Aug. 31, 1954 P. V. WHITNEY 2,687,785

GRAVITY AND FRICTION OPERATED BACK-STOP MECHANISM

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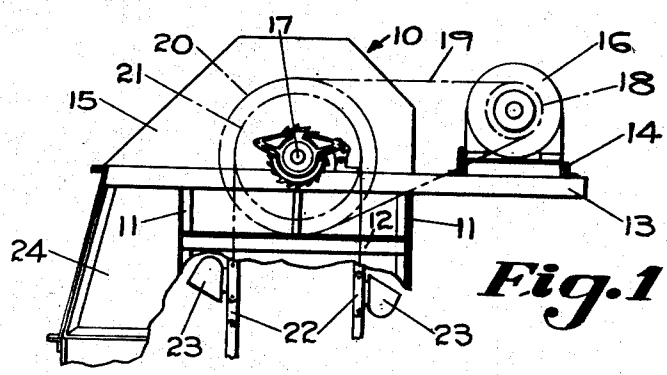


Fig. 1

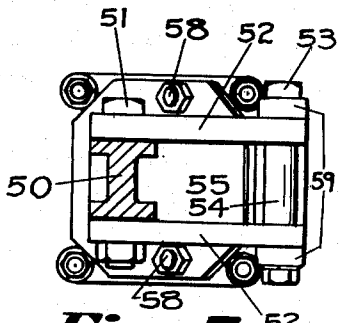


Fig. 5

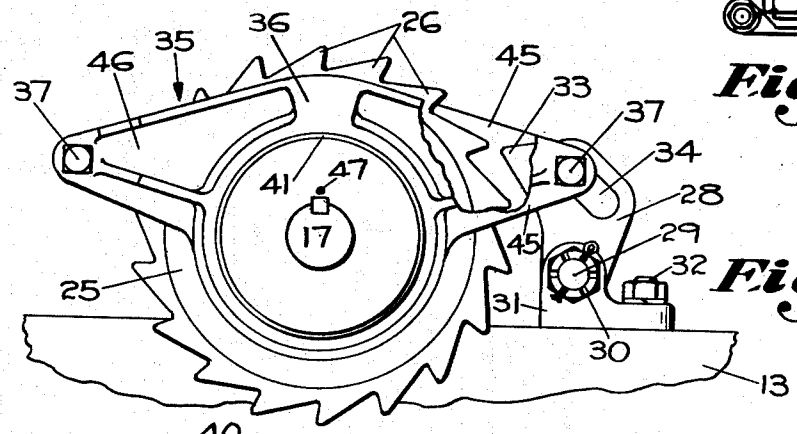


Fig. 2

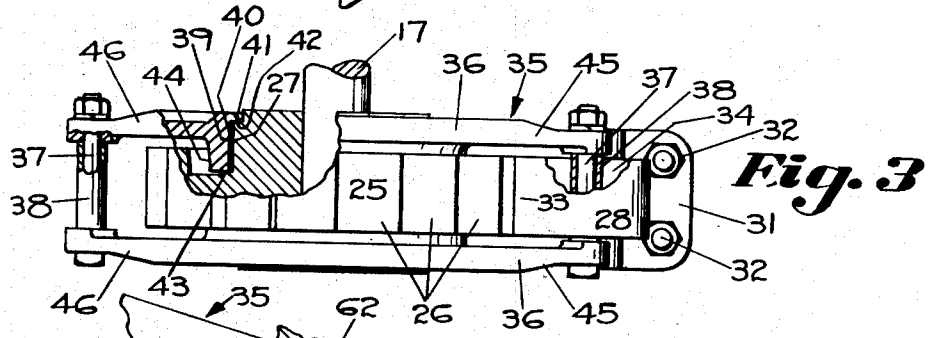


Fig. 3

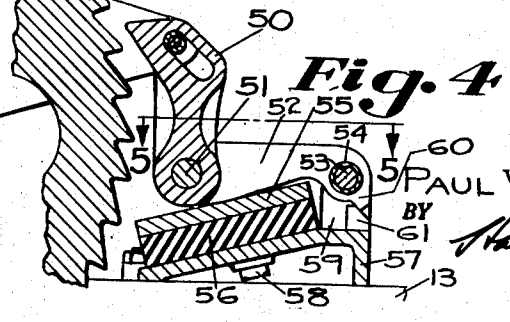


Fig. 4

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GRAVITY AND FRICTION OPERATED BACK-STOP MECHANISM

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4 Claims. (Cl. 188—82.7)

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This invention relates to back-stop mechanisms, and more particularly, to an improved back-stop mechanism that may be employed with particular advantage for arresting reverse operation of machinery preferably, but not necessarily, by being applied to a shaft thereof.

An object of the invention is to provide an improved back-stop mechanism of the type set forth that includes a ratchet wheel, a dog that engages the ratchet wheel for arresting rotation of it in one direction, and a dog operating mechanism that holds the dog out of engagement with the ratchet wheel when the latter is rotated in the other direction and which permits or causes the dog to engage the ratchet wheel when it is rotated in the said one direction.

Other objects of the invention will appear hereinafter the novel features and combinations being set forth in the appended claims.

In the drawing:

Fig. 1 is a view in side elevation of the top portion of a chain and bucket elevator showing the back-stop apparatus of this invention applied to the head shaft of the elevator;

Fig. 2 is a side view in elevation on a larger scale of the back-stop mechanism seen in Fig. 1, with a portion of the elevator member supporting it being shown;

Fig. 3 is a view in plan of the back-stop mechanism seen in Fig. 2 with portions broken away to show certain of its internal features of construction;

Fig. 4 is a fragmentary view of the back-stop mechanism embodying the invention and including a resilient mounting means for the ratchet wheel engaging dog; and

Fig. 5 is a view in section, the section being taken substantially on line 5—5 of Fig. 4.

In Fig. 1 of the drawing there is shown the top, head or discharge portion of a chain and bucket elevator 10. Elevator 10 includes a frame having four spaced upright side angle members 11 and a plurality of cross-members, one of which is indicated at 12. At the top of the upright members 11 there are two spaced horizontally extending frame members 13 that form the base of a platform 14 located at one side of the casing 15 of the elevator head portion. Platform 14 supports an electric motor and speed reducing gear mechanism 16 which drives the head shaft 17 of elevator 10 through a sprocket 18 mounted on the driven shaft of the motor and speed reducing gear apparatus 16, a chain 19, and a large sprocket wheel 20 mounted upon and keyed to the head shaft 17. The head shaft 17 is supported adjacent each of its ends by a suitable bearing, not shown, each of which is mounted upon one of the horizontally extending frame members 13. Head shaft 17 extends transversely and generally horizontally through the casing 15, and within the casing 15 it carries a pair of spaced wheels or sprockets 21 over which spaced chains, one of which is seen at 22, of a chain and bucket conveyer, travel and are driven. In the operation of elevator 10 material which is conveyed upwardly by the buckets 23 of the conveyer is discharged over the wheels or sprockets 21 and passes from the casing 15 through a discharge chute 24 formed at one side of the casing 15. It is imperative in apparatus such as the elevator 10, described in part above, that a mechanism be provided that will positively prevent reverse rotation of the elevator when its operating motor is de-energized. The back-stop mechanism of this invention is shown associated with head shaft 17 of this elevator and it may be used with particular advantage for preventing or arresting the above mentioned reverse rotation or motion of the elevator.

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Referring now to Figs. 1, 2 and 3 of the drawings, and more particularly, to Figs. 2 and 3 thereof, the back-stop mechanism includes a ratchet wheel 25 that may be pressed upon and keyed, or otherwise suitably secured, to one end of the head shaft 17 of elevator 10 so that it may partake of any rotary motion of the head shaft 17. The ratchet wheel 25 is serrated throughout its entire outer periphery to form teeth 26 which, in general, resemble those of a saw. At each of its opposite sides the ratchet wheel 25 is machined to form a cylindrical friction surface or drum 27 (see particularly Fig. 3). A dog 28 is mounted for pivotal swinging movement about a horizontal axis positioned laterally of and extending parallel to the axis of rotation of the ratchet wheel 25 and it is positioned so as to engage the teeth 26 of the latter for preventing rotation of both the ratchet wheel 25 and the shaft 17 in a clockwise direction as viewed in Fig. 2 of the drawings. Dog 28 is mounted for pivotal movement about the axis of a stainless steel bolt 29 and nut 30 carried by a bracket or lug 31 bolted directly upon the top of one of the frame members 13 by bolts and nuts 32. The shape of the dog 28 is such that when it is rotated or swung counterclockwise, as viewed in Figs. 1 and 2 of the drawings, its nose 33 will engage one of the teeth 26 of the ratchet wheel 25 to prevent rotation of the latter in a clockwise direction. Dog 28 forms a cam slot 34 that extends transversely through it and lies in a plane that extends parallel to the axis of rotation of the head shaft 17 and slopes upwardly toward the ratchet wheel 25. Dog 28 is held out of engagement with the ratchet wheel 25 when the latter rotates in a counterclockwise direction, as seen in Figs. 1 and 2 of the drawings and it is moved into engagement with one of the teeth 26 when the ratchet wheel is rotated clockwise.

The mechanism for operating the dog 28 as aforesaid, includes a frame or cage 35 formed of a pair of identical but reversely positioned side

members 36 spaced one on each side of the ratchet wheel 25 and connected by bolts 37 and spacers 38. Each side member 36 includes a hub having a bore 39 (see Fig. 3) that surrounds one of the cylindrical friction surfaces or drums 27 of the ratchet wheel 25. Interposed between the bore 39 and each side member 36 and each of the cylindrical friction surfaces 27 is a wearing ring or lining 40 which may be made of any material, such for example, as an asbestos brake lining material, brass, babbitt, or any other suitable wear resistant friction substance, and this wearing ring of friction material 40 is retained in position between the bore 39 and the cylindrical friction surface 27 by a shoulder or cylindrical radially inwardly projecting abutment 41 that overlaps a cylindrical peripheral shoulder 42 formed at the side of the cylindrical surface 27 of the ratchet wheel 25 and a radial shoulder 43 formed on the ratchet wheel 25 against which the innermost edge of the liner 39, as well as a shoulder or boss 44 of the side member 36 abuts. The wearing ring 40 functions to a slight degree as a brake or friction band and it preferably floats in the bore 39 and on the friction surface 27, that is, it is not anchored and it is held in its proper position by the shoulders 41 and 43, as previously mentioned.

The side members 36 together with bolts 37 and spacers 38 form, in effect, a cage that is carried by the ratchet wheel 25 through the cylindrical friction surfaces 27 of the latter and this cage normally tends to rotate with the ratchet wheel 25 by reason of friction created between the surfaces 27 and 39 and the ring or band 40 of friction material. One of the bolts 37 and spacers 38 extend between the operating arms 45 of the members 36 through the cam slot 34 in the dog 28. It will be seen that when the cage 35, including the side members 36, bolts 37 and spacers 38 is rotated by the ratchet wheel 25 in a clockwise direction, as seen in Figs. 1 and 2 of the drawings, that the bolt 37 and spacer 38 in the cam slot 34 of dog 28 will cooperate with the cam slot 34 to cause the dog 28 to be swung or rotated counter-clockwise about the horizontal axis of its mounting bolt 29 to draw positively the nose 33 of the dog 28 into engagement with a tooth 26 of the ratchet wheel. It will also be seen that when the nose 33 of dog 28 is engaged with one of the teeth 26 of ratchet wheel 25 and the ratchet wheel 25 is started to rotate in a counter-clockwise direction that the tooth 26 immediately below and engaging the nose 33 of dog 28 will operate to cam or rotate the dog 28 in a clockwise direction. This action of the dog 28, of course, assists the floating cage 35 in starting to rotate with or follow the motion of the ratchet wheel 25. Continued rotation of the cage 35 causes the dog to become completely disengaged from the periperal tooth 26 of the ratchet wheel 25 as the latter continues to rotate in a counter-clockwise direction as seen in Figs. 1 and 2 of the drawings.

It is important to note that the side members 36, as seen in Fig. 2 of the drawings, are symmetrical about a vertical plane passing through the horizontal axis of rotation of the shaft 17 and the ratchet wheel 25 and they are made symmetrical for two reasons, namely, so that in the manufacture of the unit two identical castings may be employed to form opposite sides of the cage 35 and to provide counterbalance arms 46 which together with the bolt 37 and spacer 38 that interconnect the opposite arms 46 of the cage 35 will substantially counterbalance the operating arms 45 and the bolt 37 and spacer 38 that interconnects them and extends through the cam slot 34 in the dog 28. The arms 45 and 46 are positioned above a horizontal plane passing through the axis of rotation of the shaft 17 and ratchet wheel 25 so as to offset the center of gravity, as indicated at 47 in Fig. 2 of the drawings, from said axis of rotation and so that when the cage 35 is in the position shown wherein the dog 28 is being held away from the ratchet wheel 25, the center of gravity of the cage 35 lies substantially in or adjacent a vertical plane passing through said axis of rotation of shaft 17 and ratchet wheel 25. In other words, the cage is so counterbalanced by its arms 46, and interconnecting bolts 37 and spacer 38, that when it is occupying the position seen in Fig. 2 of the drawings, its center of gravity 47 is above the axis of rotation of the shaft 17 and ratchet wheel 25 or, in or adjacent a vertical plane intersecting the latter, and, therefore, the cage 35 is substantially balanced with respect to the axis of rotation of the ratchet wheel when the dog is being held disengaged from the ratchet wheel 25 by the cage 35.

It will be seen that when the ratchet wheel is rotated in a counter-clockwise direction, as viewed in Fig. 2 of the drawings, and above described, that cam slot 34 in dog 28 acts upon the bolt 37 and spacer 38 to hold the cage in the substantially balanced position described and that whenever reverse rotation, or rotation in a counter-clockwise direction as shown in Fig. 2 occurs the cage 35, by reason of its own weight, will create sufficient friction between the bores 39, the friction bands 40 and the spaced cylindrical surfaces 27 to cause the cage to follow the reverse rotation of the latter. The cage 35 is easily unbalanced by reverse rotation of the ratchet wheel and upon rotating reversely with it its operating arms 45 acting through the interconnecting bolt 37 and spacer 38 cooperate with the cam slot 34 to cause the dog to be cammed rapidly and positively into engagement with one of the teeth 26.

In Figs. 4 and 5 of the drawings there is shown a modified mechanism in which a dog 50, having the identical function of dog 28, is mounted through a stainless steel bolt 51 between a pair of generally horizontally extending arms 52 mounted upon a cross bolt 53 and spaced apart by a spacer 54. Arms 52 rest upon a bed assembly that includes a plate 55, a resilient pad or cushion 56 and a base member 57 that are secured together by a pair of bolts and nuts 58. Base member 57 is bolted upon one of the members 13, as is the bracket 31, and it is provided with a pair of spaced upstanding ears 59 through which the bolt 53 that carries the spaced arms 52 extends. Arms 52 are each provided with a downwardly extending lug 60 that engages a shoulder 61 on each of the ears 59 of base member 57, for preventing arms 52 from rotating clockwise as viewed in Fig. 4 of the drawings, or away from the plate 55. The resilient mounting of the dog 50, shown in Figs. 4 and 5 of the drawings, is particularly useful in a back-stop apparatus wherein the diameter of the ratchet wheel 62 is relatively large, and wherein the shaft, when it reverses its direction of rotation, is heavily loaded because when the dog is swung against the ratchet wheel and engages one of the teeth thereof, a portion of the shock created by stopping the reverse rotation of the ratchet wheel is cushioned by means of the resilient pad 56.

From the foregoing description it will be readily apparent that the back-stop mechanism is capable of and does actually operate by reason of friction created solely by the weight of the operating cage **35** riding upon the spaced cylindrical surfaces **27** of the ratchet wheel and it may be stated that the band of friction material **40** is employed more for the purpose of its wear resistant qualities or longevity than for its friction qualities and this because long life of the wearing ring **40** is desirable. Because the operating cage is substantially balanced, very little rotative effort, and consequently, friction is required to cause the cage **35** to follow or rotate with the friction surfaces or drums **27** of the ratchet wheel **25**.

Obviously those skilled in the art may make various changes in the details and arrangement of parts without departing from the spirit and scope of the invention as defined by the claims hereto appended and applicant wishes therefore not to be restricted to the precise construction herein disclosed.

Having thus described and shown an embodiment of the invention, what it is desired to secure by Letters Patent of the United States is:

1. A gravity and friction operated back-stop mechanism including a ratchet wheel adapted to rotate on a generally horizontal axis having means forming a pair of cylindrical friction surfaces spaced one at each side thereof, a dog, means for mounting said dog for swinging movement about an axis extending parallel to said axis of rotation of said wheel, dog operating means for holding the dog away from said ratchet wheel when the latter is rotated in one direction and for causing the dog to swing against the ratchet wheel upon rotation of the latter in the reverse direction, said dog operating means including a cage having a pair of substantially identical side members spaced one at each side of said ratchet wheel, each of said members including a hub surrounding one of said cylindrical friction surfaces and a shoulder, a readily replaceable band of wearable material interposed between said bore and said cylindrical friction surface and abutting said shoulder, each of said members also including a laterally extending arm for operating said dog and a laterally extending counterbalance arm, bolt and spacer means interconnecting the counterbalance arms, and bolt and spacer means interconnecting the dog operating arms, said cage having a center of gravity offset from the axis of rotation of said ratchet wheel and lying substantially directly thereabove when said dog is swung away from said ratchet wheel whereby said dog operating means is substantially balanced and whereby it is easily unbalanced by friction created by its own weight when said ratchet wheel is rotated in said reverse direction.

2. A gravity and friction operated back-stop mechanism including a ratchet wheel adapted to rotate on a generally horizontal axis having means forming a pair of cylindrical friction surfaces spaced one at each side thereof, a dog, means for mounting said dog for swinging movement about an axis extending parallel to said axis of rotation of said wheel, dog operating means for holding the dog away from said ratchet wheel when the latter is rotated in one direction and for causing the dog to swing against the ratchet wheel upon rotation of the latter in the reverse direction, said dog operating means including a cage having a pair of substantially identical side members spaced one at each side of said ratchet wheel, each of said members including a hub surrounding one of said cylindrical friction surfaces, a readily replaceable band of wearable material interposed between said bore and said cylindrical friction surface, each of said members also including a laterally extending arm for operating said dog and a laterally extending counterbalance arm, bolt and spacer means interconnecting the counterbalance arms, and bolt and spacer means interconnecting the dog operating arms, said cage having a center of gravity offset from the axis of rotation of said ratchet wheel and lying substantially directly thereabove when said dog is swung away from said ratchet wheel whereby said dog operating means is substantially balanced and whereby it is easily unbalanced by friction created by its own weight when said ratchet wheel is rotated in said reverse direction.

3. A gravity and friction operated back-stop mechanism including a ratchet wheel adapted to rotate on a generally horizontal axis having means forming a cylindrical friction surface adapted to rotate therewith, a dog, means for mounting said dog for swinging movement about an axis extending parallel to said axis of rotation of said wheel, dog operating means for holding the dog away from said ratchet wheel when the latter is rotated in one direction and for causing the dog to swing against the ratchet wheel upon rotation of the latter in the reverse direction, said dog operating means including a member having a hub surrounding said cylindrical friction surface, a band of friction material interposed between said bore and said cylindrical friction surface, said member also being counterbalanced and having its center of gravity offset from the axis of rotation of said ratchet wheel and lying substantially directly thereabove when said dog is swung away from said ratchet wheel whereby said dog operating member is substantially balanced and whereby it is easily unbalanced by friction created by its own weight when said ratchet wheel is rotated in said reverse direction.

4. A gravity and friction operated back-stop mechanism including a ratchet wheel adapted to rotate on a generally horizontal axis having means forming a cylindrical friction surface adapted to rotate therewith, a dog, means for mounting said dog for swinging movement about an axis extending parallel to said axis of rotation of said wheel, dog operating means for holding the dog away from said ratchet wheel when the latter is rotated in one direction and for causing the dog to swing against the ratchet wheel upon rotation of the latter in the reverse direction, said dog operating means including a member having a hub surrounding said cylindrical friction surface, said member also being counterbalanced and having its center of gravity offset from the axis of rotation of said ratchet wheel and lying substantially directly thereabove when said dog is swung away from said ratchet wheel whereby said dog operating member is substantially balanced and whereby it is easily unbalanced by friction created by its own weight when said ratchet wheel is rotated in said reverse direction.

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