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AUTOMATIC THROTTLE CLOSING AND BRAKE CONTROLLING DEVICE.

APPLICATION FILED FEB. 4, 1909.

945,406.

Patented Jan. 4, 1910.

2 SHEETS—SHEET 1.

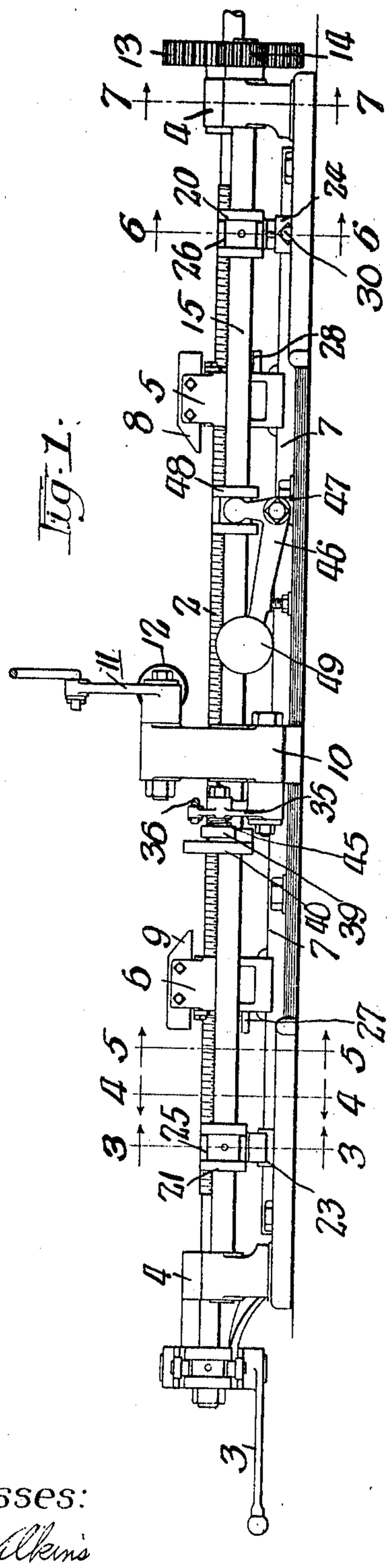

Fig. 1.

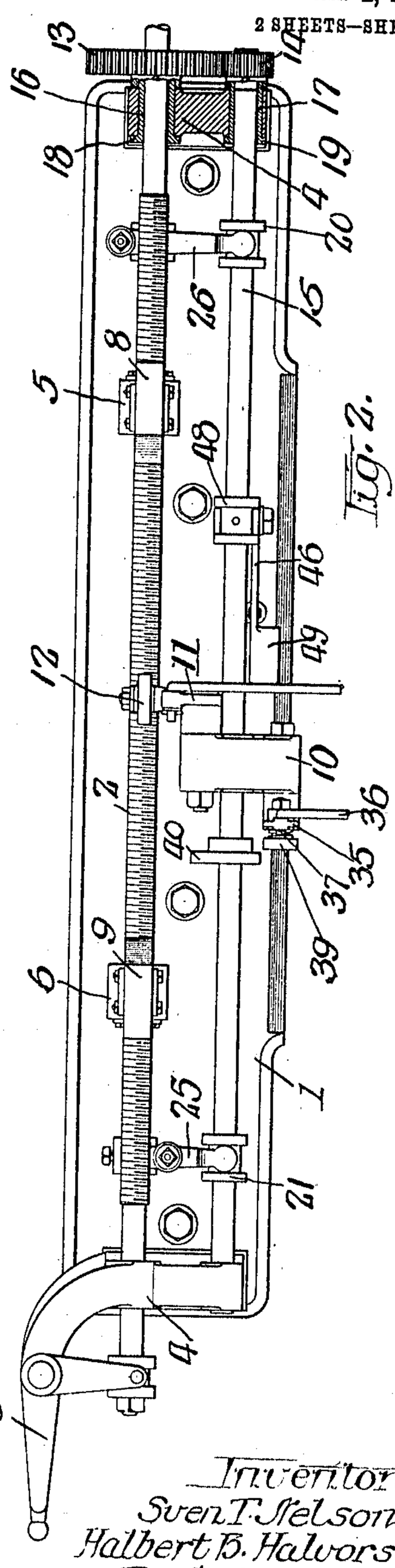

Fig. 2.

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2 SHEETS—SHEET 2.

Fig. 5.

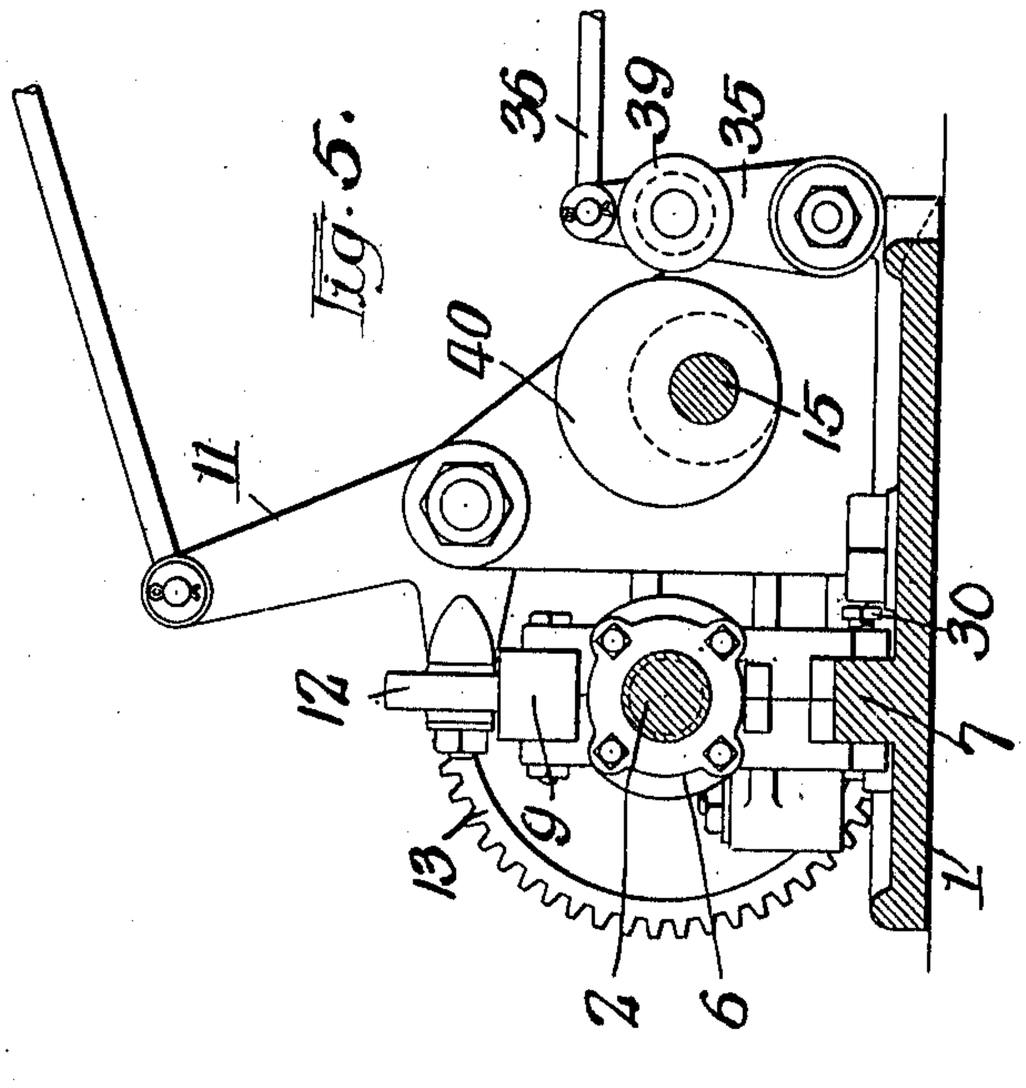

Fig. 6.

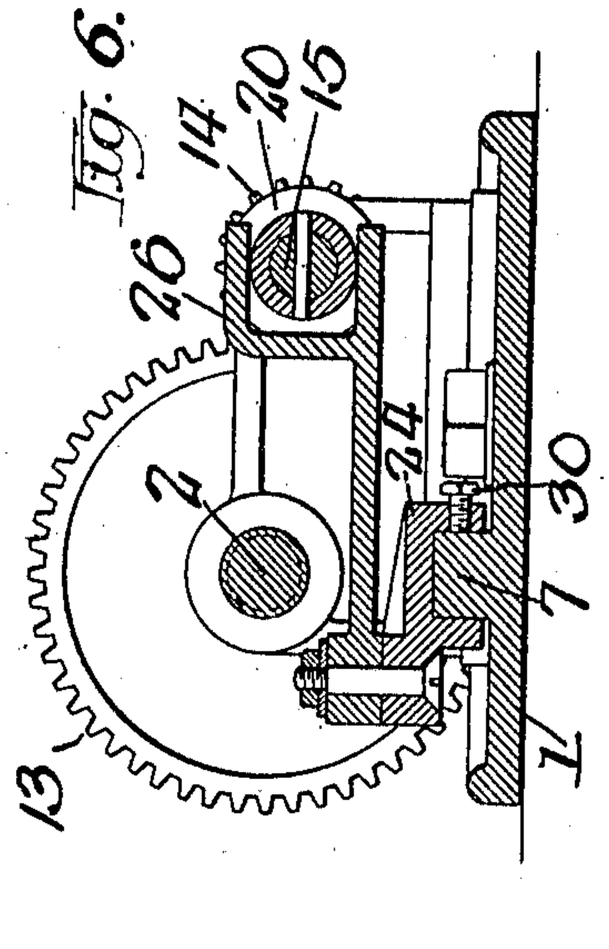

Fig. 7.

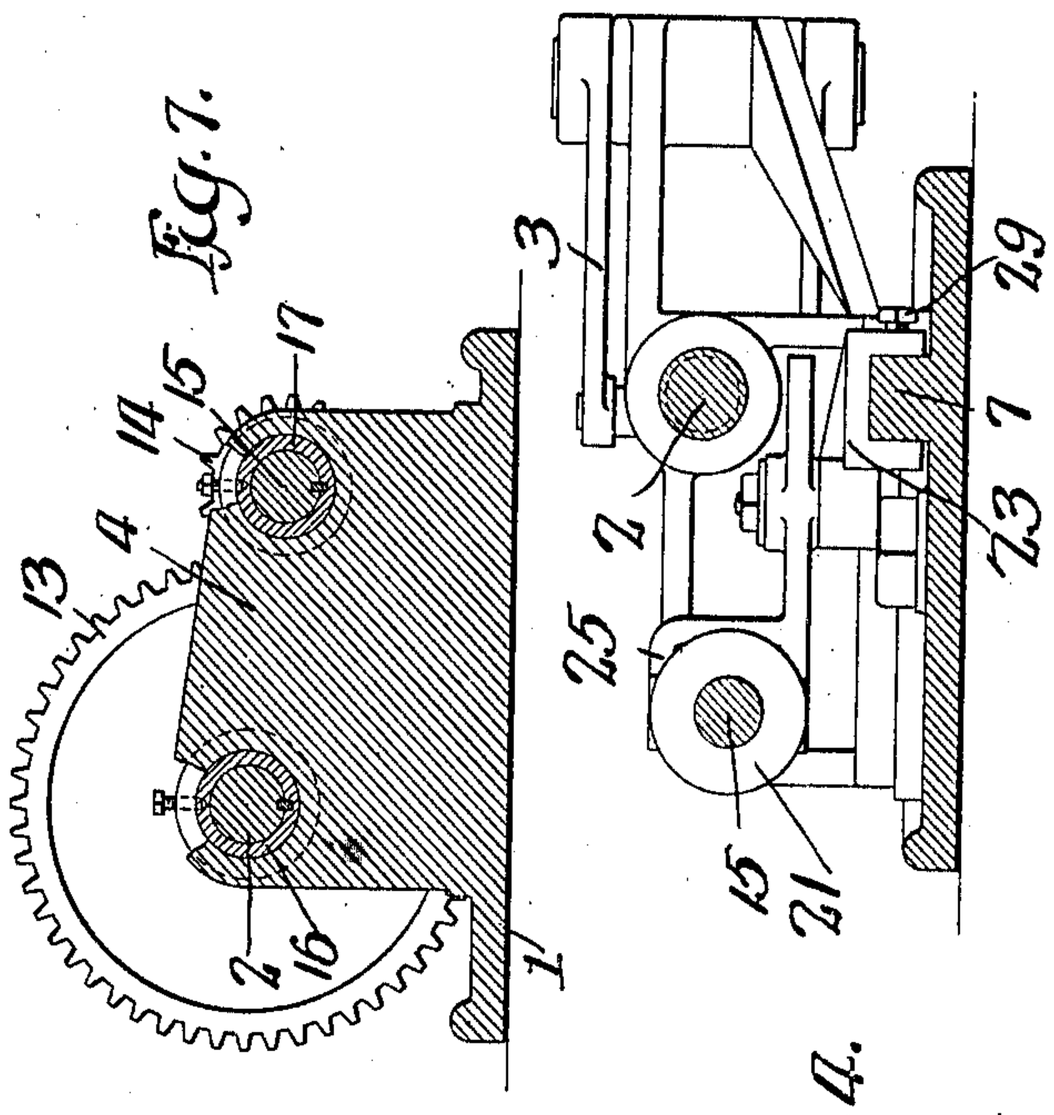

Fig. 3.

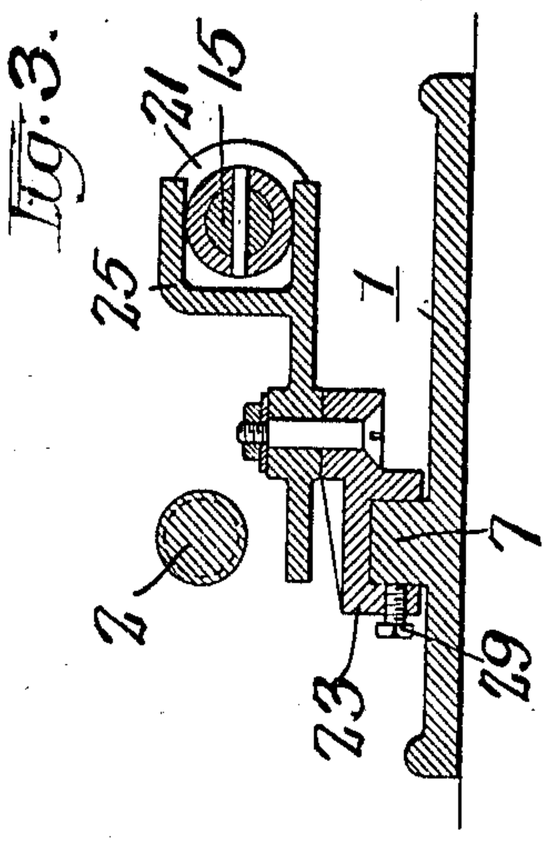

Fig. 4.

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UNITED STATES PATENT OFFICE.

SVEN T. NELSON, HALBERT B. HALVORSEN, AND FRANK A. HALLECK, OF CHICAGO, ILLINOIS, ASSIGNORS TO SULLIVAN MACHINERY COMPANY, A CORPORATION OF MAINE.

AUTOMATIC THROTTLE-CLOSING AND BRAKE-CONTROLLING DEVICE.

945,406. Specification of Letters Patent. Patented Jan. 4, 1910.

Application filed February 4, 1909. Serial No. 467,035.

To all whom it may concern:

Be it known that we, SVEN T. NELSON, HALBERT B. HALVORSEN, and FRANK A. HALLECK, citizens of the United States, and residents of Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Automatic Throttle-Closing and Brake-Controlling Devices; and we do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, and to the numerals of reference marked thereon, which form a part of this specification.

This invention relates to an apparatus for use in connection with a hoisting engine and hoisting drum, employed for operating the cages or skips in mines, and which operates to automatically close the throttle valve of the hoisting engine as the cages approach the limits of their movement in both directions, and to effect automatically the application of the brake to arrest the movement of the hoisting drum and cages after the throttle valve is closed.

In the prior patent to Sven Nelson No. 900,769, of October 13th, 1908, is shown and described an apparatus for like purposes in connection with hoisting machinery including two hoisting drums which are mounted on a common shaft and are separately connected by clutches to said shaft.

An apparatus embodying our present invention is more especially designed for use in connection with a single hoisting drum, on which are suspended cables, supporting two cages or skips which are suspended in balance therefrom, or with two drums affixed to a common shaft.

Certain of the features of construction herein described and claimed are, however, adapted for use in connection with a hoisting drum arranged and operating as set forth in said prior patent.

The accompanying drawings illustrate only the throttle and brake controlling mechanism to which the present invention directly relates, it being deemed unnecessary to illustrate therein the hoisting engine, hoisting drums, brake mechanism and associated parts, which in themselves form no part of the invention and which may be of any usual or preferred construction.

The invention consists in the matters hereinafter set forth and more particularly pointed out in the appended claims.

In the drawings:—Figure 1 is a view in side elevation of an apparatus embodying our invention. Fig. 2 is a plan view with parts broken away of the apparatus shown in Fig. 1. Fig. 3 is a cross-sectional view, taken on line 3—3 of Fig. 1. Fig. 4 is a cross-sectional view, taken upon line 4—4 of Fig. 1. Fig. 5 is a cross-sectional view, taken upon line 5—5 of Fig. 1. Fig. 6 is a cross-sectional view, taken upon line 6—6 of Fig. 1. Fig. 7 is a cross-sectional view, taken upon line 7—7 of Fig. 1.

The machine shown for operating the throttle valve of the hoisting engine is constructed as follows:

1 designates an elongated, horizontal base plate upon which the apparatus is mounted.

2 indicates a horizontal, screw-threaded shaft which is arranged longitudinally over the base plate 1, and is rotatively mounted in two supporting standards 4, 4 mounted on opposite ends of the base plate 1. The said shaft is connected at one end with, and adapted to receive rotative motion from, the drum of the hoisting engine, said shaft being turned alternately in opposite directions as the direction of rotation of the drum is reversed for raising and lowering the cages or skips.

5 and 6 indicate two cross heads which have screw-threaded apertures for the passage of the shaft 2 and are moved thereby in a direction endwise of the shaft. Said cross heads have downwardly extending parts which are grooved to fit and slide upon a longitudinally arranged rib 7, upon the base plate 1; said rib being arranged vertically in line with the shaft 2 and being adapted to prevent the rotation of the said cross heads so that the latter will be moved lengthwise of the shaft 2 when said shaft is rotated. The said heads 5 and 6 are mounted on either side of a central support 10 upon the base 1 and are provided above said shaft 2 with rigidly attached wedge shaped blocks 8 and 9 which extend in a direction lengthwise of the shaft. Pivotally mounted upon the said support 10 is a bell crank lever 11 upon one arm of which is mounted an antifriction roller 12 adapted to be alternately engaged by the upper surfaces of said wedge shaped blocks 8 and 9

when the blocks reach the roller in the turning of the shaft in one direction or the other. The other arm of the bell crank lever is connected with the throttle valve mechanism of the hoisting engine and is adapted to close the throttle valve when the inclined upper surfaces of either of the wedge shaped blocks 8 or 9 engage and lift the roller 12 upon the first named arm of the bell crank lever.

The upper surface of each of the blocks 8 and 9 is inclined or beveled at its inner end, or that nearest the roller 12, and is horizontal in its outer part, and the blocks are so located or arranged on the screw-shaft that the inclined portions thereof will engage and lift the roller 12 and thereby close the throttle of the hoisting engine before the cages or skips actuated by the drum reach the top or bottom of the mine shaft. The parts will usually be arranged to operate the throttle and stop the engine when the said cages or skips are within two or three hundred feet of the top and bottom of the shaft, the parts being allowed to travel under their own momentum until the cages or skips reach the final limits of their travel, and the movement of the drum being finally stopped by means of a brake controlled by the engineer or by the automatic brake-controlling means hereinafter described.

The horizontal part of each of the wedge shaped blocks 8 and 9 is made of such length that the block which operates to close the throttle valve of the hoisting engine will remain in contact with the bell crank lever and hold the same in position to keep the throttle valve closed during the period in which the drum is being turned by its own momentum, that is to say, the time which elapses between the throttling of the engine and the complete stopping of the winding drum. This construction serves to prevent the engineer from either reversing the engine or starting it ahead in the same direction after the closing of the engine throttle and until the drum has been brought to rest, thereby avoiding liability of accident due to the travel of the cages or skips an unnecessary distance beyond their usual range of movement. Such an arrangement also allows sufficient time for the engineer to apply the brakes by hand to the hoisting drum.

As hereinbefore set forth, the engagement of the wedge shaped blocks 8 or 9 with the bell crank lever 11 serves to lock the throttle of the hoisting engine in a closed position and the following features of construction are provided whereby the engineer is enabled to unlock the throttle to operate the hoisting engine. The screw-threaded shaft 2 is movable longitudinally in its bearings and is adapted to be moved or shifted endwise by means of a bell crank lever 3 acting on the end of the same. The said bell crank lever is arranged to move the said shaft 2 in either direction a sufficient distance longitudinally to entirely disengage the wedge shaped block from the bell crank lever 11, thereby releasing the throttle valve of the hoisting engine and permitting the engineer to operate the said throttle valve to reverse the engine. Either of the wedge shaped blocks may be disengaged from the bell crank lever 11 by moving the shaft 2 in a direction to carry the said block in an opposite direction to that which it was traveling when it engaged the said bell crank lever. After the shaft 2 is moved to position to unlock the throttle valve of the hoisting engine it is retained in such position during the reverse motion of the drum and until the other wedge shaped block has been moved far enough to again close the throttle valve of the hoisting engine. The shaft is then moved longitudinally in a reverse direction to disengage the operating wedge shaped block and is retained in its shifted position during the succeeding or reverse rotation of the hoisting drum.

While the apparatus hereinbefore described provides for the closing of the throttle valve of the hoisting engine to insure against the ascending and descending cages reaching the top and bottom of the mine shaft when the engine is under a full head of steam and the momentum of the hoisting drum and parts moving therewith is relied upon to complete the travel of the cages, it is necessary that the brake be applied to the drum to insure the stoppage of the cages when they reach the ends of their travel. The brake will usually be controlled by the engineer, but to insure against any negligence on his part there is provided apparatus adapted to be actuated by the movable cross-heads 5 and 6, to automatically effect the application of the brake to the hoisting drum, embracing features as follows: Rotatively mounted in the supports 4, 4 is a rotative, endwise movable shaft 15 which is parallel with and slightly below the level of the screw-threaded shaft 2. Said shaft 15 is driven from the shaft 2 by means of intermeshing gear wheels 13 and 14 mounted on the support 4 adjacent to the winding drum. As shown in Figs. 2 and 7, the said gear wheels 13 and 14 are secured to sleeves 16 and 17 which surround said shafts 2 and 15, and which extend through and are rotatively supported in bearing apertures in the support 4. Upon the inner ends of the sleeves 16 and 17 are collars 18 and 19 which hold the said sleeves 16 and 17 and the gear wheels 13 and 14 from longitudinal movement in the said support 4. The adjacent outer ends of each of the shafts 2 and 15 are adapted to slide endwise in the sleeves and are locked to the same so as to rotate therewith by means of splines and grooves in the

parts. The said shaft 15 is provided with two rigidly attached, longitudinally spaced grooved collars 20 and 21, located one near each end of the said shaft. A horizontally swinging lever 25 extending transversely of the shafts 2 and 15 is pivotally supported between its ends on the base plate 1 with its pivotal axis located laterally between the shafts 2 and 15. The outer arm of said lever 25 has a forked end in engagement with the collar 21. A lever 26 also arranged transversely of the said shafts 2 and 15 is pivotally supported upon the said base plate with its pivotal axis at the side of said shaft 2 remote from the shaft 15, and has its swinging end forked to engage the collar 20. Carried upon the cross head 6 and located vertically in line with and below the shaft 2, in position for contact with the lever 25, is a longitudinally projecting contact stud 27, which extends outwardly or toward the left from said cross head and is adapted to engage the inner arm of the said lever 25 in a manner to move the shaft 15 longitudinally in a direction opposite to that of the movement of the cross head 6. A similar endwise projecting contact stud 28 is carried upon the cross head 5 and extends outwardly, or toward the right therefrom, below the shaft 2. Said contact stud 28 is adapted to engage the lever arm 26 at a point between its ends, or between its pivotal axis and the shaft 15, in a manner to effect movement of said shaft in the same direction as that of the said cross head 5.

To provide for bodily adjustment of the levers 25 and 26 on the base plate in a direction endwise of the shaft 2, the said levers are pivotally mounted on blocks 23 and 24 which are adjustably secured on the rib 7 of the base; said blocks, as shown in the drawings, being provided in their lower surfaces with grooves to receive said rib, and being provided with set screws 29, 30 by which the blocks are clamped to said rib. The purpose of providing endwise bodily adjustment of the said levers 25 and 26 on the base, is to enable the apparatus to be readily adjusted for operation in first assembling the parts of the same, as well as to permit the time of operation of the brake controlling devices to be changed with respect to the time of operation of the throttle closing device, as required in adjusting the apparatus for operation in first assembling the parts or as found desirable or necessary in the application of the apparatus to any particular hoisting engine. It will of course be understood that, when the levers 25 and 26 are so bodily adjusted on the base to change the time of operation of the brake controlling lever, the collars 20 and 21 will be adjusted endwise on the shaft 15 to correspond with the changed positions of the pivots of the said levers.

Connections for operating the brake device from the shaft 15 are provided as follows: Pivotally secured to the centrally located support 10 is a lever arm 35 which is connected at its upper end with the brake or brake operating engine of the hoisting drum by means of a rod 36. Loosely mounted upon a stub shaft 37 carried upon the said lever arm 35 is an antifriction roller 39. Secured upon the shaft 15 and adapted to engage the roller 39 in one longitudinal position of the said shaft 15, is an eccentric or cam disk 40 which acts through the rotation of the shaft 15 to swing the lever arm 35 in a manner to operate the rod 36 and the brake device. As the brakes will be applied to the hoisting drum shortly after the closing of the throttle valve of the hoisting engine, the lever arms 25 and 26 are so located with respect to the positions of the movable cross heads 5 and 6 that, when either of the latter approaches the end of its travel away from the roller 12, it will engage its associated lever 25 or 26 and thereby move the shaft 15 into position with the eccentric thereon in engagement with the roller 39 on the lever arm 35, this occurring at a time shortly after the other one of the wedge shaped blocks has come into contact with and has lifted the roller 12.

In the operation of the device it will sometimes occur that the shaft 15 will be moved into position for operating the brake controlling device at a time when the eccentric or cam disk thereon is in a position in which its portion of greater eccentricity extends past or overlaps the margin of the roller 39. To avoid injury to or breakage of the parts under these circumstances, the roller 34 is adapted to slide endwise on the stub shaft 37 and a spring 45, mounted upon the said stub shaft between the roller 39 and the lever arm 35, acts to hold the said roller yieldingly in its operative position. Said spring permits the roller to have a longitudinal yielding movement upon the stub shaft 37 when the eccentric strikes said roller in the endwise movement of the shaft 15, and said spring acts to force the roller into the same plane with, or in position to be acted upon, by said eccentric 40, when the latter in its rotation reaches a position to permit such movement of the said roller. For returning the shaft 15 to position with the eccentric or cam 40 thereon away from the roller 39 so as to release the brake when the screw shaft 2 is shifted endwise to permit the reversal of the engine, there is provided a bell crank lever 46 which is pivotally supported upon a lug 47 which projects upwardly from the base 1. One arm of the said bell crank lever engages a flanged collar 48 upon the said shaft 15 while the other arm of the said lever is provided with a weight 49 which acts upon the said lever to swing the same in a direction to move the

shaft 15 longitudinally in a direction to restore said shaft to its normal position in which the eccentric 40 is out of engagement with the roller 39.

The operation of a device made in accordance with our invention is as follows: The cross heads 5 and 6 are so located upon the screw-threaded shaft 2 that they will travel a required distance, depending upon the length of cable to be wound and unwound from the hoisting drum, and one or the other, depending upon the direction of rotation of the hoisting drum, will be moved into position for the actuation of the roller 12 to close the throttle at a time when the ascending skip or cage is within two or three hundred feet of the top of the mine shaft, this distance being determined by the number of revolutions that are made by the winding drum under its own momentum. Likewise, the supports 23 and 24 for the lever arms 25 and 26, controlling the longitudinal movement of the shaft 15, are so adjusted with respect to the cross heads 5 and 6 that at the time either of the said cross heads with its wedge shaped block has moved into engagement with the roller 12 the other of the said cross heads will have been moved to position with its contact arm engaging its co-acting lever for giving longitudinal movement to the shaft 15, thereby moving the said shaft into position with the eccentric or cam disk thereon in engagement with the lever arm of the brake controlling mechanism and operating to apply the brakes to the hoisting drum soon after the closing of the throttle valve of the hoisting engine. After the parts have reached a position for throttling the engine and applying the brakes to the hoisting drum, the bell crank lever 3, connected with the end of the screw-threaded shaft 2, will be operated by the engineer to move the actuating cross head with its wedge shaped block out of engagement with the roller 12, thus permitting the engine to be reversed. The longitudinal movement of the shaft 2 will shift the brake actuating cross head out of engagement with its co-acting lever, thus permitting the shaft 15 to be moved longitudinally to its normal position, with its eccentric or cam out of engagement with the brake controlling levers, thereby permitting the brakes to be released from the drum.

While reference has been herein made to only one hoisting engine and one drum around which the cable for raising and lowering the skips or cages out of or into the mine is wound in opposite directions, the device will be equally effective in case two drums upon a single shaft, operated by separate engines, are employed to raise and lower the separate cages, it being evident that two engine throttle valves can be operated from the one bell crank lever as well as can one. In the same manner that the one bell crank lever of the throttle closing device may be employed to control one or two engines so may the one lever arm 35 be adapted to actuate the brakes or brake controlling means of one or two hoisting drums.

It will be understood that an apparatus, constructed and operating as hereinbefore described precludes the possibility of the cage being carried past its stopping point by the action of the hoisting engine in case of neglect or inability on the part of the engineer to close the throttle of the engine at the proper time, and also insures application of the brake to the winding drum in time to prevent the cage being carried by the momentum of the moving parts past its stopping point, in case the engineer fails at the proper time to arrest the movement of the moving parts by the use of the hand-controlled brake.

We claim as our invention:—

1. An automatic throttle closing and brake controlling device for a hoisting engine embracing a screw shaft having rotative movement alternately in opposite directions, a movable throttle closing member, a movable brake controlling member, and two cross heads engaged with and moved by said shaft and adapted for alternate action upon said throttle closing member, a second, rotative, endwise movable shaft, means operating by the rotation of said second shaft for operating the brake controlling member adapted to be thrown into and out of operative connection with said brake controlling member by endwise movement of said second shaft, means maintaining said second shaft normally in inoperative position, and means actuated by said cross heads adapted to shift said second shaft endwise in the same direction in the rotative movements of the said screw-threaded shaft in both directions.

2. An automatic throttle closing and brake controlling device for a hoisting engine embracing a rotative screw-threaded shaft, throttle actuating means operated thereby, a brake controlling member, a second rotative, longitudinally movable shaft separate from and parallel with the screw-threaded shaft for actuating said brake controlling member, said second shaft being normally in inoperative relation to the brake controlling member, and means operated by said screw-threaded shaft acting to shift the said second shaft endwise into position for operative connection with the brake controlling member.

3. An automatic throttle closing and brake controlling device for a hoisting engine, embracing a rotative screw-threaded shaft, a cross head engaged with and actuated by said screw-threaded shaft, a throttle actu-

ating member operated by said cross head, a brake controlling member, a second rotative, longitudinally movable shaft separated from and parallel with said screw-threaded shaft, means operating by the rotation of said second shaft for actuating said brake controlling member adapted to be thrown into and out of operative connection with said brake controlling member by endwise movement of said second shaft, and which are normally in inoperative relation to said brake controlling member, and means actuated by the movable cross head for shifting the said second shaft endwise to bring said actuating means into operative connection with said brake controlling member.

4. An automatic throttle closing and brake controlling device for a hoisting engine, embracing a rotative screw-threaded shaft, a cross head engaged with and actuated by said shaft, a throttle actuating member operated by said cross head, a second rotative, longitudinally movable shaft separate from and parallel with said screw-threaded shaft, a brake controlling member actuated by the rotation of said second shaft, adapted to be thrown into and out of operative connection with the brake controlling member by endwise movement of said second shaft, a weight applied to hold said second shaft in inoperative position, and means actuated by the movable cross head for shifting said second shaft endwise into operative connection with said brake controlling member.

5. An automatic throttle closing and brake controlling device for a hoisting engine, embracing a rotative screw-threaded shaft, a cross head engaged with and actuated by said shaft, a throttle actuating member actuated by said cross head, a second rotative, longitudinally movable shaft separate from and parallel with said screw-threaded shaft, a brake controlling member, a cam disk carried by the said second shaft and adapted by endwise movement of said second shaft to be brought into and out of operative rotation with the brake controlling member, means holding said second shaft normally in position with said eccentric in inoperative relation to the brake controlling member, and means actuated by said movable cross head adapted to shift said second shaft endwise in a direction to bring said eccentric into position for action upon the brake controlling member.

6. An automatic throttle closing and brake controlling device for a hoisting engine, embracing a rotative screw-threaded shaft, a movable cross head engaged with and actuated by said shaft, a second rotative longitudinally movable shaft separate from and parallel with said screw-threaded shaft, a cam disk carried by said second shaft, a pivotally supported brake controlling lever adapted to be actuated by said cam disk, means maintaining said second shaft in position with the cam disk in inoperative position, and a pivoted lever acting upon the said second shaft and adapted to be engaged by the movable cross head to shift said second shaft endwise to bring said cam disk into operative relation to said brake controlling lever.

7. An automatic throttle closing and brake controlling device for a hoisting engine, embracing a rotative screw-threaded shaft, a movable cross head engaged with and actuated by said screw-threaded shaft, a second rotative, longitudinally movable shaft, a brake controlling member, means on said second shaft for actuating said brake controlling member, a bell crank lever connected at one end with said second shaft and provided at its other end with a weight adapted to maintain said second shaft normally in inoperative position, and means actuated by said cross head for shifting said second shaft into position for operative connection with said brake controlling member.

8. An automatic throttle closing and brake controlling device for a hoisting engine embracing a rotative screw-threaded shaft, a base upon which the same is mounted, a movable cross head engaged with and actuated by said screw-threaded shaft, a throttle closing member actuated by said cross head, a second rotative, endwise movable shaft mounted on said base, a brake controlling member pivoted to said base, a pivoted lever connected with said endwise movable shaft and adapted to be engaged with said movable cross head to shift endwise the second shaft, and a support for said pivoted lever mounted on the said base and adjustable thereon in a direction endwise of said shafts.

9. An automatic throttle closing and brake controlling device for a hoisting engine embracing a screw shaft having rotative movement alternately in opposite directions, a movable throttle closing member, a movable brake controlling member, and two cross heads engaged with and moved by said shaft and adapted for alternate action upon said throttle closing member, a second, rotative, endwise movable shaft, means operating by the rotation of said second shaft for operating the brake controlling member adapted to be thrown into and out of operative connection with said brake controlling member by endwise movement of said second shaft, means maintaining said second shaft normally in inoperative position, and two pivoted levers, the pivots of which are arranged in opposite lateral relation to the path of movement of the cross-heads, and which are acted upon severally by said cross-heads; said levers acting to shift said second shaft endwise in

the same direction when given movement by each of said cross-heads.

10. An automatic throttle closing and brake controlling device for a hoisting engine embracing a base, a screw-threaded shaft mounted upon said base, a longitudinally arranged rib upon said base, a cross head having screw-threaded engagement with said shaft and sliding engagement with said rib, a movable throttle closing member mounted on the base and adapted to be actuated by said cross head, and a movable brake controlling member adjustably secured to said longitudinally arranged rib adapted to be actuated by said cross head.

In testimony, that we claim the foregoing as our invention we affix our signatures in the presence of two witnesses, this 2nd day of February A. D. 1909.

SVEN T. NELSON.
HALBERT B. HALVORSEN.
FRANK A. HALLECK.

Witnesses:
FRANK A. ROGERS,
EDWIN O. HANSON.