(57) Abstract: A guide roller assembly 10 comprises a base plate 12 to which a roller cluster 14 is fitted. The cluster 14 consists of a rail load carrier facing roller engaging surface roller 16 mounted to a swivellably mounted roller carrying formation pair 18 and a pair of facing rail side face engaging rollers 20 each mounted to a roller carrying arm formation 24. The ends of the formation pairs 18 and the arm formations 24 remote from the locations of roller mounting interact with rubber cushioning 30, 48, 68 that resiliently resist roller displacement resulting from lateral movement of a skip fitted with assemblies 10. Cushioning resistance to compression of the cushions 48 is promoted by forming them by way of narrow girths flaring towards opposite cushion ends.
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(1) TITLE OF THE INVENTION
GUIDE ROLLER ASSEMBLY

(2) BACKGROUND TO THE INVENTION

Skips used along mining shafts are guided against lateral displacement during shaft traversal by way of rails extending along facing walls down a shaft. Guiding is achieved by means of roller assemblies fitted to the skip in a way that cause them to engage with the opposite rails. Typically two roller assemblies are mounted one at a high and the other at a low elevation along each side of the skip that face a rail to guide the skip in a centralised way along the shaft. The object of maintaining proper centralisation is to prevent the skip from coming into contact with the rails and other equipment running along the shaft wall or even the wall as such that can cause excessive wear and even result in the damaging of equipment. While skips are often fitted with slipper plates to serve as additional backup in preventing skip to shaft or equipment contact, contact between such plates and the guide rails or other equipment is not desirable as it is by way of non rolling abrasive sliding motion that causes undesirable wear. While shafts are meticulously formed they can never be fully symmetrically and straight down formed into the earth. The same applies to the railing that is used for centralising the movement of a skip along a shaft by way of the roller assemblies. Typically in a well-prepared shaft the railings are aligned along a straight line within five millimetres measured over three guide support sets. This alignment is within ten millimetres for an average shaft and within twenty millimetres for a poor shaft. With a travelling speed of between 12 and 18 metres per second the shaft configuration naturally creates lateral displacement of a skip travelling there along that can pick up substantial momentum when such skip is loaded. It is, amongst others, an object of this invention to accommodate the lateral movement of a skip or other conveyance along a shaft in a way that extensively reduces the possibility of skip to rail, equipment or shaft contact during shaft traversal despite the normal lateral skip movement that exist during such shaft traversal.

(3) FIELD OF THE INVENTION

This invention relates to a guide roller assembly of which a plurality are securable to a shaft bound load carrier for promoting its rail-guided movement against equipment wear along its shaft. Although not so limited the invention is of useful application in the case of guiding a skip along its minshaft.
(4) PRIOR ART DESCRIPTION

Guide roller assemblies conventionally used to accommodate lateral skip movement during shaft traversal amongst others make use of sprung skip lateral displacement resisting means of which the resisting effect is from time breached causing abrasive skip to rail engagement in turn resulting in rapid wearing of the equipment. These assemblies also do not cater for the difference between inter rail lateral movement and rail lateral movement that take place otherwise even though the inter rail lateral movement is more critical in that skip to rail abrasive engagement take place more easily in such direction. It is thus an object of this invention to address this situation.

(5) BRIEF DESCRIPTION OF THE DRAWING

The invention is now described, by way of example, with reference to the accompanying drawings. In the drawings

Figure 1 shows a guide roller assembly, according to in invention, in plan view,

Figure 2 shows the assembly in side elevation,

Figure 3 shows the assembly in frontal view,

Figure 4 diagrammatically shows the operation of the assembly once fitted to a shaft bound load carrier in accommodating its lateral inter rail displacement during shaft traversal while omitting the rollers that accommodate carrier displacement in the direction transverse to opposing load carrier guiding rails,

Figure 5 diagrammatically shows the operation of the assembly in accommodating the lateral displacement of an assembly fitted load carrier in one direction transverse to opposing load carrier guiding rails during shaft traversal, and

Figure 6 in partially sectioned side view shows the constitution of a guide roller forming part of the assembly.

(6) DETAILED DESCRIPTION OF THE DRAWINGS

Referring to the drawings a guide roller assembly, according to the invention is generally indicated by reference numeral 10.

The assembly 10 comprises a roller carrier in the form of a base plate 12 to which a roller cluster 14 is fitted. The cluster 14 is constituted from a rail load carrier facing roller engaging surface roller 16 mounted to roller carrying means in the form of a swivellably mounted roller carrying formation pair 18 and a pair of facing rail side face engaging rollers 20 facing one
another across a rail guiding recess 22 while each is mounted to roller carrying means in the form of a swivellably mounted roller carrying arm formation 24. The rollers 20 are mounted to their respective arm formations 24 to the effect of causing their axes of rotation 26 to be in parallel with one another while standing at right angles to the axis of rotation 28 of the roller 16. The rollers 16, 20 are further mounted to result in the axes 26, 28 to extend at least substantially co-planarly.

The rollers 16, 20, are mounted to be displaced transverse to their respective axes of rotation 26, 28 in response to the appropriate swivelling of the formation pair 18 and the arm formations 24 of which the ends remote from the rollers 16, 20 interact with resilient load carrier lateral displacement accommodating means in the form of rubber cushioning 30 of which the function is to resiliently resist roller displacement as brought about by lateral movement of a shaft bound load carrier such as a mining skip, as thus appropriately fitted with a number of assemblies 10, during shaft traversal.

Each of the formations 18.1, 18.2 of the formation pair 18 extends through an elbow 32 at which position it is mounted via a swivelling element 34 to a bracket 36 secured to the base plate 12 to swivel about a common axis 38. Each formation 18.1, 18.2, as thus formed to perform a toggle type swivelling motion, consists of an outwardly extending section 40 and a base plate following section 42. The roller 16 is mounted to a shaft 44 extending between the outer end regions of the sections 40. The outer ends of the sections 42 are cushioned by the cushioning 30 of which the function is to resiliently resist displacement of the rail load carrier facing roller engaging surface roller 16 in the direction of arrow 46. The cushioning 30 so associated with the formations 18.1, 18.2 are in the form of a pair of rubber cushions 48 extending in alignment with adjacent arm section end locations 50 from the base plate 12.

To prevent the formations 18.1, 18.2 from extending with excessive play if at all between the outer surface 52 of a rail 54 (shown in broken lines in figure 1) against which its runs via the roller 16, and the cushions 48 once the relevant number of assemblies 10 are fitted to a skip once in operative shaft bound use the formations 18.1, 18.2 are each fitted with an adjustment mechanism in the form of an adjusting bolt 56 fitting threadably along an aperture through each of the end locations 50. The cushion engaging ends of the bolts 56 are adequately extensive and flat to ensure an extensive bolt to cushion abutment effect that also contributes to limiting the possibility of cushion damaging on their becoming compressed during operative use of the assembly 10.
Cushioning sensitivity is promoted by giving it an extensive physical range of compression. To this effect the fulcrum as found at the axis of swivelling 38 of the formations 18.1, 18.2 is situated to give the sections 42 leverage advantage of in the order of two to one over the sections 40. A small displacement of the roller 16 is consequently transposed to a larger displacement of the end regions 50. While the leverage advantage is given as two to one it will be appreciated that is not in any way so limited. The leverage advantage, if any, is naturally a function of the compression characteristics of the cushioning 30. Being generally egg timer shaped thus having a narrow girth flaring towards opposite broader end faces has the effect of causing the cushions 48 to non-linearly progressively increase resistance to swivellable displacement of the formations 18 as brought about by the appropriate lateral displacement of a skip to which a plurality of assemblies 10 are fitted in centalisably accommodating its displacement.

In contrast with the formation pair 18 the arm formations 24 extend along linear central axes. Their axes of swivelling 58, being parallel to one another, stand at right angles to the axis of swivelling 38 of the formation pair 18. The arm formations 24 are mounted via elements 60 to brackets 62 extending away from the base plate 12. The axes 58 and 38 extend in substantially the same plane.

The rail side face engaging rollers 20 are mounted to the outer end regions 64 of the arm formations 24 while their inner end regions 66, similar than in the case of the arm formation pair 18, interact with the cushioning 30, in the form of an inboard mounted cushion 68 for each arm formation 24. The functions of the cushions 68 are again to resiliently resist displacement of the rollers 20, however in this case accommodating lateral displacement of a skip relative to a rail 54 in contrast with the cushions 48 of which the functions are to accommodate inter rail displacement of a skip between rails secured to opposite shaft walls during shaft traversal. While the lateral displacement of the skip as centralisably accommodated by the cushions 68 during shaft traversal is less intense than in the case of inter rail lateral displacement the cushions 68 are of a conventional linear compressive resistibility as of pad like fixed cross section.

Similar to the formation pair 18 the formations 24 are also fitted to enable their adjustment to extend against excessive play if at all between the side surfaces 70 of a rail 54 against which they run via their rollers 20, and their respective cushions 68 once the relevant number of assemblies 10 are fitted to a skip once in operative shaft bound use. Adjustment is again achieved via an adjustment mechanism in the form of an adjusting bolt 72 for each arm formation 22 fitting threadably along an aperture through the end region 66 of each arm.
formation 24. The cushion engaging ends of the bolts 72 are again adequately extensive and flat to ensure an extensive bolt to cushion abutment effect that also contributes to limiting the possibility of cushion damaging on their becoming compressed.

In more particular referring to figure 4 and in centralisably accommodating inter rail skip displacement, the sideward movement of a skip 74 towards the rail 54 during shaft traversal causes the formation pair 18 of an appropriate assembly 10 to become progressively swivelled in the direction of arrow 46 as a result of the force exerted by the rail 54 on the roller 16. This has the effect of causing the end locations 50 of each formation 18.1,18.2 to via the outer ends of their adjusting bolts 56 exert a progressively increasing compressing force on the cushions 48 that thus increasingly resist and accordingly accommodate the displacement of the skip in this direction as progressively shown between figures 4(a) and 4(c).

As the design of the cushions 48 effect a non-linear, even to the extent of being exponentially, increase in compressive resistance, the inter rail lateral movement of the skip 74 in the direction of arrow 46, while at the outset being resisted in a normal way for the conventional type of rubber cushioning used in this application, is progressively vigorously resisted on further displacement in the direction of the rail 54 than would have been the case if the cushioning only catered for a linear increase in compressive resistance. This has the effect of more effectively limiting the possibility of the skip or its slipper plates coming into metal-to-metal resistive sliding contact with the rail that would result in excessive equipment wear.

It will be appreciated that while the design of the cushions 48 as specifically shown has the characteristic of a non-linear progressively increasing resistance to compression other cushioning designs can also have this characteristic. A conventional regularly profiled cushion that is formed with apertures extending transverse to its direction of compression will thus also have a non-linear progressively increasing resistance to compression though more by way of a stepped increase to compression at the instant where such cushion has been compressed to the extent of its apertures becoming closed.

In further more particular referring to figure 5 skip displacement during shaft traversal transverse to the plane extending between the rails is accommodated by the rollers 20 and their associated arm formations 24. The operation of the arm formations 24 is similar to that as described for the formation pair 18 with reference to figure 4. Resistance to increased displacement of the appropriate arm formation 24 of the relevant assembly 10 in the direction
of arrow 76 as progressively shown from figures 5(a) to 5(c) is again found in the resistance to compression of the relevant cushion 68. The functions of the cushions 68 are again to resiliently resist displacement of the rollers 20, however in this case accommodating lateral displacement of a skip relative to a rail 54 in contrast with the cushions 48 of which the functions are to accommodate inter rail displacement of a skip between rails secured to opposite shaft walls during shaft traversal.

It will be appreciated that the operation of the assembly 10 as discussed independently for inter rail and rail lateral displacement with reference to figures 4 and 5 for each of the assemblies fitted to a skip 74 in effect takes place integrally during skip shaft traversal as the skip is caused to be laterally to its central axis of displacement displaced in all possible directions as brought about by factors such as not fully linearly extending rails, non-perfect shaft formation and even inherent skip oscillation during its shaft traversal.

In referring to figure 6 each roller 16, 20 is in the form of a hub 78 fitted with a resilient tyre in the form of a rubber tyre 80 formed with internal reinforcing in the form of tyre embedded meshed woven strands 82. The tyres 80 are typically formed by layer-wise wrapping the meshed strands 82, typically in the form of elongated chicken wire mesh, around a rim 84 and sandwiching it between layers of rubber 86 that is vulcanised into position causing the integral bounding of the strands 82 to each other and onto the rim 84. Each tyre 80 naturally protrudes beyond its rim 84 typically to the extent of about five millimetres. Once the tyre 80 has worn to the extent of the rim 84 running against a rail the relevant roller naturally requires replacement.

The hardness of the rubber of the tyres 80 typically lies between IRHD values of 40 to 90 and preferably 70 though depending on the particular duty of the tyre 80 and the unevenness of the shaft guide rails 54.

It will be appreciated that the rollers 16, 20 can be in the form of any other conventional type thus not limited to the figure 6 configuration.

While the assembly 10 finds useful application in its use in conjunction with mining operation type skips it will be appreciated that it can be usefully employed under all circumstances of load carrier shaft traversal such as an ordinary lift in a building.

It is an advantage of the invention as specifically described that particular provision is made to limit the possibility of load carrier to shaft of traversal equipment contact otherwise than by way of the rail guided rollers thus obviating equipment wear.
(5) CLAIMS

(1) A guide roller assembly (10) of which a plurality are securable to a shaft bound load carrier (74) for promoting its rail-guided movement against equipment wear along its shaft comprising

a roller carrier (12) via which the assembly is securable to such load carrier,

a roller cluster (14) that is fitted to the roller carrier (12) to the effect of its rollers (16, 20) being rollably guided by a shaft extending rail (54) once such load carrier, as thus appropriately fitted with guide roller assemblies (10), is in use, in centralisally stabilising such load carrier against shaft equipment and load carrier wear creating lateral movement during shaft traversal owing to at least the majority of rollers (16, 20) of the cluster (14) being mounted via roller carrying means (18, 24) to be displaced transverse to their axes of rotation (26, 28) while being urged by resilient load carrier lateral displacement accommodating means (30, 48, 68) into resiliently resisting lateral load carrier displacement during load carrier shaft traversal characterised in that

at least one of the displaceably mounted rollers (16) though to the extent of maintaining a balanced carrier lateral movement accommodating effect relative to a rail and in the case of a rail presenting a load carrier facing roller engaging surface (52) at least the at least one roller that co-acts with such surface (52) though in the case of a number of rail load carrier facing roller engaging surface rollers (16) then being mounted in adjacent co-axial relationship, being urged by resilient load carrier lateral displacement accommodating means (48) that is of compressively resilient character.

(2) A guide roller assembly as claimed in claim 1 in which the compressively resilient load carrier lateral displacement accommodating means (48) is of non-linear progressively compression resisting resilient character to the effect of non-linearly progressively increasingly resisting rail load carrier facing roller engaging surface roller displacement at least from a specific extent of displacement accommodating means compression if not through its full range of compression.

(3) A guide roller assembly as claimed in claim 2 in which the roller carrying means (18) of at least the rail load carrier facing roller engaging surface roller (16), as thus guidable along an appropriately profiled rail, is in the form of swivellably arranged roller carrier (18) as thus swivellable along an arc extending in a plane transverse to the axis of rotation of its roller (16).
(4) A guide roller assembly as claimed in claim 3 in which the roller carrier (18) of the rail load carrier facing roller engaging surface roller (16) is lever fashion mounted with its roller being mounted at its one end while its opposite end (50) interacts with the compressively resilient carrier lateral displacement accommodating means (48) in compressively resisting roller displacement once the assembly (10) is in operative use.

(5) A guide roller assembly as claimed in claim 5 in which the roller carrier (18) extends to give a substantial leverage advantage towards its side interacting with the compressively resilient carrier lateral displacement accommodating means resulting in a smaller extent of arcuate displacement of the roller (16) being converted into a larger extent of arcuate displacement of its end region (50) so interacting with the compressively resilient carrier lateral displacement accommodating means (48).

(6) A guide roller assembly as claimed in claim 6 in which the leverage advantage is in the order of two to one as reflected by the length (42) of the roller carrier between its fulcrum and its compressively resilient carrier lateral displacement accommodating means interacting end being in the order of twice that (40) of between its fulcrum and its roller.

(7) A guide roller assembly as claimed in any one of claims 4 to 6 in which the roller carrier (18) extends through an elbow (32) resulting in its being formed to perform a toggle type swivelling action.

(8) A guide roller assembly as claimed in any one of claims 4 to 7 in which the roller carrier (18) includes an adjustment mechanism (56) for adjusting the relationship between the resilient carrier lateral displacement accommodating means (48) and its associated roller carrier interacting end (50) for limiting play between its roller (16) and a rail (54) and the roller carrier (18) and the resilient carrier lateral displacement accommodating means (48) once the assembly (10) is fitted to an operatively installed load carrier.

(9) A guide roller assembly as claimed in any one of claims 4 to 8 in which the roller carrier (18) is in the form of an independently swivellably mounted roller carrying formation pair (18.1, 18.2) between and at the one end of which the rail load carrier facing roller engaging surface roller (16) is rollably mounted while the opposite ends of the formations (18.1, 18.2) interact with the compressively resilient carrier lateral displacement accommodating means (48).

(10) A guide roller assembly as claimed in any one of claims 4 to 9 in which the compressively resilient carrier lateral displacement accommodating means (48) is in the form of rubber cushioning of appropriate characteristics and design to render it desirably resistively
resilient for the purpose intended, in the case of the roller carrying means (18) being in the form of an independently swivellably mounted roller carrying formation pair (18.1, 18.2) the cushioning (30) in the appropriate case being in the form of a cushion (48) for each of the formations.

(11) A guide roller assembly as claimed in claim 10 in which the cushioning (48) is of generally egg timer shape thus presenting a narrow girth flaring outward to opposite ends; being so shaped thus rendering it non-linearly progressively increasingly resistant to compression as brought about by rail load carrier facing roller engaging surface roller displacement once the assembly as load carrier fitted is in operative use.

(12) A guide roller assembly as claimed in any one of the preceding claims in which the remainder of the rollers (20) of the roller cluster (14), thus excluding the at least one roller (16) that is urged by resilient carrier lateral displacement accommodating means of compressively resilient character, and as displaceably mounted, are each mounted to a roller carrier in the form of an independent swivellably arranged roller carrying arm formation (24) with each roller (20) thus being swivellably along an arc extending in a plane transverse to its axis of rotation (26).

(13) A guide roller assembly as claimed in claim 12 in which the roller carrying arm formations (24) are lever fashion mounted with each's rail engaging roller (20) being mounted at its one end (64) while its opposite end (66) co-acts with its associated resilient carrier lateral displacement accommodating means (68) in compressively resisting roller displacement once the assembly as load carrier fitted is in operative use.

(14) A guide roller assembly as claimed in claim 13 in which the resilient carrier lateral displacement accommodating means (68) associated with each arm formation (24) is in the form of rubber cushioning of appropriate characteristics to render it desirably resilient for the purpose intended.

(15) A guide roller assembly as claimed in claim 13 or claim 14 in which the roller carriers (24) each includes an adjustment mechanism (72) for adjusting the relationship between the associated resilient carrier lateral displacement accommodating means (68) and its associated roller carrier interacting end (66) for limiting play between its roller (20) and a rail (54) and the roller carriers (24) and the resilient carrier lateral displacement accommodating means (68) once the assembly (10) is fitted to an operatively installed load carrier.

(16) A guide roller assembly as claimed in any one of claims 13 to 15 that is constituted of the rail load carrier facing roller engaging surface roller (16) and a pair of facing rail side face
engaging rollers (20) facing one another across a rail guiding recess (22) formed in conjunction with the rail load carrier facing roller engaging surface roller (16) and of which rail side face engaging rollers (20) the axes of rotation (26) stand transverse to that (28) of the rail load carrier facing roller engaging surface roller (16) though parallel to one another, the assembly thus being employable in being guided along a rail (54) of rectangular profile as conventionally used in mining operations.

(17) A guide roller assembly as claimed in claim 16 in which the axes of rotation of the various rollers (26, 28) extend co-planarly while in the case of the roller carrier (18) of the rail load carrier facing roller engaging surface roller (16) being in the form of lever mounted facility the axes of swivelling (38, 58) of various roller carriers (18, 24) also extending co-planarly.

(18) A guide roller assembly as claimed in any one of the previous claims in which at least the majority of guide rollers (16, 20) are fitted with resilient tyres (80) each incorporating internal reinforcing (82).

(19) A guide roller assembly as claimed in claim 18 in which each tyre (80) is in the form of solid rubber tyre fitted to a deep groove formed in its wheel hub (78) while protruding substantially beyond the outer rim (84) of its hub.

(20) A guide roller assembly as claimed in claim 17 or claim 18 in which the internal reinforcing (82) is in the form of circumferentially extending tyre embedded meshed woven strands.