April 18, 1967 H. HUNDHAUSEN ETAL 3,314,514

CONVEYOR BRAKE

Filed Sept. 6, 1966 2 Sheets-Sheet 1

Fig. 1

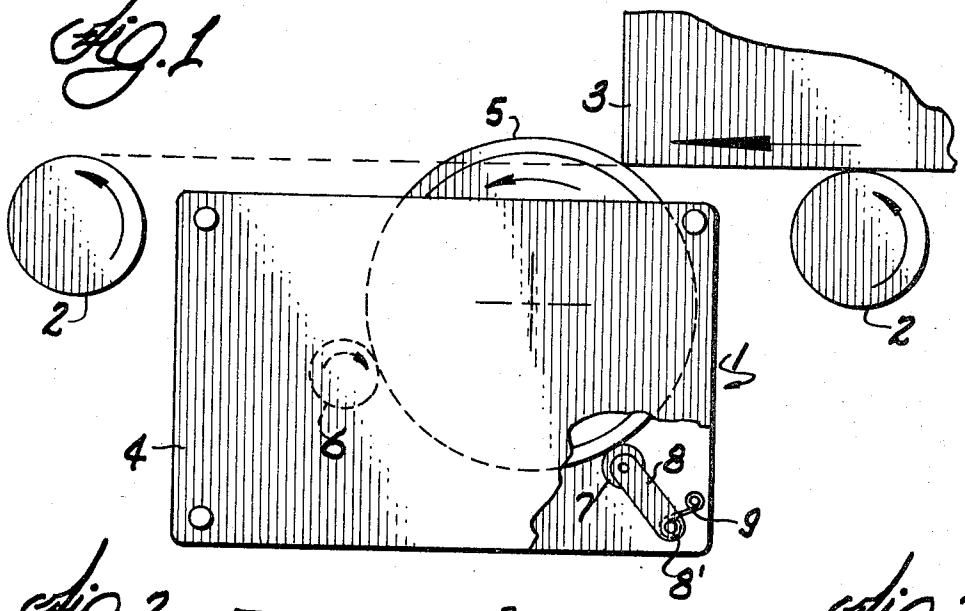


Fig. 2

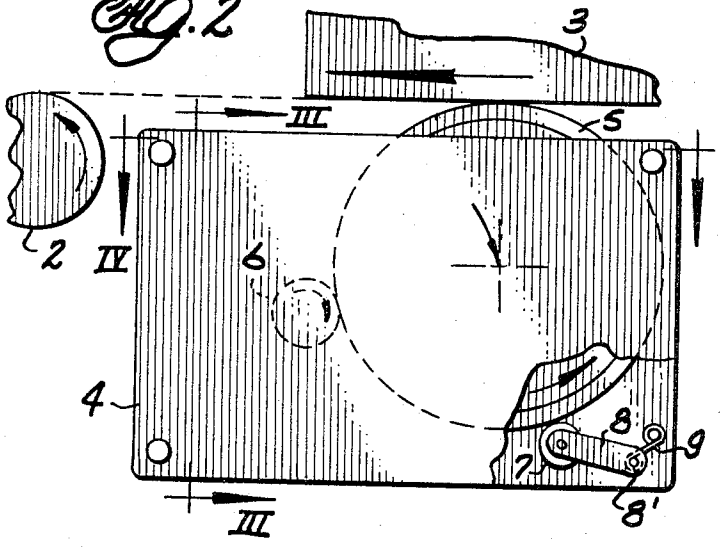
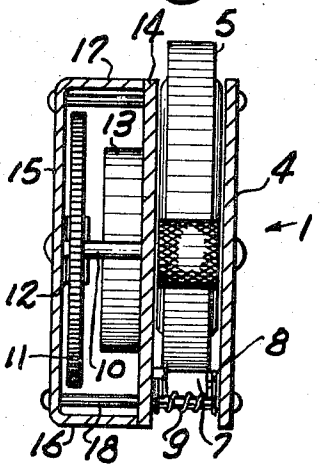


Fig. 3



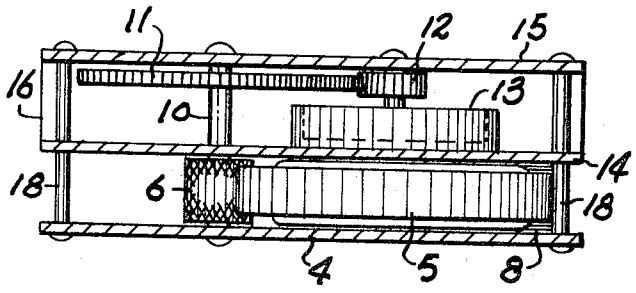


Fig. 4

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Fig. 5

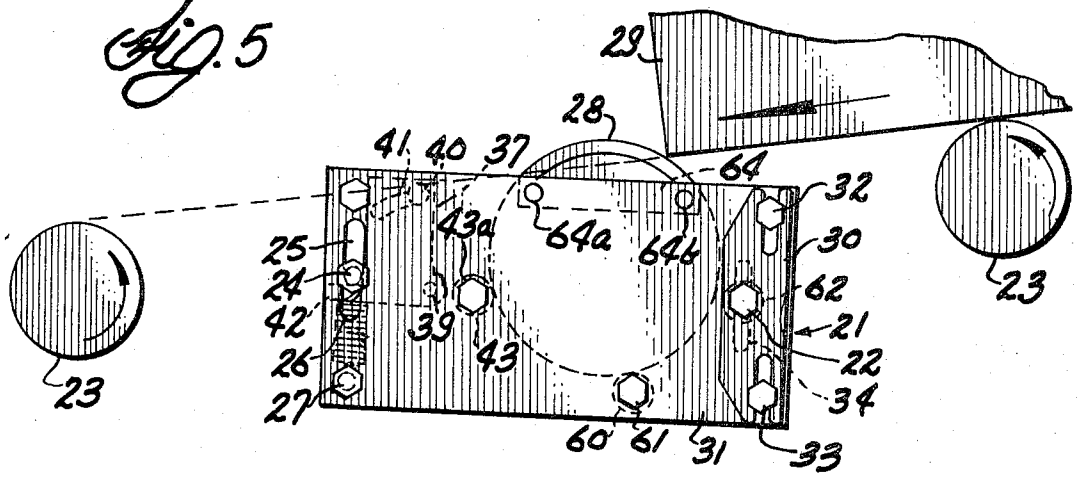


Fig. 6

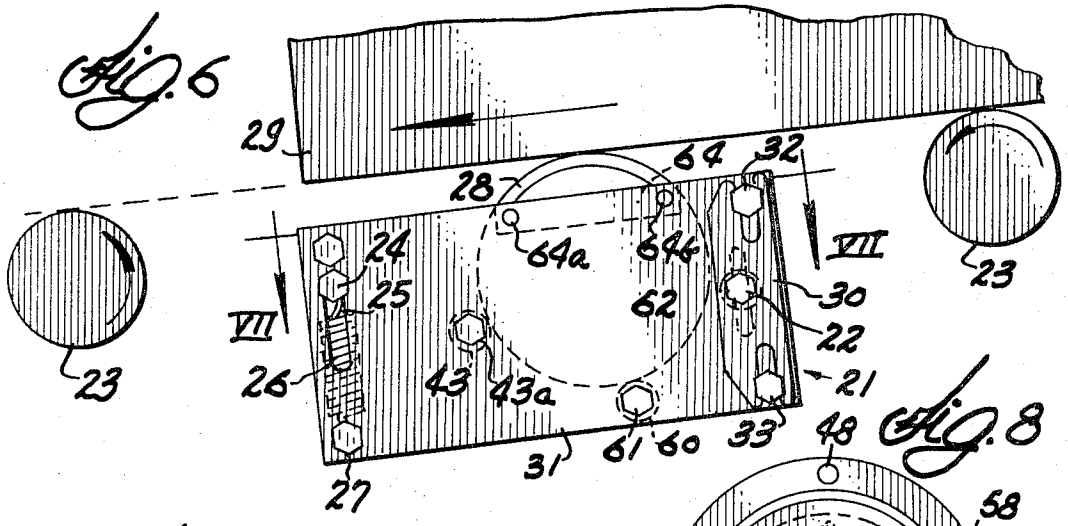


Fig. 7

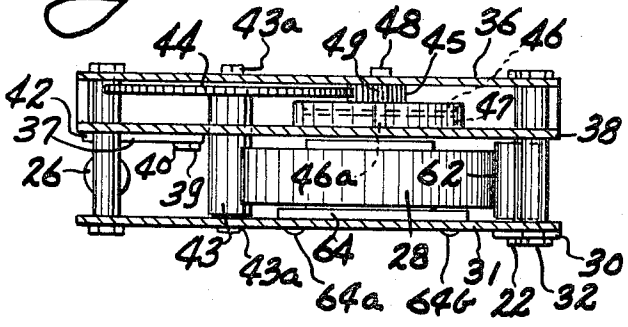
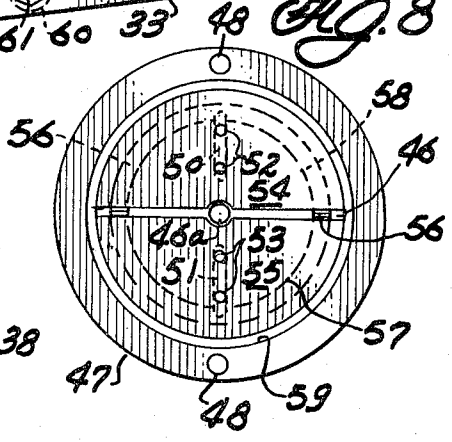


Fig. 8



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CONVEYOR BRAKE

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Claims priority, application Germany, Sept. 15, 1965, St 24,394

6 Claims. (Cl. 193—35)

This invention relates to a low-cost, highly-effective braking arrangement, particularly for braking goods being moved or conveyed along a roller conveyor track, for instance the braking of boxes or the like. In a preferred embodiment it comprises a contacting roller which resiliently engages the goods to be braked, a housing, appropriate gearing and a centrifugal brake which exerts a braking action depending upon the rotational speed of the braking elements. The primary roller of the brake is free floating, e.g., axle-free, and projects over the outline of the housing into the path being traversed by the moving goods such that the kinetic energy of the moving goods is resiliently transmitted to the input wheel of the gearing for dissipation in the centrifugal brake.

It is well known to provide a speed-governed braking arrangement between the supporting rollers of a roller conveyor means. Such roller conveyor means comprises a supporting construction or frame with rollers which are rotatable in the direction of the goods which are being conveyed. The so formed course or track is more or less inclined in one direction so as to provide gravitational flow for the goods being conveyed. The purpose of the braking rollers is to avoid excessive speeds of the goods moving along the course. Roller conveyors are preferably used where the goods to be transported appear at irregular periods or intervals and in localities where the use of permanently running belts is not justified. Roller conveyor means present the additional advantage that they permit the construction of courses or tracks with relatively small radii of curvature and with changing inclination.

Prior-art braking arrangements which are provided between the supporting rollers have a number of disadvantages. For example, they require a relatively great expenditure of labor when building in the different required elements into the rollers. The roller itself must be equipped on its outside face with a friction coating or surface so that the moving goods can drive the roller and the braking force thereby produced by the roller can be transmitted to the goods. Because the braking mechanism must be mounted within the interior of the roller, the roller must have a relatively large diameter and length. In consequence, the roller is expensive to produce. Moreover, because the space within the interior of the roller is quite restricted, it is necessary to provide several gearing stages in order to create the rotational speed necessary to produce the required braking action. Furthermore, it is difficult to repair damages in the braking mechanism when they occur. It is therefore an object of the invention to improve the braking arrangement of the above-mentioned nature so that the production costs thereof are considerably reduced, the device can be used in various structures, and the other disadvantages thereof are avoided.

It is also necessary to arrange braking devices of the aforesaid type resiliently such that they are able to yield when an object comes into contact with the roller. This is due to the fact that the moving object initially transmits a heavy impact to the roller which is very dangerous and potentially damaging to the gearing. Also, the undersides of the moving objects being conveyed sometimes are not planar and care must be taken so that contact between

the roller and the moving object is assured at all times. It is therefore another object of the present invention to provide a resiliently-mounted conveyor brake which maintains contact with moving objects having non-planar contacting surfaces. These and other objects will become more apparent as the detailed description proceeds.

To achieve the objectives of the present invention, a conveyor brake is provided which features a "floating" contacting roller in conjunction with a unique housing, gearing and braking arrangement. The contacting roller is preferably arranged within the housing without axle or bearings and is supported by smaller transverse rollers. One of the transverse rollers may comprise a fixedly-mounted rotatable shaft, which rotates about an axis to drive the gear train of the brake. Another transverse roller may be resiliently mounted, for example, on a spring-biased pivotal arm. By this special arrangement of the elements, the necessary resiliency is produced and an additional advantage is obtained in that the contacting roller can be easily exchanged when worn or defective.

In a preferred embodiment the arrangement can also be made such that the complete mechanism, including the roller, housing, gearing and the brake, is pivotally and yieldably mounted within the conveyor structure. This arrangement, which may take the form of a pivotal and complementary spring-biased support for the housing, as is more fully set forth hereinafter, may require certain precautions so as not to impede the mounting of the braking device at any spot of the conveyor structure.

In the embodiment featuring a resiliently-mounted support for the contacting roller, an excellent arrangement is obtained when the fixedly-mounted support shaft and the yielding or resiliently-mounted support are provided below a horizontal plane led through the axis of the contacting roller. This will become apparent from the specific description of the embodiment hereinafter.

The lateral guides for the contacting roller can be formed by two spaced, parallel walls of the housing, whereby suitable spaces are provided between the roller and the said walls. A very simple embodiment of the invention is obtained when the contacting roller is arranged between an outside and a separating wall of the housing such that the gearing and the brake are located on the other side of the separating wall. Advantageously, the gearing and brake assembly are covered, at least on the topside, preferably on every side, so that they are protected against dirt and dust.

According to a further feature of a particular embodiment of the invention, the yielding support for the contacting roller consists of at least one lever which is equipped with a rotatable roller. The lever can be mounted in the lower part of the housing on that side which the moving goods reach first. The other roller rotatably mounted on an axis stationary in relation to the housing is located on the opposite side. By this arrangement, the advantage is obtained that the roller is pressed against the stationary mounted roller such that this latter roller can be and does act as the input wheel of the gearing. The connection with the gearing is interrupted when the contacting roller is rotated in the opposite direction. This free-wheeling action is due to the fact that the contacting roller, when rotated in the opposite direction, tends to lift from the stationary mounted roller and is supported mainly by the yielding roller.

Since the diameter of the contacting roller corresponds approximately only to the height of the housing, the contacting roller rotates with a relatively high circumferential speed or angular velocity when an object passes the arrangement. If this high circumferential speed or angular velocity is transmitted to a roller or shaft having a small diameter to which is attached a gear with a large diameter, which in turn drives a small-diameter gear, it is

possible to obtain the high circumferential speed or angular velocity for the brake sufficient for producing an adequate braking action. The mounting of the last mentioned large diameter gear is possible because the housing has relatively high or large spaces in its interior. Since only a few toothed gears are necessary, the production costs of the device are considerably reduced. Likewise, the number of moving elements is decreased, and thus less parts are exposed to wear.

The transmission of the driving force between the contacting roller and the gearing can be effected in different ways provided that the simple replacement of the roller is not impaired and that its mobility is not reduced. Since the contacting roller during the normal braking operation rotates about the axis of the stationary mounted roller such that the distance therebetween remains constant, the transmission of the force can be effected by an endless belt or chain if this is desired. It is also possible, if the roller is annularly formed as it oftentimes is made, to support it along its interior circumference. The support may again comprise a friction wheel or toothed gear rotatably mounted on an axis fixed in relation to the housing and a second roller arranged at the end of a yielding lever.

The brake mechanism itself as used in the arrangement can be of any suitable type. The brake can form an integrally exchangeable group of elements such that it can be laterally drawn out of the housing. The brake can comprise flyweights swingably mounted or radially movable on a suitable support or plate which is fastened to a driving shaft so as to move out against the internal circumferential surface of an annular brake housing when the plate is rotated at sufficient speed. The flyweights can be mounted upon crank levers the longer arms whereof hold the weights whereas the shorter arms contact ring-shaped or cylindrical brake surfaces when actuated. The flyweights also can be two half circular segments being housed within a cylindrical housing and being driven by a driving shaft (e.g., the output shaft of the gear train) by means of dogs fastened to the shaft. The flyweights can comprise moon sickle formed segments hingedly fastened to a plate rotating with the driving shafts such that the segments are pressed against a circumferential brake surface when the shaft rotates with a certain speed.

The present invention will be more clearly understood from the following description of certain embodiments which are illustrated in the accompanying drawings, wherein:

FIG. 1 is a longitudinal, part-broken-away view of one embodiment of the present invention as a moving object on a roller conveyor comes in contact therewith;

FIG. 2 is a view corresponding to FIG. 1 showing how the moving object depresses the contacting roller and its resiliently-mounted supporting roller as it moves thereover;

FIG. 3 is a transverse sectional view taken on line III—III of FIG. 2;

FIG. 4 is a sectional view on line IV—IV of FIG. 2;

FIG. 5 is similar to FIG. 1 and shows a longitudinal, part-broken-away view of another embodiment of the present invention wherein the entire housing is resiliently and pivotally mounted on the roller conveyor;

FIG. 6 shows the embodiment of FIG. 5 as the moving object depresses the contacting roller and thereby pivots the housing;

FIG. 7 is a transverse sectional view taken on the line VII—VII of FIG. 6; and

FIG. 8 is an elevation view of one example of a centrifugal brake which may be employed in the present invention.

FIG. 1 shows the braking arrangement of the present invention mounted in the course or track of a roller conveyor. The arrangement consists of a housing **1** which is mounted between two rollers **2** of the conveyor. The conveyor is not shown in detail. An object **3** of any kind which is transported along the conveyor moves in the direction of the arrow, and by gravity approaches the braking means.

Within the housing **1** of the braking arrangement, the front wall of which is shown at **4**, an annular contacting roller **5** is provided having a relatively large diameter. The roller **5** is provided at its outside surface with a friction coating, for instance, a 1/16" to 1/8" thick layer of natural or synthetic rubber or blends thereof or other resilient material, e.g., an 80-durometer urethane composition. The roller **5** is not fastened to an axis. Instead, the roller in its lower sector is supported upon a roller or wheel or shaft **6** which is rotatable about an axis stationarily mounted with respect to the housing **1**. The roller or wheel **6**, which is optionally knurled or otherwise treated to present a relatively non-slip contacting surface, is arranged on that side of the roller **5** which is opposite to the front wall which the moving object **3** passes first. Offset by approximately 60° with relation to the roller **5** or wheel **6** there is provided in the lower portion of the housing a swingable lever **8** which is hingedly fixed in the joint **8'**, where bolt **18** provides a pivotal mounting. The lever supports on its free end a rotatable roller **7** which contacts the external circumferential surfaces of roller **5**. The lever **8** is connected with a spring **9** tending to turn the lever clockwise. The mobility of the lever **8** in both directions is limited by abutments, which are not shown, so that the lever never can take such position that the roller **5** falls down between the supports **6** and **7**.

When the object **3** moves past the roller **5** which projects with its upper portion higher than the adjacent rollers **2** in its normal position, the roller **5** is pressed down whereby the lever **8** rotates counterclockwise. The contact between the roller **5** and the roller-shaft or input wheel **6** is thereby retained. The driving force which is transmitted by the object **3** to the roller **5** actuates the roller or wheel **6**. The weight of the object **3** increases the frictional contact between the rollers **5** and **6**. After the object **3** has passed beyond the roller **5**, this latter moves back to its initial position shown in FIG. 1.

As shown in FIGS. 3 and 4, the housing consists of three parallel and distantly arranged plates or walls **4**, **14** and **15**, which are fastened to one another by bolts **18**. The transverse distance between the plates **4** and **14** is somewhat greater than the width of the roller **5** so as to allow free rotation thereof but still secure the roller against excessive lateral movements. The roller or wheel **6** which rotates when the roller **5** is driven by a passing object may, as aforementioned, have a knurled surface to increase friction. The wheel **6** is fixed to a shaft **10** which has an extension projecting into the space between the plates **14** and **15**. The shaft **10** is rotatably supported in suitable bearings. Between the plates **14** and **15** a large toothed gear **11** is fixed to the shaft **10**. The gear **11** is in permanent engagement with a correspondingly-toothed gear **12**. Mounted upon the same shaft with the gear **12** is a suitable braking device within a cylindrical housing **13**, which braking device is not shown in detail in FIGS. 3 and 4, but one embodiment thereof is shown in some detail in FIG. 8, to be discussed hereinafter.

As shown in FIG. 4, the gearing consists only of two toothed gears **11** and **12**, which provide for a suitable increase of the speed. It is sufficient to operate the device by means of two toothed gears primarily because the roller **5** has a relatively large diameter and because the housing **1** enables the mounting of the relatively large toothed gear **11**. In a typical embodiment, roller **5** may have a diameter of about 3½"; wheel **6** may have a diameter of about 9/16"; gear **11** may have 84 teeth; and gear **12** may have 10 teeth. Accordingly, the rotational speed of gear **12** is more than 50 times greater than that of roller **5**.

The gearing is mounted within a completely closed portion of the housing which is formed by walls **14**, **15**, **16** and **17** such that the gears are secured against dust and dirt. As can be seen from FIGS. 1 and 2, the roller **5** is free-floating and can be exchanged easily by lifting it out of the space between the plates **4** and **14**. No axles or fastening means need to be loosened for such purposes. The "free-floating" and axle-free feature can, of course, be functionally obtained by employing a roller with projecting axles which fit into loose slots or openings or are otherwise bearingless, and such embodiment is considered within the scope of the present invention.

The invention can be varied in different ways within its scope. For example, instead of one lever **8**, two scissor-like arranged levers can be mounted which rotate about a common axis at **8'**. One of the two levers normally takes approximately the position of the lever **8** in FIG. 2 whereas the second lever has a steeper position than the lever **8** in FIG. 1. Between the two levers a spring is arranged which tends to pull the levers to one another. By the provisions of suitable abutments the levers are prevented from approaching one another in excess of a certain angle. When the roller **5** is pressed down by a passing object, the scissor-like arranged levers spread wide and extend the spring connecting them. After the object has passed roller **5**, the roller is moved back to its initial position.

It is possible to arrange the toothed gears **11** and **12** closely to the intermediate wall **14** of the housing and to join the braking device **13** to the outside wall **15**. If the braking device after a certain time of operation must be exchanged, this can be done easier when the mounting of the device is made such that it can be laterally drawn out after the removal of a cover fixed to the wall **15**. In this case it is not necessary to detach the bolts **18** which hold together the housing parts.

Since the roller **5** can under all conditions retain the same distance from the roller or wheel **6**, the two mentioned rollers can be connected by means of an endless belt or a chain. If a chain serves to transmit the driving force from the roller **5** onto the wheel **6**, the said elements can be provided with a circumferential groove in the lowest part, in which groove teeth are fixed which are in engagement with the chain links. The roller **5** is then equipped with annular friction layers on both sides of the groove. In other embodiments, however, it is desirable to move roller **5** away from wheel **6**, particularly when backing up a load. This permits moving a load backwards without operating the braking mechanism, as will be described in connection with the embodiment of FIGS. 5–7.

The embodiment of FIGS. 5–7 is functionally similar to that of FIGS. 1–4. The primary difference lies in the fact that instead of resiliently mounting the contacting roller on a spring-biased supporting roller and lever as in FIGS. 1–4, the entire housing is spring-biased and pivotally mounted, as is apparent from the following detailed description of FIGS. 5–7.

Referring to FIGS. 5 and 6, housing **21** is pivotally mounted by means of adjustable bolt **22** to the frame of the conveyor (not shown) of which the rollers are schematically represented at **23**. The other extremity of housing **21** is resiliently secured to the frame of the conveyor by means of bolt **24** which passes through housing slot **25**. Housing **21** is resiliently biased in a clockwise direction by means of coil spring **26**, the extremities of which are secured to the shanks of bolts **24** and **27**. Bolt **24** is slidably engaged in slot **25** so that pivotal movement around the shank of bolt **22** is possible.

Housing **21** is secured to the frame of the conveyor (not shown) so that contacting roller **28** projects into the path of conveyed object **29**, which depresses roller **28** as it passes thereover. When contacting roller **28** is thus depressed, housing **21** pivots in a counterclockwise direction around the shank of bolt **22**, thereby tensioning

spring **26**, as depicted in FIG. 6. The proper positioning of housing **21** on the conveyor is facilitated by means of position locking plate **30** which is secured to front wall **31** by means of bolts **32** and **33**. Position locking plate **30** has slots at its upper and lower extremity and a single aperture adjacent its center through which bolt **22** passes to secure housing **21** to the conveyor frame. Housing **21** has complementary registering slots **34** in walls **31**, **38** and **36**.

The initial tensioning of coil spring **26** is adjustable by means of tensioning plate **37** (FIGS. 5 and 7) which is pivotally secured to intermediate wall **38** by pin **39**. Tensioning plate **37** is rotatable about pin **39** and can be locked into the desired position by means of bolt **40**, the shank of which passes through arc-like slot **41** in tensioning plate **37**. Lip **42** of tensioning plate **37** passes underneath the shank of bolt **24** so as to fix the position thereof and thus the initial tension on spring **26**.

As in the embodiment of FIGS. 1–4, contacting roller **28** rotates roller shaft **43** which is rotatably mounted on the shank of bolt **43***a*. Toothed gear **44** is operatively connected to roller shaft **43** and is in engagement with matching toothed gear **45**, to which is secured plate **46** in brake housing **47**. Gear **45** and plate **46** rotate as a unit on a central pin **46***a* protruding from wall **36**. Brake housing **47** is mounted on wall **36** by bolt shanks **48** which pass through mounting spacers **49**.

The details of the centrifugal brake are shown in FIG. 8, which brake is an example of many which may be employed. Rotatable plate **46** in stationary brake housing **47** has two radial slots **50** and **51** which engage paired radial pins **52** and **53**, respectively, on brake band half-circle elements **54** and **55**. The peripheral surfaces of brake band halves **54** and **55** are held away from the inner surfaces **59** of brake housing **47** by means of circular spring **56** which fits into peripheral, U-shaped slots **57** and **58**, respectively. As plate **46** is rotated, centrifugal forces tend to move brake band halves **54** and **55** against the inner surfaces **59** of housing **47**. The frictional retarding forces thus developed depend upon the speed of rotation of brake band halves **54** and **55**.

Since in the embodiment of FIGS. 5 through 7 the entire housing is resiliently-pivotally mounted, the axis of roller support **60** is stationary with respect to the housing and is mounted on walls **31** and **38** by means of the shank of bolt **61**. While the contacting roller **28** is normally in contact with and supported by rollers **43** and **60**, it should be noted that contacting roller **28** is normally not in contact with roller **62**, which is mounted on the shank of bolt **22**. Accordingly, if moving object **29**, after it has passed over contacting roller **28**, is moved in the opposite direction, i.e., uphill or from left to right in FIG. 6, it will move contacting roller **28** away from roller **43** and against roller **62**. This has the important advantage of permitting the reverse motion of the conveyed object without engaging the brake.

As in the embodiment of FIGS. 1–4, the contacting roller **28** of the embodiment of FIGS. 5–7 is free-floating in the sense that its axis is not stationary relative to the housing. Accordingly, contacting roller **28** can be removed by simply lifting it from between walls **31** and **38**. In a preferred embodiment, a safety plate **64** may be secured by screws **64***a* and **64***b* to wall **31** so as to engage the hub of roller **28** to prevent the accidental, unintentional or mischievous removal of roller **28**. Safety plate **64** is readily removed, however, by undoing screws **64***a* and **64***b*.

Of fundamental importance in the present invention is the ability of the mechanism to absorb the initial impact of heavy, fast-moving objects and thereafter braking the same without damaging the mechanism. This unique feature results from the built-in resiliency and gradual energy absorption capabilities of the entire mechanism. For example, upon initial impact of the moving object with the resiliently-coated surfaces of the contacting roller, energy

is gradually absorbed (rather than instantaneously absorbed) because the resilient surface (e.g., the 3/32" coating of black natural rubber on the contacting roller) is compressed and, in addition, the moving object can initially slip over the surface. This same surface compression and slippage of the contacting surfaces initially occur at the surfaces of rollers **5** and **28** and input rollers **6** and **43**, respectively. Moreover, in both embodiments, the resilient movement (pressing down) of the contacting rollers **5** and **28** against the resiliency of springs **9** and **26**, respectively, also permits the gradual application of energy. Finally, the principal braking action is not initiated until sufficient angular velocity is achieved so that the rotating brake components move against the braking surfaces.

The action of springs **9** and **26** also assures the continuous contact of the contacting rollers **5** and **28** with the moving objects **3** and **29**, respectively. Thus, braking action is assured even if the lower surfaces of the moving objects are irregular.

While the present invention has been described in connection with certain specific embodiments, it should be understood that the invention is not limited thereto. Alternative modifications of the present invention will be apparent from the above description to those skilled in the art and such modifications are considered within the scope and spirit of the present invention even though they may not literally be covered by the language of the claims hereof.

Having thus described the invention, what is claimed is:

1. A braking device for braking moving objects gravitationally flowing along a conveyor track comprising in combination:

(a) a housing mountable within the lateral extremities of said track;

(b) a friction brake secured to said housing with braking forces responsive to the rotational speed of rotatable elements thereof;

(c) a gear train having a rotatable input shaft, the output of said gear train being operatively connected to the rotatable elements of said friction brake so as to drive the same;

(d) an axle-free roller within and projecting above said housing into the path of conveyed objects to be braked, said roller being disposed so as to frictionally engage and rotate said rotatable input shaft when a conveyed object on said track rotates the axle-free roller from at least one direction; and

(e) means for initiating and maintaining resilient engagement of said axle-free roller with the conveyed object and with said rotatable input shaft as the conveyed object passes over said axle-free roller;

whereby the braking action of the friction brake is resiliently transmitted to the conveyed object so as to decrease the speed thereof.

2. The braking device of claim **1** wherein said means for initiating and maintaining resilient engagement comprises a spring-biased auxiliary supporting roller for said axle-free roller.

3. The braking device of claim **1** wherein said means for initiating and maintaining resilient engagement comprises a spring-biased pivotal mounting for said housing.

4. The braking device of claim **1** wherein the external engaging surfaces of said axle-free roller comprise a resilient substance.

5. The braking device of claim **4** wherein said resilient substance comprises rubber.

6. The braking device of claim **1** wherein said axle-free roller is disposed so as to be moved away from said rotatable input shaft when a conveyed object is moved over said axle-free roller in a direction opposite from said one direction.

No references cited.

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