Feb. 11, 1941. O. BLOCK ET AL 2,231,105

COUNTING DEVICE OF AXLES OF RAIL VEHICLES

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Fig.1

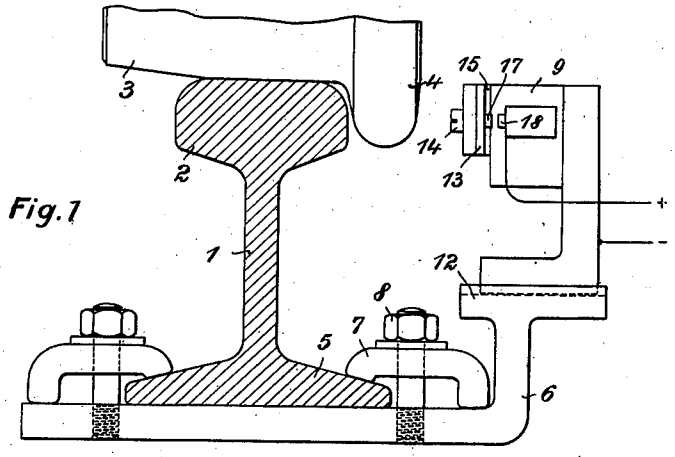


Fig.2

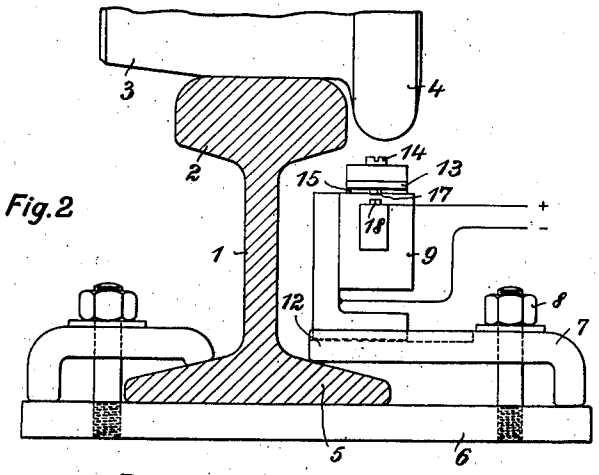


Fig.3

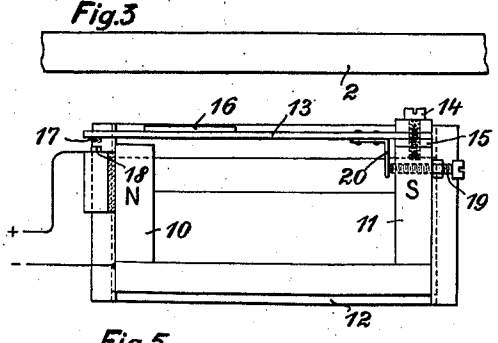
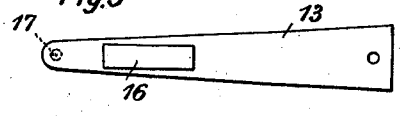


Fig.5



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COUNTING DEVICE OF AXLES OF RAIL VEHICLES

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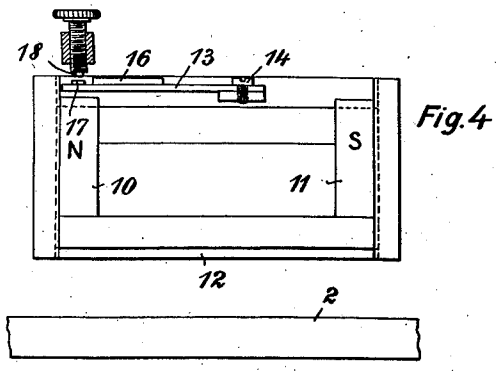


Fig.4

Fig.6

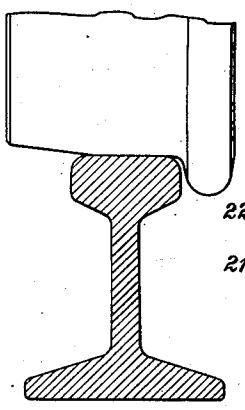


Fig.7

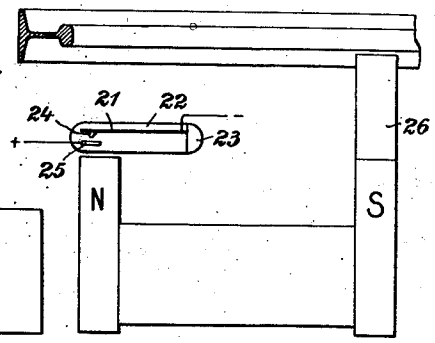


Fig.8

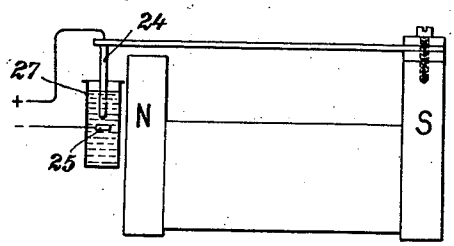
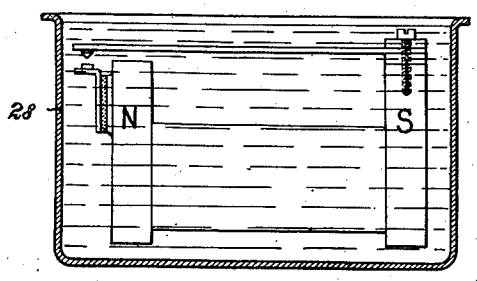


Fig.9



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UNITED STATES PATENT OFFICE

2,231,105

COUNTING DEVICE OF AXLES OF RAIL VEHICLES

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In Germany July 23, 1937

3 Claims. (Cl. 246—249)

For safety service of railway trains, it is desirable to count the axles of the trains passing a block length of rail, in order to be sure that in effect all trucks pass the controlled or supervised length of rail. For this purpose various so-called axle counting devices are already known, the purpose of which is to automatically prevent a blocked length of rail from being liberated, if all the axles which pass the length of rail have not completely passed over the latter.

The hitherto known arrangements employ either pressure contacts operated by the wheels, or they utilise the deflection of the rail under the influence of the pressure of the axle for varying an electrical resistance which is interposed in an operating current circuit. The so-called wheel feelers, which are arranged on the rails and which on passing of a wheel close a current circuit for the purpose of counting of axles, are subjected however to hard wear and fail completely at high train speeds. The devices functioning with an electrical resistance variable under the influence of the pressure of the axles have the disadvantage that it is very difficult to obtain a uniform variation of resistance during the passing of a wheel. Moreover, these devices necessitate relays or other amplifying arrangements.

Another axle counting arrangement works by means of a current induced in a winding on a permanent magnet, and generated when a wheel runs past the poles of the magnet. The induced current so generated is amplified by relays or other devices are used to count the axles. Such an arrangement, however, is very dependent on the speed at which the wheel passes. At low velocities for example in shunting service, such an arrangement fails. Moreover, considerable amplification of the impulses by relays and the like is necessary in any event.

The counting device of axles in accordance with the invention also employs permanent magnets but not to produce an induced current, which is employed after amplification for actuating the counting device, but a current circuit for the counting device is opened or closed directly by a magnet, so that direct current and also alternating current can be employed.

Axle counting devices in which an armature is resiliently mounted in front of a permanent magnet, which armature varies its position to open or close respectively a signal current circuit when the train passes over it, are already known. The magnetic field operating the contact is, however, short-circuited thereby by the iron of the wheels and axles travelling over the rails. Such an arrangement is found to be unreliable and where iron sleepers are used the satisfactory working of the device is completely impossible, as the magnet circuit would be constantly closed by the sleepers. Moreover, the rails, wheels and axles must co-operate for the satisfactory operation of the device. It is obvious that the greater the number of elements, the greater is the possibility of defects.

Contrary to the known arrangement, in accordance with the present invention, a permanent magnet provided with an armature controlling the signal current circuit is arranged in the vicinity of the head of a rail and the stray field of the magnet is influenced by the wheel flange in such a manner that the resiliently mounted armature varies its position in consequence of the field variation to open and close the signal current circuit. The effect is in consequence independent of the creation of a magnetic short circuit. The device in accordance with the invention can be employed without any difficulty in conjunction with rails supported on iron sleepers. Moreover, the entire arrangement requires much less space than the known apparatus. The possibilities of failure are considerably reduced in consequence of the omission of connections to both rails. The armature is so dimensioned that it does not absorb all the magnetic lines of force, and a large leakage field is created, so that numerous magnetic lines of force can be received by the wheel travelling on the rail, and in consequence the armature is strongly influenced to change its position. The advantageous effect of the stray field can, if desired, still be increased by the selection of an appropriate form of the permanent magnet, for example, by the employment of a bar magnet or modified bar magnet.

The present invention is differentiated from the known counting devices in that in the known devices a current impulse is generated dependent in magnitude on the speed of the wheel, whilst in the present invention the magnetic circuit of the magnet is influenced by the aid of the wheel, that is to say, is either strengthened or weakened at predetermined positions. A further important difference consists in the fact that a device employing inductive actuation usually employs an open magnet circuit with possibly small magnetic leakage, while it is of considerable importance to the present invention to obtain a magnetic circuit with the greatest possible stray field.

As bar magnets possess the greatest leakage field and in consequence have only a small attraction on an iron armature in comparison with a bar which has the same measurements but is bent to a U-shape with its ends close together, the employment of a straight bar magnet perhaps with the ends bent over, or with angularly extending pole pieces, but not with the ends close together as in a U-magnet is suitable for the present invention.

When the field is unvaried, that is to say, after the wheel has passed, the magnetic body, in accordance with the invention, returns to its equilibrium position. Possibly the field may be varied in the reverse sense to effect this return, but it is advantageous, however, to use for this purpose a force of gravity or of a spring.

The signal arrangement released by the oscillating magnetic body can be of any suitable design. Preferably the oscillating magnet body closes and opens an electric current circuit, which operates a counting or signal arrangement. In the air gap between the head of the rail and the magnet pole, the magnetic body is fixed on a spring which also supports an electric contact plate. The spring itself need not be of magnetic material, although a steel spring may of course be employed, upon which if necessary an iron armature is mounted. The weight of the spring and magnetic mass, the length and/or force of the spring are chosen in such a way that for the range between stationary conditions and the highest velocity of the train the natural frequency of the spring system may be neglected. It has been found expedient to use a spring preferably of trapezoidal form, rather than one of rectangular shape.

In order to adapt the arrangement to various working conditions of the location in which it is used, or to be able to carry out modifications during the use, it is preferable to make the force and/or the equilibrium position of the spring relatively to the magnet poles adjustable. The spring itself can be fixed on the second magnet pole, but it can also be arranged independently of the magnets. In the latter case it is sometimes preferable to connect the second magnet pole in a magnetically conducting manner with the rail.

In order to confine the magnet system to a small space, the latter can entirely or partially be placed in the hollow space of the rails. Conveniently, the magnet system is fixed on the base or foot of the rail by means of a rigid clip. The magnet poles can be arranged longitudinally of the rails or vertically thereto. A slide guide may be provided in order to adjust the distance of the device in regard to the head of the rail.

For protection against influences of various kinds, the magnet with the oscillating system may be conveniently enclosed by a magnetic housing at a distance sufficiently far so as not to impede the working of the device, but to eliminate all external disturbances. Further, it is possible to produce the magnet in a known manner from magnetic material pulverised from an alloy of high coercivity, the particles of which are enclosed in a housing or are cemented with a binding agent.

The oscillating iron piece or armature or the spring and the contacts may be enclosed in an insulating sleeve, for example, of glass, for protection against the atmospheric influences and against a damage of the contact plate by arcs caused by opening or closing of the circuit. Conveniently this housing is evacuated and filled with inert gas. The magnet system and the oscillating system may be also immersed with the electrical contact in an insulating liquid, for example, oil, in the housing. For the same purpose the electric contacts alone may be immersed in a receptacle filled with insulating liquid.

The mode of working of the device in accordance with the present invention is based on the following process:

The magnetic body, for example a steel spring, movably mounted in the vicinity of a magnet pole overcomes under the force of attraction of the pole a part of the force of the spring, and the body remains in an equilibrium position corresponding to that force, so long as the number of lines of force penetrating the spring does not vary. If, however, the iron mass of the rim of a wheel comes in the neighbourhood of the magnet, the state of the oscillating member immediately varies. As air has a great magnetic resistance, the lines of force return by way of the iron in the neighbourhood, and the iron therefore acquires a great part of the stray field. If this iron collecting the stray lines is on the side of the magnet, at which side the spring is situated, the magnet field is strengthened on this point by the amount of the stray lines collected and the leaf spring is removed from its actual rest position and is attracted towards the magnet pole. However, the spring will be repelled from the magnet if the iron piece or armature is on the side remote from the leaf spring, as in this case the lines of force reinforcing the field do not penetrate the spring but weaken the field of the latter.

The invention will now be described with reference to the accompanying drawings, showing by way of example one embodiment:

In the drawings Figures 1 and 2 are side elevations of two different arrangements of the counting device;

Figures 3 and 4 show in plan two different arrangements of the oscillating system;

Figure 5 is a diagrammatical view with the spring with the magnetic piece or armature;

Figures 6 and 7 show two different arrangements of the spring enclosed in an insulating sleeve;

Figures 8 and 9 illustrate the immersion of the electrical contacts, or of the entire device respectively, in an insulating liquid.

On the rail 1 is fixed by means of the clip 6 the contact device and the clip is held on the foot of the rail 5 by means of stirrups 7 and the bolts 8. In the arrangement shown in Figures 1 and 3 the magnet 9 is placed with the spring 13 laterally of the head of the rail 2 so that the flange 4 of the wheel 3 runs through the air gap between the magnet and the rails. In accordance with Figure 2 the magnet is arranged close to the rail with poles directed upwards. In the arrangement in accordance with Figure 4, the magnet is situated laterally of the head of the rail, however, the poles N, S, are remote from the rail. In consequence, the spring 13 is also placed upon this side.

The contact device may be displaced entirely in the slide 12 in regard to the rail.

The spring plate 13 carries the magnetic armature 16 and the contact plate 17, which is arranged opposite to the second electrical contact plate 18. On the bar magnet 9, which is of the strong permanent kind, are mounted the pole pieces 10 and 11. The spring can be mounted

on the pole 11 by means of a screw 14. A non-magnetic plate, for example, a brass plate 15 may be inserted between the pole and the spring. The spring may also be made shorter, as illustrated in Figure 4, and be mounted at any desirable point. For fine adjustment of the position of the spring, an angle bar 20 may be provided which bears against the set screw 19.

The Figures 6 to 9 illustrate various embodiments of the invention for the protection of the spring and of the contact plate. In accordance with Figures 6 and 7, the spring 21 which carries the contact plate 24, is enclosed with the contact plate 25 in the glass tube 22. The spring is fused in the glass at 23. The conducting wires of the operating current circuit are installed in the known manner through the glass. As can be seen from both figures, the glass tube with the spring can be arranged either vertically or horizontally. Figure 7 shows, moreover, another magnetic connection 26 between one pole and the rail.

In accordance with Figure 8, the contact bar 24 which is drawn down, immerses in a receptacle 27 which is filled with insulating oil or the like. The fixed contact 25 is fixed opposite to the contact 24. In accordance with Figure 9, the device formed in the manner of Figure 2 is built in a housing 28 and is immersed in the insulating oil.

What we claim is:

1. A device for sensing passage of a magnetically permeable track wheel portion through a zone adjacent a track rail section comprising a permanent magnet having relatively widely separated ends facing said rail section supported with both its ends near but in spaced relation both to the rail section and the path of motion of the wheel portion whereby the wheel portion is interposed in the stray field of the magnet between the magnet ends and the rail; a substantially light, flexible armature normally spaced with respect to one of the magnet ends, positioned between the magnet end and the path of the moving wheel portion and moved towards the near magnet end by changes in the stray field of the magnet caused by said wheel portion; and circuit controlling means operated by movement of the armature.

2. A metallic wheel sensing mechanism comprising a permanent magnet having widely spaced poles mounted with its ends proximate the path of a wheel along a rail section whereby, when passing, a portion of the wheel is disposed within the stray field of the magnet producing a zone of local concentration of lines of magnetic force having substantially the cross-sectional area of the magnet end between the wheel path and one of the magnet ends; a light armature, normally positioned in spaced adjacency to the magnet end in said zone but movable toward the magnet end by said concentration of force-lines; and circuit control means operated by movement of the armature.

3. A device for sensing a wheel passing along a rail section comprising a U-shaped permanent magnet mounted with its ends in spaced proximity to the rail section and near the path of the wheel in a manner such that during movement, a portion of the wheel occupies a position within the stray field of the magnet producing a zone of local concentration of magnetic force-lines between one magnet end and the wheel in its path on the rail section and having substantially the cross-sectional area as the magnet end; a yieldable light armature, normally positioned in spaced relation to the said magnet end and disposed in said zone but movable toward said magnet end by said concentration of force-lines; and circuit controlling means operable by movement of the armature.

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