No. 846,807. PATENTED MAR. 12, 1907.

W. THORNBER.

SAFETY ARRANGEMENT FOR HOISTING APPARATUS.

APPLICATION FILED MAR. 27, 1906.

4 SHEETS—SHEET 1.

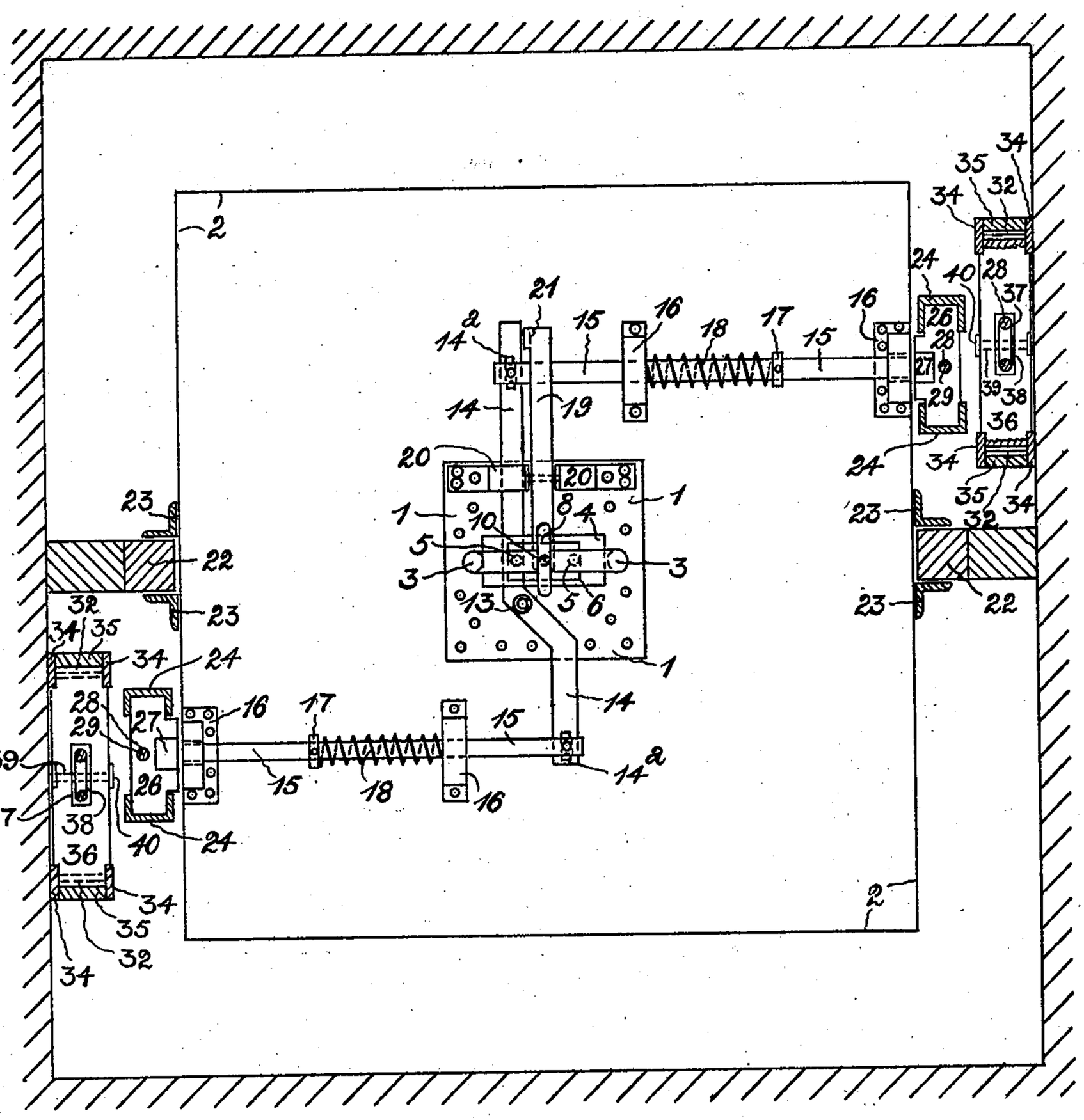


Fig. 1.

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4 SHEETS—SHEET 2.

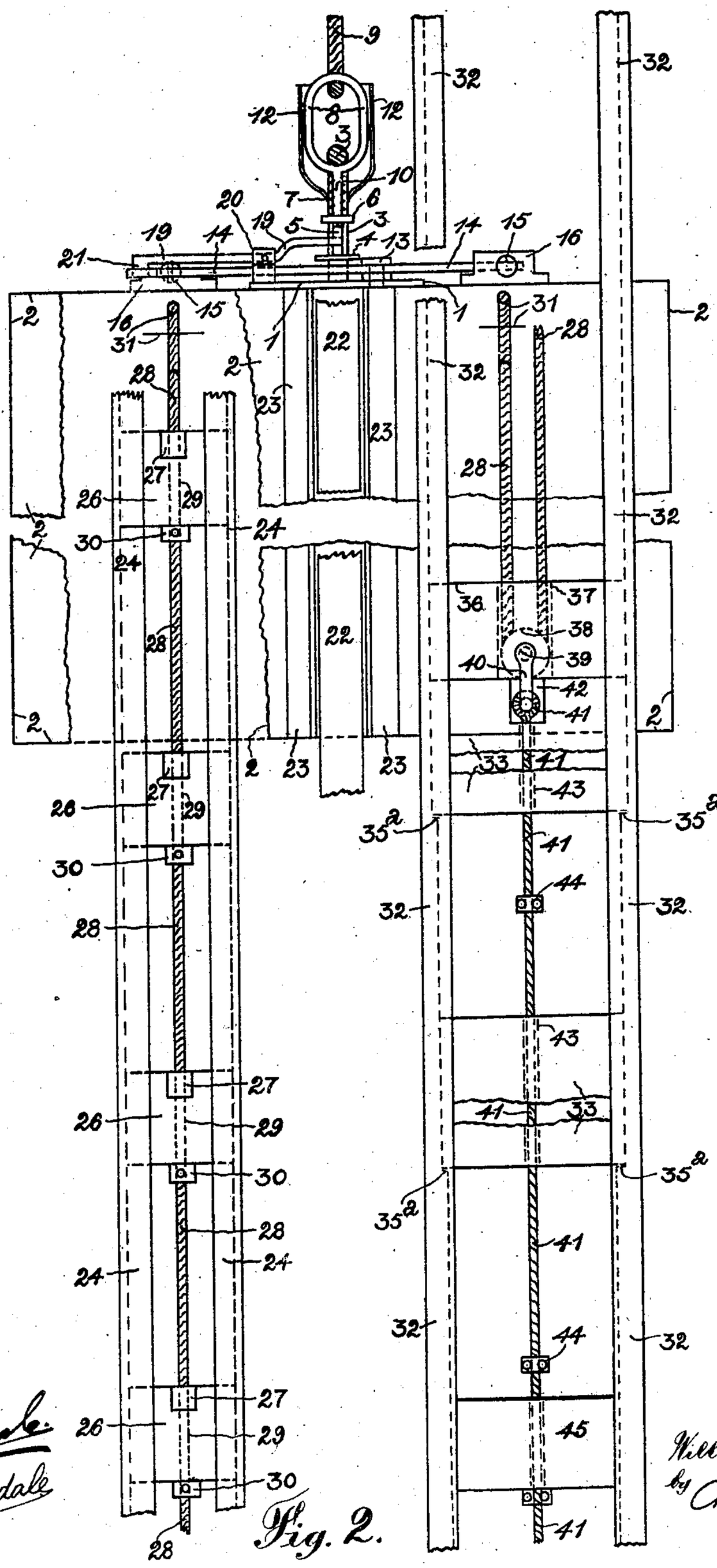


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Fig. 2.

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4 SHEETS—SHEET 3.

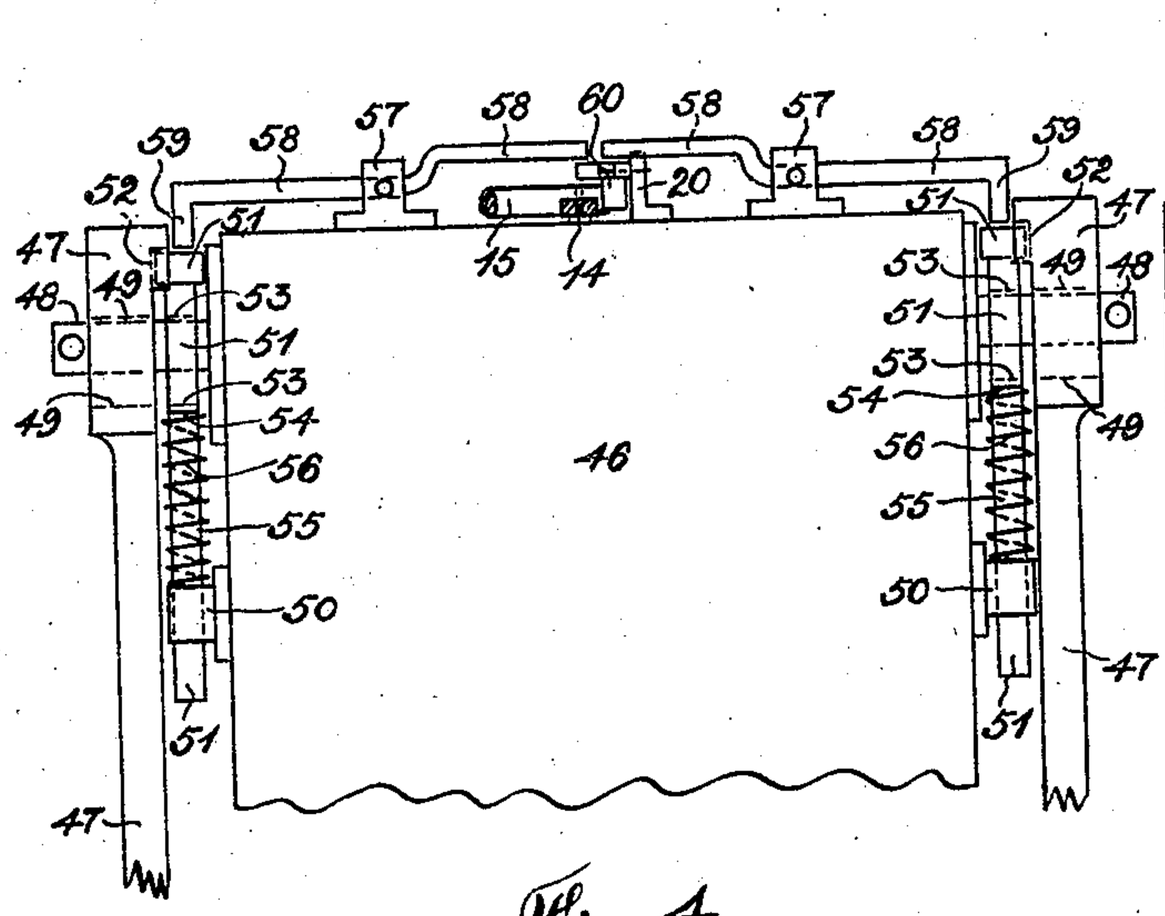

Fig. 4.

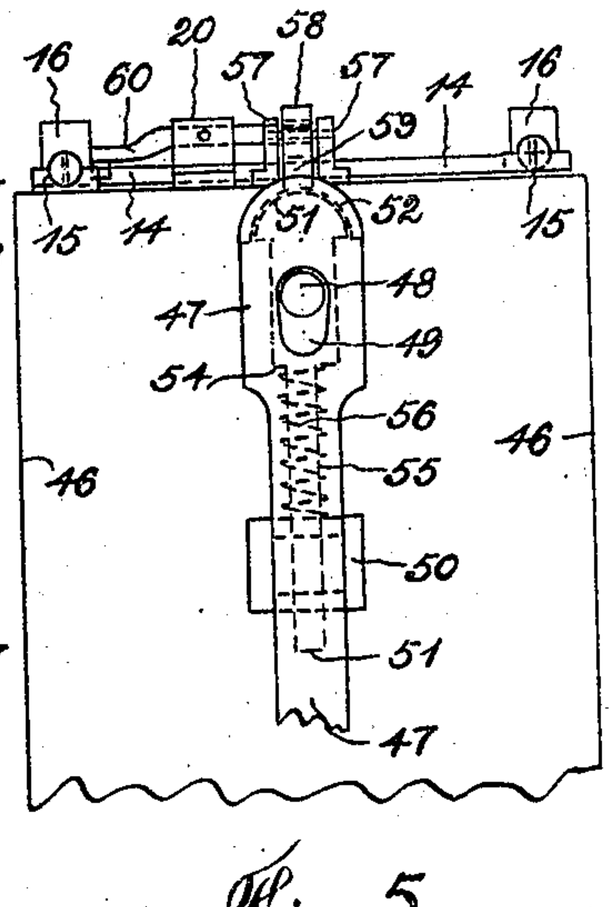

Fig. 5.

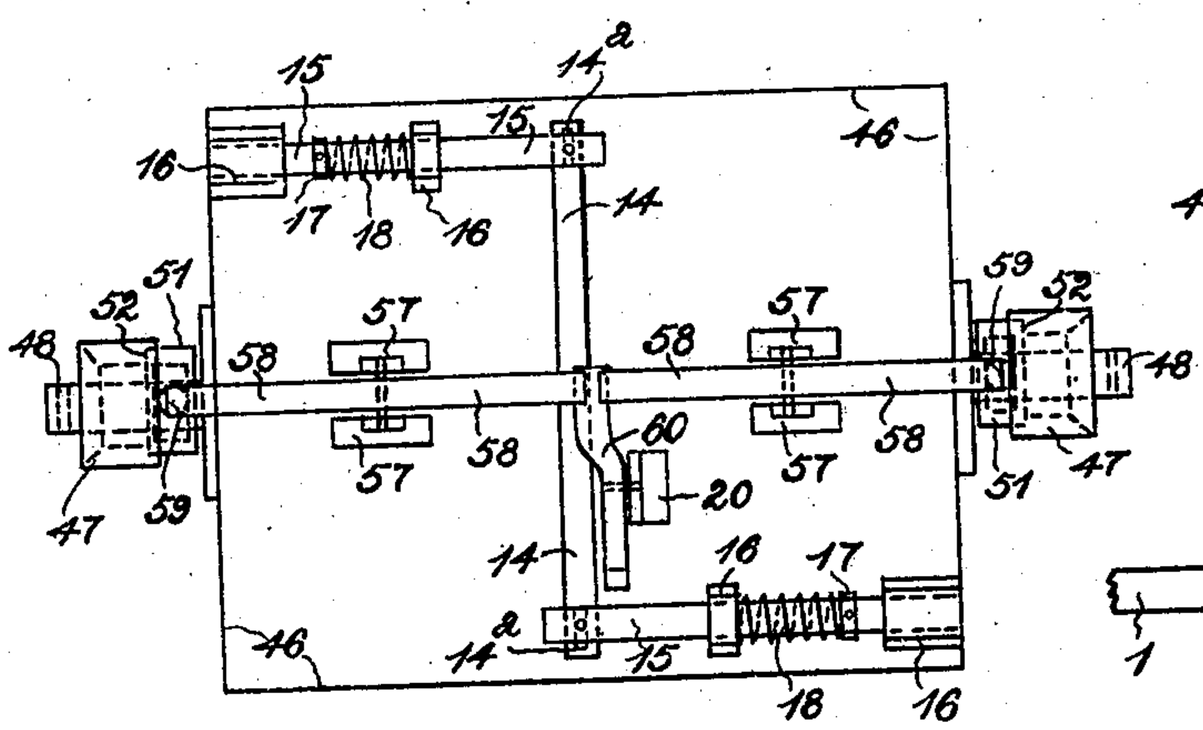

Fig. 6.

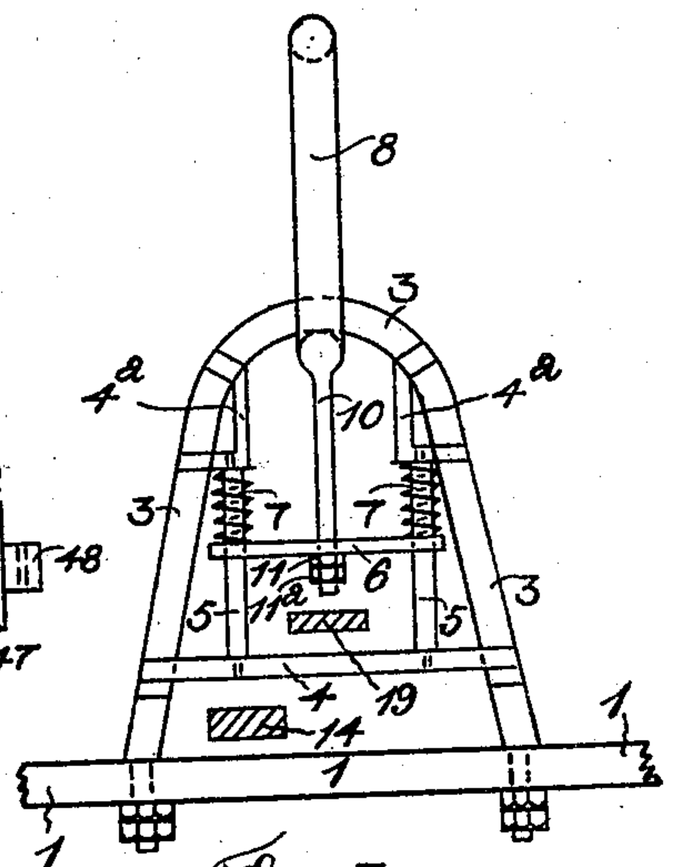

Fig. 3.

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4 SHEETS—SHEET 4.

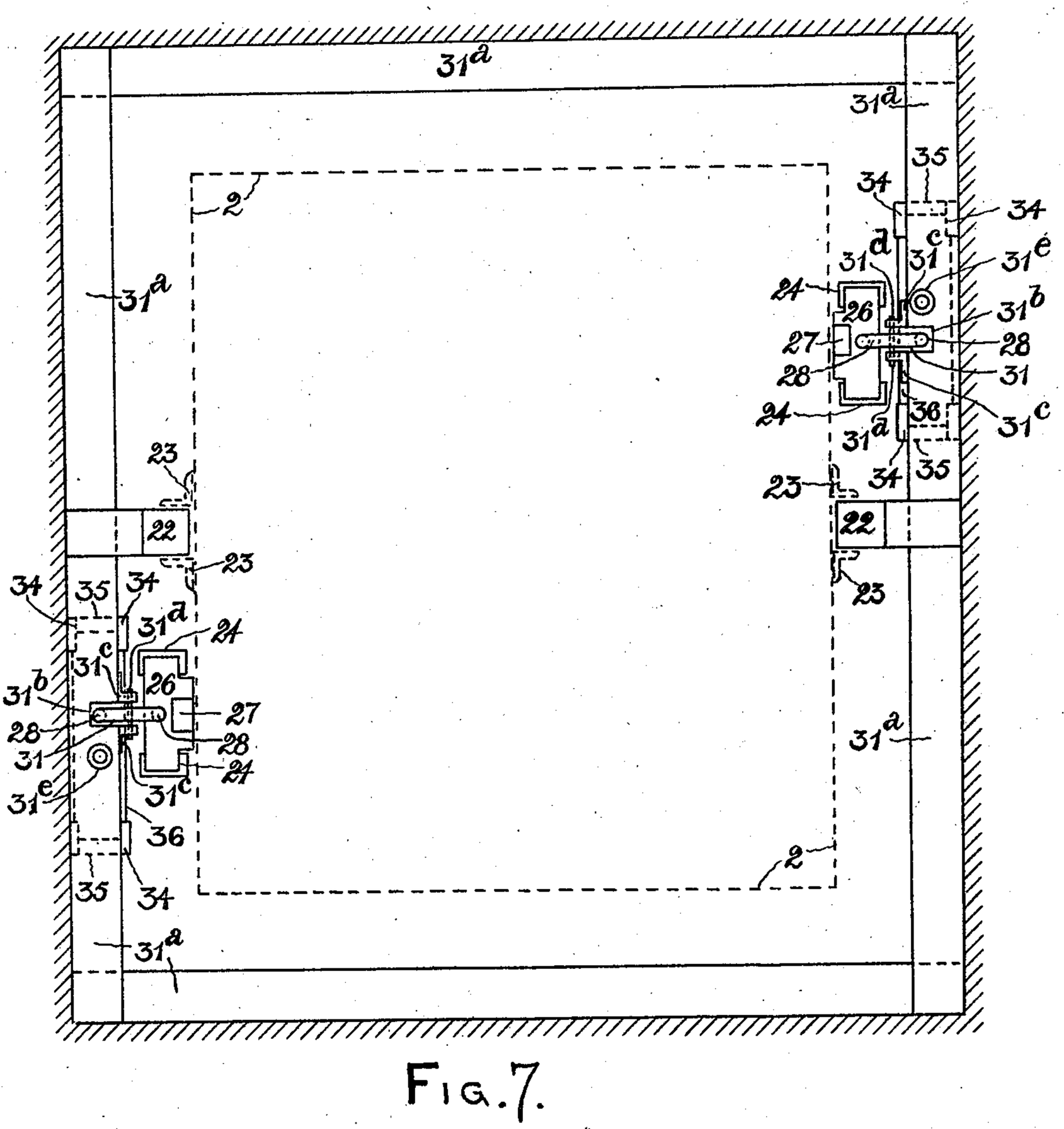


FIG. 7.

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# UNITED STATES PATENT OFFICE.

WILLIAM THORNBER, OF JOHANNESBURG, TRANSVAAL.

## SAFETY ARRANGEMENT FOR HOISTING APPARATUS.

No. 846,807. Specification of Letters Patent. Patented March 12, 1907.

Application filed March 27, 1906. Serial No. 308,240.

*To all whom it may concern:*

Be it known that I, WILLIAM THORNBER, a subject of the King of Great Britain, residing at Johannesburg, Transvaal, have invented certain new and useful Improvements in Safety Arrangements for the Hoisting Apparatus of Mines and the Like, of which the following is a specification.

This invention relates to safety apparatus primarily designed for use with cages, skips, or similar vehicles employed in the shafts of mines, although it may be adapted to elevators, hoists, lifts, or other analogous hoisting apparatus.

The object of the present invention is to provide safety apparatus of a thoroughly reliable character in which the stops, or that portion of the apparatus which serves to arrest the movement of the cage, &c., will not operate or be dependent upon the guides or runners provided in the shaft for guiding the cage in its ascent and descent.

In accordance with the present invention I provide the shaft with a set of guides in which are arranged sliding weights. These weights are preferably arranged in sections of, say, two, three, or more, and they are so connected that first one weight acts against the falling skip and then another, and so on until the maximum load or resistance is reached and the movement of the cage thereby resisted and arrested. In another set of guides, preferably in front of the weight-guides, is arranged a number of sliding pieces or blocks which are connected to a cross-head working in the weight-guides above the weights. The cross-head has attached to it a counterweight to counterbalance the sliding blocks or pieces and to keep them in position. The several sliding blocks are connected by means of a rope which passes over a conveniently-disposed pulley, then round a pulley in the cross-head, and up to a suitable height, at which point it is fixed.

The above-described mechanism is preferably provided at two opposite sides of the shaft and on opposite sides of the runners.

On top of the cage or vehicle is arranged the mechanism which operates in the event of the rope breaking to engage the sliding pieces or blocks. This mechanism is connected with the hauling-rope in such a way that in the event of breakage of the latter or in the event of the skip becoming unsupported by the rope from any other cause then rods are projected beyond the sides of the cage and by engaging the sliding pieces or blocks operate against the weights.

The apparatus may be adapted to shafts constructed with one, two, or more compartments. It may be also adapted to inclined as well as to vertical shafts or to both vertical and inclined shafts.

To facilitate the further detailed description of the invention, I append explanatory drawings in which, by way of example, I show the invention adapted to a single compartment and vertical shaft.

In the drawings, Figure 1 represents the cage or vehicle in plan and showing the weight and sliding-block guides and the guides or runners in horizontal section. Fig. 2 is an elevation of the cage or vehicle, showing on one side of the runners the weight-guides and weights and on the other side the sliding blocks and their guides. Fig. 3 is an elevation of a part of that portion of the apparatus which is located on the top of the vehicle and illustrating certain details to a larger scale. Fig. 4 is a front elevation of a skip, showing a mode of applying the invention thereto. Fig. 5 is a side elevation of Fig. 4. Fig. 6 is a plan of Fig. 4; and Fig. 7 is a horizontal section of a shaft, illustrating the guide-pulleys for the ropes connecting the sliding blocks and the sliding weights.

I will first describe the mechanism which serves to operate the rods to engage the sliding blocks in the event of breakage of the hauling-rope or in the event of the vehicle becoming unsupported. In Figs. 1, 2, and 3 this arrangement consists of a plate 1, which is bolted, riveted, or otherwise securely fixed on the top of the cage 2. This plate 1 is constructed in one piece with or has securely fixed to it and also, if desired, to the top of the cage a bow 3. Between the sides of and at the bottom of the bow 3 is fixed a plate 4. Between brackets $4^a$, fixed to the top of the bow 3, and the plate 4 are fixed two vertically-disposed and stationary rods 5. On the rods 5 is arranged a cross-head or sliding plate 6. Round the rods 5 between the cross-head 6 and the inside of the top of the bow 3 are placed spiral springs 7, which tend to force the cross-head downward or in the direction of the stationary plate 4.

8 is a link which engages the bow 3 (see Fig. 2) and serves for making connection between the bow and the hoisting rope or cable 9. This link 8 is fashioned with a downward vertical extension or rod 10, which passes

through a hole in the center of the cross-head 6 and has screwed on its extremity beneath the cross-head a nut 11 and lock-nut 11[a] or their equivalent.

As shown in Fig. 2, the link 8 is drawn up against the inside of the bow 3, and the cross-head 6 is raised by the rod 10, so placing the springs 7 in compression. In the normal running of the vehicle in the shaft this is the position assumed by these several parts. Should the hauling-rope break, it will be evident that the link 8 will fall and aided by the force of the springs 7 will move the cross-head 6 in a downward direction on the rods 5. To insure vertical movement of the link 8 and rod 10, a guard 12, serving also as a guide, is shown fixed to the bow 3 and inclosing the greater portion of the link 8.

Arranged on top of the vehicle and adapted to move in a horizontal plane about a pivot 13 is a lever 14. This lever 14 passes between the sides of the bow 3 beneath the stationary plate 4. To the extremities of this lever 14 are pivotally attached the rods 15, which serve as the stops and engage the sliding blocks when the safety mechanism comes into operation. These rods 15 slide in guides or brackets 16, one located some distance from the inner end of the rod 15 and the other located at or in proximity to the edge of the vehicle. On each of the rods 15 is keyed or otherwise fixed a collar 17, between which and the bracket 16 is located a suitably-strong spiral spring 18, which is placed in compression when the rod is in its normal or inoperative position. The connection between the rods 15 and the ends of the levers 14 is made by elongated slots 14[a], through which the pivot-pins pass, so as to allow for the radial movement of the lever about its pivot and the rectilinear movement of the rods 15 in their guides 16.

The lever 14 and the rods 15 are maintained in their normal positions with the spiral springs 18 in compression by means of a catch or releasing lever 19, which is pivotally supported between brackets 20, fixed on the top of the vehicle. This catch-lever 19 is arranged parallel with and to one side of the main lever 14, and it is constructed at one end with a tailpiece or projection 21, which engages one arm of said lever 14. The other arm of the catch-lever 19 projects between the sides of the bow 3 and between the cross-head 6 and stationary plate 4. When the cross-head 6 moves in a downward direction, owing to the breakage of the rope, as previously explained, then the inner arm of the catch-lever 19 is depressed and the outer arm raised, so releasing the main lever 14 and permitting the spiral springs 18 to thrust the rods 15 in an outward direction beyond the sides of the vehicle.

22 represents the runners fixed to the sides of the shaft which are engaged by the shoes, consisting of the angle-irons 23, to guide the vehicle in its ascent and descent.

Arranged vertically in the shaft and preferably at opposite sides of the runners 23 I provide guides 24, which, as shown, consist of U-irons, in which guides 24 are arranged a number of blocks or pieces 26, which are adapted to slide longitudinally of said guides. In Fig. 2 I show four of such sliding blocks 26, although it will be evident that more or less may be provided for each section of the apparatus. The guides 24 are so positioned in the shaft in relation to the runners 23 and vehicle 2 that the blocks 26 will be engaged by the outer extremities of the rods 15 when the latter are thrust in an outward direction or beyond the edge of the vehicle by the operation of the safety-gear. The blocks 26 are shown formed with a recess 27 on the inside, with which the outer extremities of the rods 15 will engage. All the four sliding blocks 26 are connected by means of a wire or other suitably strong rope 28, which passes through a hole 29, formed vertically through the center of the blocks 26, on which rope 28 are fixed collar or rope-clamps 30, located beneath the blocks for supporting the latter. The rope 28, connecting the sliding blocks 26, is carried up to a suitable height and passes round a grooved pulley 31, fixed to the timbers in the shaft or otherwise.

In Fig. 7, 31[a] are the dividers or shaft-timbers, to which the runners 22 are fixed. 31[b] are slots or recesses cut in the dividers, and 31[c] are brackets fixed to the timber at either side of said recesses and forming bearings for the spindles 31[d] of the grooved pulleys 31. The rope 28 passes from the sliding blocks 26 round the pulley 31 under the pulley 38 in the cross-head 36 and is carried up and passed through a hole in the dividers 22 and is fixed to the dividers by means of a collar-washer or other piece 31[e], fixed to the rope above the dividers.

In the shaft and arranged alongside the guides 24 for the sliding blocks 26 is another set of guides 32 for the sliding weights 33. These guides 32 are shown consisting of two outside plates 34 and the stepped center piece 35. Two weights 33 are shown in Fig. 2. These two weights 33 and the four sliding blocks 26 constitute one complete section of the gearing. Instead of two any other desired and suitable number may be employed, and they are made of such a weight and so arranged that the maximum weight of each section will bring the vehicle to rest within the limit of fall, which is represented by the distance between the next succeeding section of sliding blocks and weights. The weights 33 are supported on the steps or recesses 35[a], formed in the center piece 35 of the guides.

In the weight-guides 32 immediately above the top weight 33 is arranged a sliding piece or cross-head 36, which has formed through

it a vertical hole 37. In this hole 37 is arranged a pulley 38, which runs on an axle 39, passing horizontally through the cross-head 36. The rope 28 from the pulley 31, which is located crosswise or between the guides, passes down between the weight-guides 32 and under the pulley 38 in the cross-head and is then carried up again, as shown in Fig. 2, and attached at its upper extremity to some fixed point of the shaft-timbers or otherwise. On the outer extremities of the axle 39 for the pulley 38 is fixed a U-shaped piece 40, to which is attached a rope 41. In the upper surface of the top weight 33 is formed a recess 42, in which the U-piece 40 projects when the cross-head 36 is resting on the top of the weight. Through the weights 33 are formed vertical holes 43, through which passes the rope 41. On the rope 41 for each weight is fixed a collar or rope-clamp 44. These collars or rope-clamps 44 are fixed to the rope in different positions—that is to say, so that should the rope 41 be drawn in an upward direction the collar or rope-clamp 44 beneath the top weight will first engage said weight and lift it off its support 35ª in the guides 32, and then the collar or rope-clamp 44 for the next succeeding weight will in like manner raise it off its support 35ª. To the lower extremity of the rope 41 is fixed a weight 45, which acts as a counterpoise for the several sliding blocks or pieces 26.

Instead of constructing the weight-guides 32 as described and shown it will be evident that they may consist of U-irons and have pieces of different thickness bolted or otherwise fixed inside to form the steps or recesses 35ª for supporting the weights 33, or that the guides for both the weights and blocks may be built up of any other suitable section, such as H or L irons, or of wood, if preferred. The guides for the weights and blocks are suitably fixed to timbers in the shaft. It is also evident that the weight-guides 32 and, if desired, also the guides 24 for the blocks 26 might be located in recesses in the sides of the shaft. The drawings illustrate one section of the weights 33 and sliding blocks 26. Similar sections are continued the full length of the shaft.

The several parts are made of suitable material and of a suitable size and strength, according to the capacity of the cage or the load it is designed to carry.

In Fig. 2 to simplify the drawing I have omitted the sliding blocks 26 and their guides 24, which would come in front of the weight-guides 32, and also the weight-guides 32 and weights 33, which would show at the rear of the sliding blocks and their guides.

The operation of the apparatus is as follows: When the catch-lever 19 is released and the rods 15 are thrust outward beyond the sides of the cage by the springs 18, the extremities of said rods 15 engage the first sliding blocks 26 presented in their paths and move the blocks downward in their guides 24. This draws down the rope 28, which is kept taut by the counterpoise 45, and draws up the cross-head 36, and with it the rope 41, until the collar or rope-clamp 44 engages the under side of the top weight 33. This lifts the weight off its support 35ª in the weight-guides 32 and throws the weight onto the rope 41, and so retards the downward movement of the sliding block 26. If it should continue to fall sufficiently far, then the collar or rope-clamp 44, fixed to the rope 41 beneath the second weight 33, comes into contact with the latter and lifts it off its support 35ª in the guides 32, and so places both weights on the rope 41. This further retards the downward movement of the sliding block 26 in the guides 24 and ultimately brings the vehicle to rest.

Means, such as a cord or the like, may be attached to the catch-lever 19 and carried inside the cage to enable the safety arrangements to be operated independently of the hauling-rope by the occupants of the cage at any time should it be necessary from any cause.

In Figs. 4, 5, and 6 I show mechanism for operating the rods 15, which engage the sliding blocks 26, adapted to a skip, in which the receptacle or body 46 is pivotally supported in the bridle 47. To the sides of the body 46 are fixed trunnions 48, over which the extremities of the bridle 47 are fitted. The holes 49, provided in the bridle, are elongated, as shown, and when the weight of the skip 46 is on the bridle 47 the trunnions 48 occupy the positions in which they are shown in Figs. 4 and 5 at the bottom of the elongated holes 49. In Figs. 4, 5, and 6 the skip is shown inverted. On each side of the skip 46 is fixed a bracket 50, in which is slidably supported a rod 51. One end of each rod 51 is made semicircular, and it fits in a corresponding semicircular recess 52, formed on the inside of the end of the bridle 47. Each rod 51 is constructed with an elongated slot 53, similar to the end of the bridle 47, and each fits over the trunnion 48 in a similar manner. Between the bracket 50 and a projection 54, formed between the part in which the slot 53 is formed and the cylindrical part 55, which slides through the bracket 50, are placed spiral springs 56, which serve to keep the semicircular ends of the rods 51 pressed into the semicircular recesses 52 in the ends of the bridle 47. When the weight of the skip is on the bridle 47, springs 56 are placed in compression. On the bottom of the skip are fixed two brackets 57, in which are pivoted two levers 58. The outer arms of these levers 58 are constructed with projections 59, which project in the direction of the semicircular ends of the sliding rods 51. The other and inner arms of the levers 58 project

over the top of the catch-lever 60, which operates in a similar manner to that previously described in connection with the other figures of the drawings to release the main lever operating the rods which engage the sliding blocks.

The construction of the bridle 47 with the semicircular recesses 52 and the semicircular ends of the sliding rods 51 allows the bridle to move round the latter in the operation of dumping the load when the skip is in the tipper without the safety-gear being operated, the catch-gear being only operated when the weight of the skip is off the bridle, so that the springs 56 may move the sliding rods 51 to actuate the releasing-levers 58. This mechanism works as follows: In the event of the rope becoming disconnected from the bridle 47 the bridle falls until the opposite ends of the slots 49 rest on the trunnions 48. In this it is aided by the action of the springs 56 forcing the semicircular ends of the rods 51 against the semicircular recesses 52 in the inside of the bridle 47. When the sliding rods 51 are moved in this manner by the springs 56, they actuate the levers which move the catch-lever, releasing the main lever and permitting the rods to be thrust outward into engagement with the sliding blocks 26.

What I claim as my invention, and desire to protect by Letters Patent, is—

1. In safety mechanism for hoisting apparatus, guides, sliding blocks or pieces in said guides, other guides and sliding weights in said latter guides, means for connecting the sliding blocks with the sliding weights, a vehicle and catch-gear carried thereby, which gear is adapted to engage the sliding blocks to cause the weights to arrest the movement of the vehicle.

2. In safety mechanism for hoisting apparatus, the combination of the vehicle, catch-gear fitted thereto, guides and a plurality of sliding blocks or pieces connected together, another set of guides and a plurality of weights slidably supported therein, and means for connecting the sliding blocks with the sliding weights so that in the event of the catch-gear being operated and engaging any one of the sliding blocks, the motion of the vehicle is retarded by the sliding weights.

3. In safety mechanism for hoisting apparatus, the combination with the vehicle and catch-gear fitted thereto, of guides and a plurality of sliding blocks or pieces therein connected together, another set of guides and a plurality of weights slidably supported therein, and means for connecting the several sliding blocks with the sliding weights in such manner that first one weight comes into operation, then another, and so on until the maximum load is reached.

4. In safety mechanism for hoisting apparatus, the combination with the vehicle and catch-gear carried thereby, of guides, a plurality of sliding blocks in said guides, a flexible rope connecting the several sliding blocks, another set of guides and a plurality of weights slidably supported therein, a cross-head, a pulley carried thereby, another pulley round which the rope passes from the sliding blocks to the pulley in the cross-head, a rope connected to the cross-head, a counter-weight fixed to said rope for balancing the several sliding blocks, and projections on the rope which serve for lifting first one weight and then another to operate to retard the motion of the vehicle when the catch-gear engages any one of the sliding blocks.

5. In safety mechanism for hoisting apparatus, the combination with the vehicle of catch-gear carried thereby, a set of guides arranged in the shaft or well traversed by the vehicle at opposite sides of the latter, a plurality of sliding blocks or pieces slidably supported in said guides, another set of guides at opposite sides of the vehicle and a plurality of weights slidably supported in said guides, a cross-head slidingly supported in said guides above the weights, a rope connecting the several sliding blocks, a pulley carried by said cross-head, another pulley fixed above and between the guides for the sliding blocks and weights, the rope passing round the latter pulley, then under the pulley in the cross-head and attached to a fixed point in the shaft, a rope depending from the cross-head, a weight fixed to the latter rope for counterbalancing the several sliding blocks, and projecting pieces provided on the rope for engaging and raising the weights successively off their supports in the guides so that the weights gradually come into operation to retard the movement of the vehicle in the event of the catch-gear being actuated and engaging one of the sliding blocks, substantially as described.

6. In safety mechanism for hoisting apparatus, in combination, the vehicle, catch-gear carried by said vehicle which is adapted to operate in the event of the vehicle becoming unsupported in the shaft, a set of guides provided at opposite sides of the shaft, a plurality of sliding blocks or pieces connected in sections, another set of guides at each side of the shaft, a plurality of weights connected in sections and slidably supported in said guides, ropes which serve for connecting the several sliding blocks of one section, a pulley fixed in the shaft above the sliding blocks round which the rope passes, a cross-head slidably arranged in the weight-guides, another pulley carried by the cross-head round which the rope passes, the end of the rope being fixed to a convenient point above the cross-head in the shaft, a rope suspended from the pulley in the cross-head, and projecting pieces on the rope which serve for raising the weights successively off their supports in the guides to re-

tard the movement of the vehicle in the event of the catch-gear engaging the sliding blocks, substantially as described.

7. In safety mechanism for hoisting apparatus, the combination of a vehicle, catch-gear which is maintained in its inoperative position so long as the weight of the vehicle is on the hauling-rope and which comes into operation automatically in the event of the skip becoming unsupported by said rope, a set of guides provided at opposite sides of the shaft, a plurality of sliding blocks or pieces connected in sections; another set of guides at each side of the shaft, a plurality of weights connected in sections and slidably supported in said guides, ropes which serve for connecting the several sliding blocks of one section, a pulley fixed in the shaft above the sliding blocks round which the rope passes, a cross-head slidably arranged in the weight-guides, another pulley carried by the cross-head round which the rope passes, the end of the rope being fixed to a convenient point above the cross-head in the shaft, a rope suspended from the pulley in the cross-head, and projecting pieces on the rope which serve for raising the weights successively off their supports in the guides to retard the movement of the vehicle in the event of the catch-gear engaging the sliding blocks, substantially as described.

8. In safety mechanism for hoisting apparatus, the combination with the vehicle, of catch-gear carried thereby, said catch-gear comprising a catch-lever and spring-controlled part adapted to operate said catch-lever in the event of the vehicle becoming unsupported by the hauling-rope, a lever which is engaged by the catch-lever to retain the catch-gear in its inoperative position, spring-controlled catch rods or bars actuated by said lever, a set of guides provided at opposite sides of the shaft, a plurality of sliding blocks or pieces connected in sections, another set of guides at each side of the shaft, a plurality of weights connected in sections and slidably supported in said latter guides, ropes which serve for connecting the several sliding blocks of one section, a pulley fixed in the shaft above the sliding blocks round which the rope passes, a cross-head slidably arranged in the weight-guides, a pulley carried by the cross-head round which the rope passes, the end of the rope being fixed to a convenient point above the cross-head in the shaft, a rope suspended from the pulley in the cross-head, and projecting pieces on the rope which serve for raising the weights successively off their supports in the guides to retard the movement of the vehicle in the event of the catch rods or bars engaging the sliding blocks, substantially as described.

In witness whereof I have hereunto set my hand in the presence of two subscribing witnesses.

WILLIAM THORNBER.

Witnesses:
CHAS. OVENDALE,
R. OVENDALE.