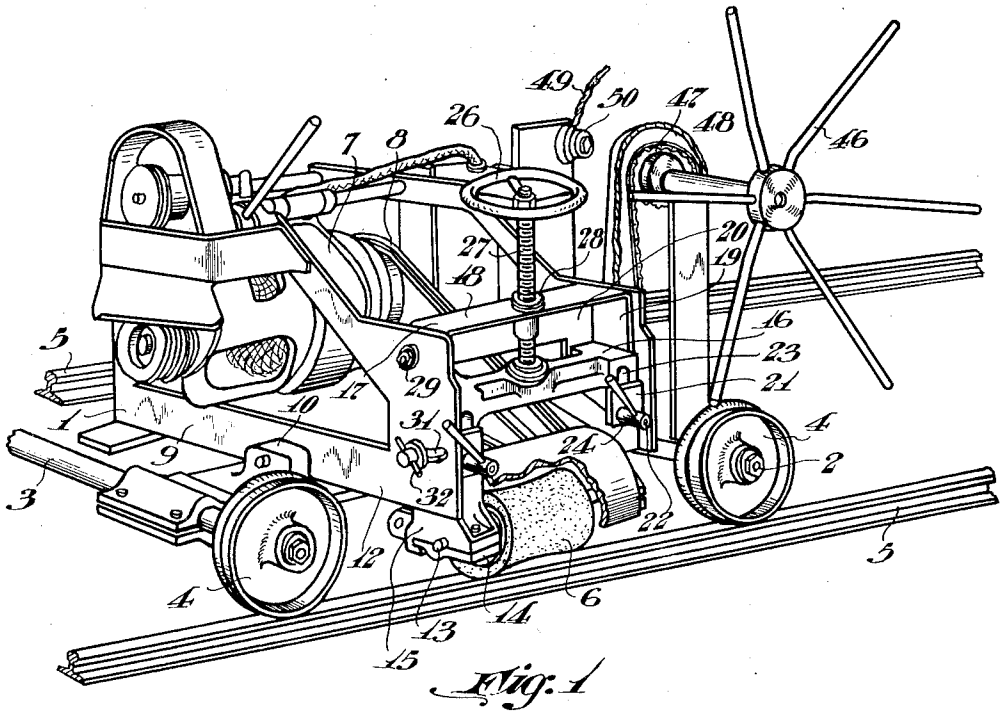


Fig. 1

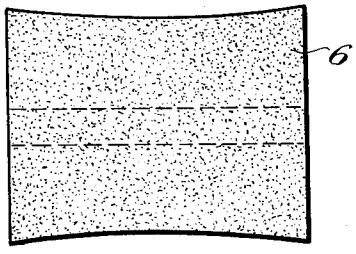


Fig. 2

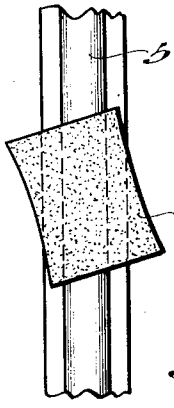


Fig. 3

WITNESSES.
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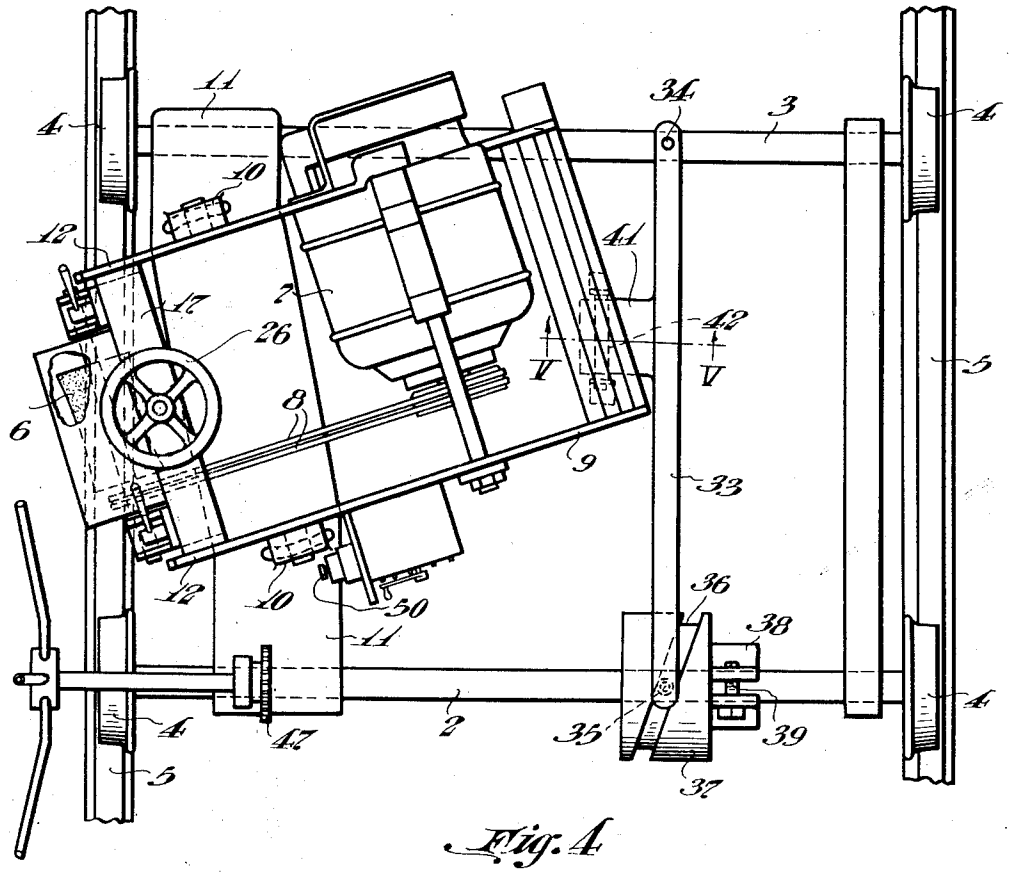


Fig. 4

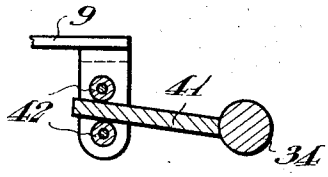


Fig. 5

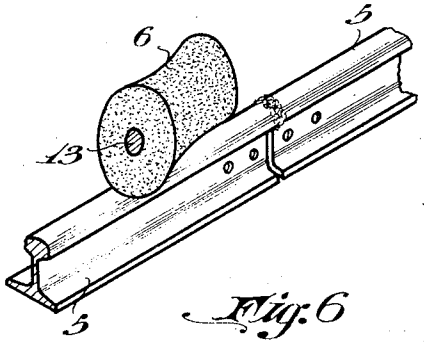


Fig. 6

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UNITED STATES PATENT OFFICE

1,923,020

METHOD OF GRINDING TRACK RAILS

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Application October 4, 1932. Serial No. 636,153

2 Claims. (Cl. 51—178)

My invention pertains to the grinding of surfaces, and relates with special importance to methods of grinding track rails, such, for instance, as are employed in railroads, street railways and the like.

Unevennesses in the operating surfaces of track rails constitute a source of material difficulty to the operators of railroads, street-railway lines, etc. Such unevennesses destroy the comfort of passengers, produce vibrations which are liable to loosen the fastenings of freight packages and the like, and reduce the speed at which the rolling stock can safely be allowed to travel. The unevennesses originally occur because of the wheels of the rolling stock "pounding" at certain localized points, owing to special track conditions obtaining at these points, and because of the tracks springing downward at certain points, owing to the proximity of joints, and as well as for a number of other reasons. Once an irregularity has developed, not only does it tend to increase, because of the blow given by every wheel which strikes the irregularity, but other irregularities appear beyond the first one, due to the fact that the wheels jump from the track on striking the first irregularity and impart a hammer blow to the track when they return thereto at a point further along the rail, thereby starting a depression beyond the first irregularity. This depression becomes deepened in time, and occasions still another depression beyond it; so that the track in time becomes in effect corrugated for quite a distance beyond the first irregularity. In street railways the irregularities generally take the form of depressions, usually occurring at so-called "pound points", though sometimes projections occur which have similar bad effects to those which have been mentioned. Such projections are created, of course, at newly welded joints, and must be removed. In railroads the irregularities most frequently develop at and near the rail joints. As one example of this, the trailing end of a rail, at a joint, will spring downward under the weight of a car wheel, causing an impact of the wheel against the receiving edge of the next rail, followed by a bounding of the wheel from the rail and an impact at a point a little further on. The result, after the passage of a material amount of traffic, is an irregular rail which occasions great discomfort to the passengers.

In the practice of my improved method, I dispose a peripherally acting grinding wheel with its axis oblique to the rail, and effect a relative movement between the grinding wheel and the rail to perform the grinding operation. With the grinding wheel thus obliquely disposed, the beginning and end of the cut will be oblique to the rail, as also will be any special depressions caused by such vibrations of the wheel as may occur. Supposing now that a car wheel arrives at a place where grinding has been conducted, the line of the beginning of the grinding cut will be inclined with respect to the line of engagement of the rail by the wheel; so that the wheel cannot drop immediately onto any lower surface that may occur beyond the beginning of the cut, but remains upon the high part of the rail until it is no longer thus supported, when the wheel will tilt the slight distance necessary for it to ride partly on the high part of the rail and partly on the slightly lowered part just beyond the beginning of the cut. Thus there is no possibility of the wheel dropping suddenly into a depression, or pounding in any way. Where the grinding wheel has caused special depressions, because, for instance, of uncontrollable vertical movements during the grinding operation, these depressions are inclined to the transverse line in which a car wheel engages the rail; so that not only does the above effect occur but often the wheel will ride upon both sides of the depression at the same time. These conditions make it possible to grind out a depression with a relatively small longitudinal movement of the wheel, since a long slope towards and away from the bottom of the depression becomes unnecessary.

A rail surface ground by my improved method improves, and becomes more level, with the passage of traffic thereover, instead of deteriorating and becoming more corrugated, as is the case with other methods, except perhaps where the surface has been specially finished by means of reciprocating abrasive bricks or the like. The improvement is due to the fact that the wheels gradually work down the little inclined grinding ridges (which, of course, are only measurable in thousandths of an inch) until the whole rail top becomes quite smooth and level.

The top of a rail is usually convex, a usual curvature being a twelve inch radius for a rail three inches wide, giving an increase in height at the center of about one thirty-second of an inch. Accordingly, for grinding such rails, I make the periphery of the grinding wheel of a longitudinal contour such as to correspond with the predetermined curve of the rail surface. The length of the wheel will be greater than a figure

obtained by multiplying the width of the rail-portion to be ground by the sine of the angle which the axis of the grinding wheel occupies with respect to the rail, though only slightly greater than this figure when the grinding wheel is of relatively small diameter and the convexity of the rail not relatively great. The concavity of the grinding wheel surface for a rail having the dimensions given above, will be about one thirty-second of an inch in about nine inches, presuming the wheel to be disposed with its axis at an angle of about 18° to the rail. For extreme accuracy the contour of the wheel can be calculated, or drawn, with exactitude; but approximate accuracy of the curvature of the rail is all that is necessary in the grinding of track rails according to my method, and this is obtainable without difficult calculations or drafting when the grinding wheel is of relatively small diameter, such as about seven inches, and the convexity of the rail surface is inconsiderable.

My improved method provides a smoother ground surface for the rail than would otherwise be obtainable; because the line of relative movement between the rail and the wheel is inclined, not parallel, with respect to the lines of movement of the particles of abrasive which make up the wheel. Further, the speeds at which grinding wheels can be safely rotated are limited and the operating speed is limited accordingly; but by my improved method a longer grinding cut can be taken on a rail of predetermined width, with a corresponding increase of operating speed. With the wheel disposed at 18° the speed of operation is about trebled, and at 30° about doubled, over what would be practicable with the wheel disposed in the old way at right angles with the rail.

By way of example, I have described in the following specification one form of apparatus that can be employed in practicing my improved method, and shown the same in the accompanying drawings, in which Fig. 1 is a perspective view of my improved grinder in position on a railway track, parts being broken away; Fig. 2 is an enlarged side view of the grinding wheel; Fig. 3 is a plan view of a portion of a rail and a grinding wheel in grinding position thereon; Fig. 4 is a plan view of the apparatus of Fig. 1; Fig. 5 is a sectional view taken on line V—V of Fig. 4; and Fig. 6 is a perspective view of portions of railway rails with a welded joint therebetween, and with a grinding wheel in position thereon.

A rail grinder constructed in accordance with my invention comprises a truck 1, having axles 2 and 3 on which are four wheels 4 adapted for operation upon a street railway track comprising rails 5. The truck 1 constitutes a carriage for a grinding wheel 6 and a motor 7 having a driving connection thereto by means of a belt 8.

The motor 7 and the grinding wheel 6 are mounted in a rectangular frame 9 that is mounted for horizontal pivotal movement in trunnions 10 supported by a plate 11 connecting the axles 2 and 3. Between the side members 12 of the frame 9, and at the forward ends thereof, is mounted means for supporting and regulating the position of the grinding wheel 6 with respect to the carriage upon which it is mounted.

The grinding wheel has a shaft 13 that is mounted in bearings 14 at the lower ends of the vertical arms 15 of a cast steel yoke 16. The latter is secured for vertical slidable movement in a box-like guide frame 17 consisting of a top 18, two vertical members 19 and a back 20. Two straps 21 extending over the front edges of the respective vertical arms 15 are each held in position by a stud bolt 22 extending through a vertical slot 23 in the corresponding arm 15 and connected to the back 20. Each stud bolt 22 is provided with a clamping nut 24 by means of which the relatively slidable yoke 16 and the guide frame 17 may be rigidly locked together to prevent relative movement when the grinding wheel is in operation.

The vertical position of the yoke 16 in the frame 17 is controlled by a hand wheel 26 and a screw-threaded shaft 27 extending through a stationary nut 28 in the top 18 of the frame 17 and connected at its lower end to the yoke 16. The frame 17 is pivotally mounted in the frame 9 by means of bolts 29 and is held in adjusted position by stud bolts extending through slots 31 in the side members 12 and connected to the members 19. Each of these stud bolts is provided with a wing nut 32 for clamping the frame 17 in adjusted position.

The variable position of the grinding wheel 6 to provide a tapering cut in removing a low spot is controlled by a cam mechanism comprising an arm or bar 33 having a pivoted connection at 34 to the axle 3 which does not rotate. The other end of the bar 33 has a vertical pin 35 projecting into a groove 36 of a cam 37 having a split collar 38 that is adapted to be clamped to the movable axle 2 by means of a bolt 39.

At an intermediate portion of the bar 33 is an inclined projecting member 41 which extends between the rollers 42 connected to the frame 9. The inclination of the member 41 is such that when the carriage moves along the rails the horizontal movement of the bar 33 about its pivot caused by the inclined groove 36 in the cam 37, causes a gradual raising or lowering of the rear portion of the frame 9 and a lowering or raising of the grinding wheel 6, but in lesser amounts, as the frame is turned about its trunnions 10.

While the ratio of vertical movement of the grinding wheel to the horizontal travel of the carriage may be arranged as desired, I preferably provide a tapering cut varying about 1/64 inch in depth for a travel of about 12 inches of the carriage along the track.

The position and inclination of the grinding wheel 6 may be adjusted by several mechanisms including certain of those previously described. For example, in adjusting the horizontal angle of the wheel, the frame 9 is rotated to the desired angular position by means of the trunnions 10 which are adjustably connected to the plate 11. These adjustments will, however, be relatively small and may be of the order of moving one end of the grinding wheel a distance of 1/64 inch or more under certain circumstances.

The horizontal position of the grinding wheel as a whole may be regulated by suitable adjustment of both trunnions 10.

The vertical angle of the axis of the grinding wheel with the rail is adjusted by varying the relative height of the trunnions by suitable means such as an adjusting nut.

The hand wheel 26 controls the vertical position of the grinding wheel 6 and its supporting mechanism including the yoke 16 and its vertical arms 15.

In the operation of the grinding apparatus of my invention it may be assumed that an irregu-

larity such as a projecting seam of a welded joint exists in the rail 5 beneath the grinding wheel 6 as shown in Figs. 1 and 6, and that it is desired to remove it by means of the grinding wheel 6. The latter is adjusted by means of the adjusting mechanisms described above to extend at the proper angle to conform to the normal convex upper surface of the rails and in such vertical position as to engage the rail at the irregularity desired to be removed.

The carriage 1 is then moved along the track for such distances as may be desirable by means of a hand wheel 46 which is connected to the axle 2 by means of a sprocket 47 and sprocket chain 48. Current for the motor 7 may be supplied in any suitable manner, such, for example, as by means of a conductor that is connected to the usual trolley wire, and connected through a conductor 49 and a switch 50 mounted on the frame 9. The grinding wheel rotates about an axis that is slightly oblique to the longitudinal axis of the rail and the upper surface of the rail is ground to its normal convex form.

When the wheel approaches a portion of the rail with which it engages, the initial portion of the cut is along a line that is substantially at the same angle as the axis of the grinder, and such cut extends over the convex upper surface of the rail. Accordingly, in the removal of any portion of the upper surface of the rail any irregularity that may be caused by excessive grinding at any particular portion of its travel will not cause a transverse depression in the rail, or a transverse projection, but any such irregularity will be engaged so gradually by the car wheels and will leave such irregularities so gradually that no rebound of the wheels will cause them to inflict any damage upon other portions of the rails.

In the case of projections above the normal surface of the rail, such as those at welded joints, the truck will be reciprocated by means of the hand wheel over the raised portions and the grinder will be operated to reduce the height thereof until the upper surface of the rails and the joint are of normal height and form. When the grinding operation is substantially finished a relatively slight cut may be taken at a relatively rapid rate over the surface being ground for the purpose of insuring that no irregularities remain as a result of the grinding operation.

In removing corrugations or irregularities that extend below the normal surface of the rail it will, of course, be necessary to reduce that portion of the rail by grinding off the higher spots between the depressions until the corrugated portions of the rail are substantially level. It will be necessary to extend such depressed portion of the rail somewhat in order to provide a properly inclined surface to the normal surface of the rails.

When it is desired to provide a gradual incline for a low spot, the cam mechanism for automatically varying the height of the grinding wheel is placed in operation when the carriage is at an appropriate position by tightening the bolt 39. The operation of the carriage then automatically produces a tapering cut. The direction of movement of the carriage and the movement of the bar 33 by the cam 37 determine whether the grinding wheel is raised or lowered, as will be readily understood.

In any case, however, the operation of the grinding wheel at an angle that is only slightly oblique to the axis of the rail insures that any change in the surface of the rail, such as may be caused by the normal operation of the grinder, or because of any accidental irregularity, will not operate to cause hammer blows of the wheels because of the gradual transition of the wheels upon engaging and leaving such irregularities.

It will be appreciated that in operating my improved grinder upon curved rails, or upon portions of tracks that are in other than straight lines and in level portions, the angle of the grinding wheel 4 may be adjusted to suitably conform to the curvature of the rails in order that the surface appropriate to such portions of the track may be maintained.

Furthermore, it may be desirable to employ a wheel whose outer surface is substantially a true cylinder instead of having a concave surface of the character described above.

The preferred horizontal angle of the axis of the grinding wheel to the longitudinal axis of the rail is about 18°, but such angle may be varied in accordance with the position or shape of the rail to be operated upon or in accordance with the relation of the contour of the outer portion of the grinding wheel to the shape of the upper surface of the rail.

It will be noted that the grinding wheel of my invention avoids the defects of apparatus of this character in use heretofore in that it is substantially impossible by accident or otherwise to cause irregularities in the rail that are transverse thereto and which operate to cause additional irregularities by reason of hammer blows caused by wheels passing thereover.

The foregoing and other advantages will be appreciated by those skilled in the art of grinders for railway rails.

I claim:

1. The method of eliminating substantially transverse irregularities occurring in track-rails which includes engaging the track-rail with the peripheral face of a grinding wheel having its axis disposed obliquely to a line extending transversely of the rail at right angles thereto, and effecting relative longitudinal movement between the track-rail and the grinding wheel while maintaining the engagement and the obliquity of the grinding wheel, whereby any grinding depressions are disposed angularly to the lines of contact made with the track rail by car wheels operating thereon.

2. The method of eliminating substantially transverse irregularities occurring in track-rails of predetermined convexity while maintaining said convexity, which includes engaging the track-rail with the peripheral face of a grinding wheel having its axis disposed obliquely to a line extending transversely to the rail at right angles thereto and having its peripheral face of a longitudinal concave contour corresponding with the predetermined convexity of the track-rail as modified by the obliquity of the grinding wheel, and effecting relative longitudinal movement between the track-rail and the grinding wheel while maintaining the engagement and the obliquity of the grinding wheel, whereby any grinding depressions are disposed angularly to the lines of contact made with the track-rail by wheels operating thereon and the predetermined convexity of the track-rail is maintained.

CYRIL A. FOX.