Sept. 13, 1932. H. E. HALLENBECK 1,877,171

SWITCH CONTROL MECHANISMS

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Fig. 2

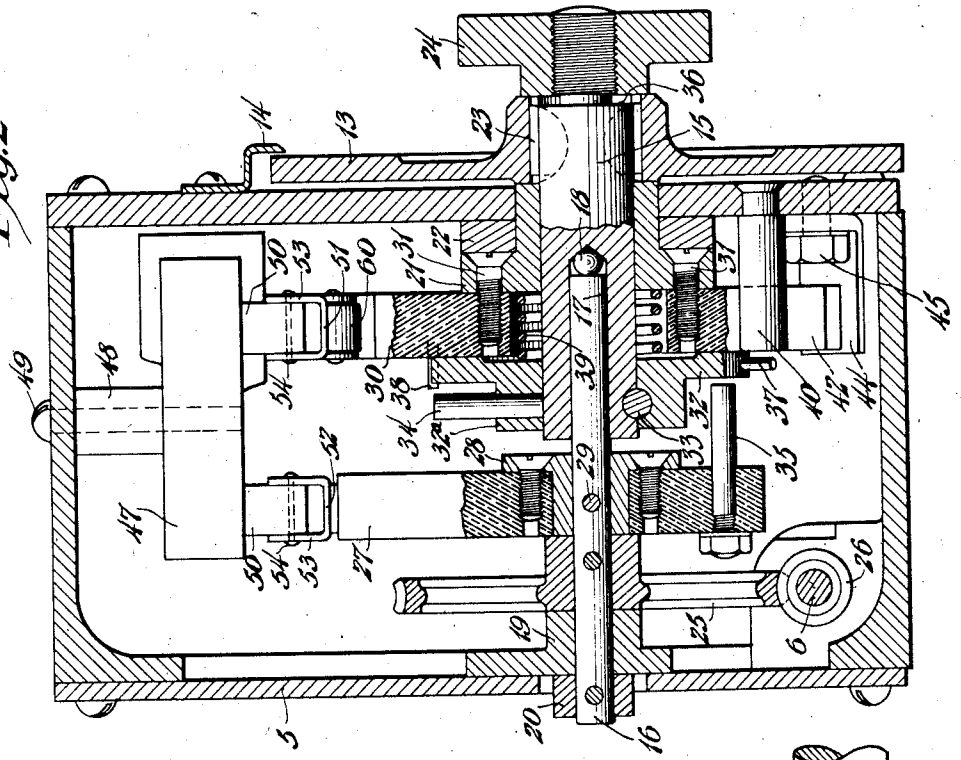
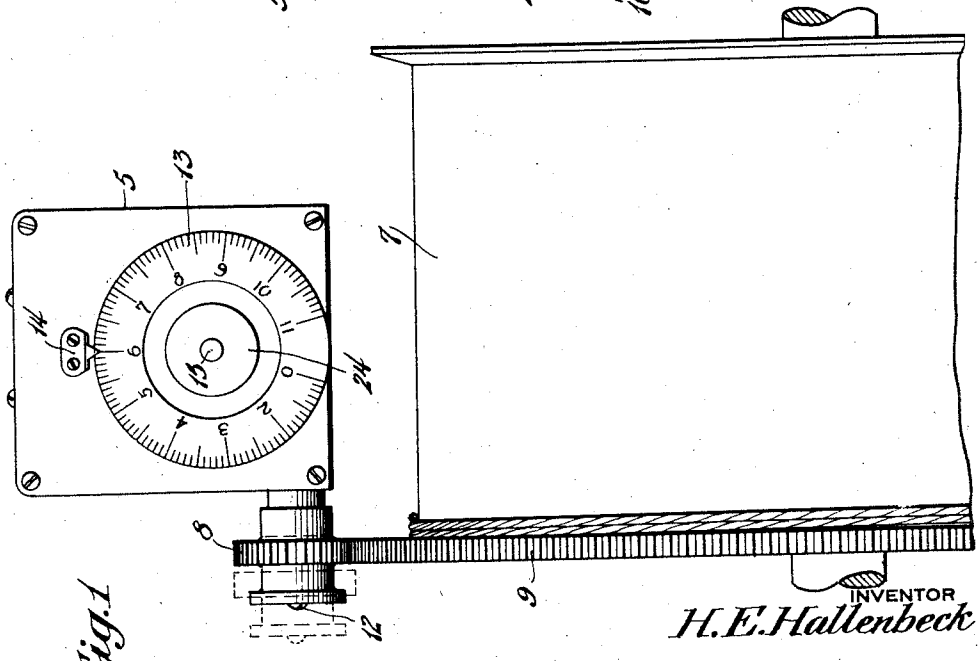


Fig. 1



INVENTOR

H. E. Hallenbeck

BY Philip L. Siggers

ATTORNEY

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Fig. 4

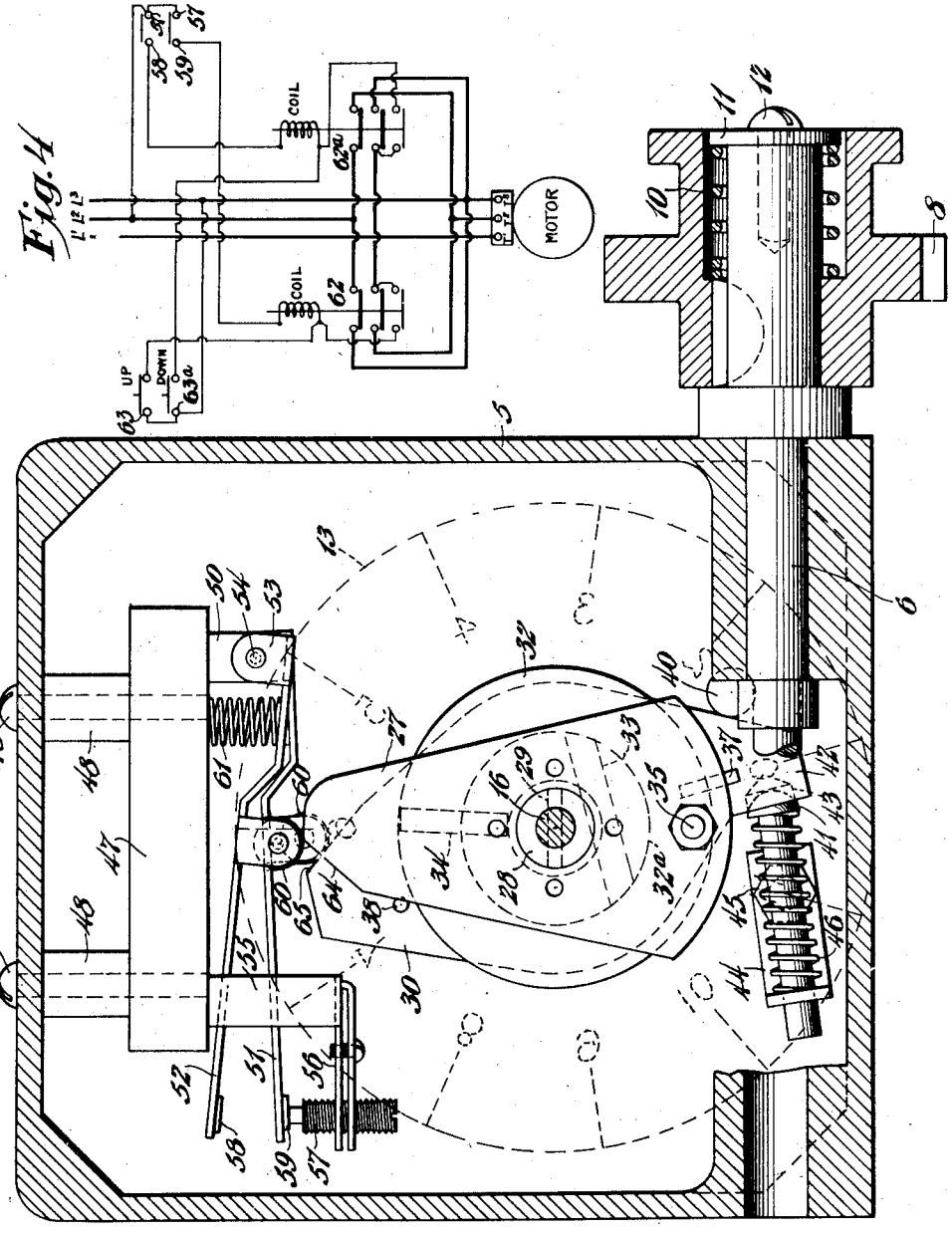


Fig. 3

INVENTOR
H. E. Hallenbeck
BY Philip P. Siggers
ATTORNEY

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UNITED STATES PATENT OFFICE

HAROLD E. HALLENBECK, OF HUDSON, NEW YORK, ASSIGNOR TO GIFFORD-WOOD COMPANY, OF HUDSON, NEW YORK, A CORPORATION OF NEW YORK

SWITCH CONTROL MECHANISMS

Application filed February 11, 1932. Serial No. 592,432.

This invention relates to switch control mechanisms of the class especially adapted to be used for tiering machines, and among other objects, aims to provide a switch actuator to control the travel of a carrier, such as a gig, which is moved between certain limits of travel by means of a motor driven unit, to stop preferably at a fixed level in its descent and at a plurality of predetermined levels in its ascent. The invention can be adapted to control traverse motion, instead of hoisting, also to control stopping of a carrier in either or both directions at fixed or variable points.

Referring to the drawings showing a preferred embodiment of the invention:

Fig. 1 is an elevation of part of a drum of a tiering machine, showing also the control mechanism driven by the drum;

Fig. 2 is a vertical section through the control unit, on an enlarged scale;

Fig. 3 is another vertical section of the same, on the scale of Fig. 2; and

Fig. 4 is a wiring diagram.

The switch control mechanism of the present invention is very advantageously employed in connection with ice tiering machines in which a cake of ice is slid onto a gig substantially flush with the floor and elevated to a point where it can be slid off on to the tops of other cakes already tiered. In order to prevent cracking or chipping of the ice cakes when they are slid onto the gig, the gig must descend exactly to the floor surface and stop. Then when a cake of ice is elevated, the gig must stop at just the right level so that the bottom of the cake lifted will be substantially flush with the top of the block on which it is to be slid. The present invention provides a cam actuated switch for automatically stopping the gig in its descent at a fixed level, i. e., the floor, a dial adjustment which can be set automatically to stop the gig in its ascent at exactly the right level of any one of several tiers, and safety stop means to prevent over travel of the gig past its upper limit, all incorporated in a single unit in a switch box. Such a unit is capable of being mounted at various places, or even added to old installations controlled entirely by hand to make them automatically controlled.

Referring more particularly to the drawings, there is shown in Fig. 1 a limit switch control unit having a control box 5 and a power driven shaft 6 connected with a gig hoist drum 7 through spur gears 8 and 9. Drum 7 is directly driven by a motor, shown diagrammatically in Fig. 4. The gear 8 is keyed on shaft 6 and has hubs on either face, Fig. 3. The outer hub has a larger bore than the inner hub, providing a shoulder and a space around the shaft for a spring 10, which with a washer 11, secured on the end of the shaft by a screw 12, holds the gear normally in mesh with gear 9. However, the gear may be drawn out from its normal meshing position, as indicated in dotted lines in Fig. 1, and remeshed after the shaft 6 has been rotated through one or more revolutions, or through a small fraction of one revolution (the smallest fraction permitted being the fraction which the width of one tooth of gear 8 is of the pitch circle of said gear). A dial 13 is located at the front of the box and has a pointer 14 fastened to the cover, and is used in adjusting the action of the limit switches as will be described.

Referring now to Fig. 2 showing a cross section of the switch operating mechanism, there is shown a dial shaft 15 colinear with a cam shaft 16 both perpendicular to the driven shaft 6. The dial shaft is of relatively large diameter and has an axial bore 17 in its inner end to sleeve the inner end of the cam shaft. A ball 18 in the bore serves as a thrust bearing. The outer end of the cam shaft is journaled in a bushing 19 and has a collar 20 pinned adjacent the bushing. The outer end of the dial shaft is journaled in a flanged bushing 21 and has a thrust washer 22 between the bushing flange and the box cover. The dial 13 is fastened to its shaft by keys 23, and adjacent the dial is a knurled hand nut 24 screw-threaded on the dial shaft.

The cam shaft 16 is driven from the shaft 6 through reduction gears comprising a worm wheel 25 pinned to the cam shaft and a worm 26 on the drive shaft. The shaft 16 carries a bakelite tripping cam 27 secured to the

flange of a brass bushing 28 which in turn is fixed on the shaft by a pin 29. Thus the cam 27 rotates whenever the drum hoist of Fig. 1 is in motion. The dial shaft 15 carries a second bakelite cam 30, fastened to the flange of the bushing 21 by screws 31, but free to remain in a fixed angular position while the shaft rotates. This cam, in fact, is restrained by stops from turning through any but a small central angle, as will be described later. Adjacent the cam 30 is a drive flange 32 having a hub 32ª keyed to the dial shaft by a tangential pin 33, as shown. The hub 32ª has a radial pin 34 which engages a perpendicular stud 35 in the cams 27 when this member is rotated. It will be observed that the hub of the knob 24, which serves also as a nut, does not bear against the shoulder 36 of the shaft, but is adapted to be tightened against the dial, which tightening draws the drive flange 32 against the face of the cam 30 providing a friction grip whereby the flange can drive the cam until the rotation of the latter is checked by the aforementioned stops. The flange also carries a radial pin 37 which will engage a perpendicular pin 38 in the cam 30 in case slipping occurs between the drive flange and the cam. The pin 37 may be set in the flange at the time of assembly to conform to the maximum travel of the gig. The cam 30 has an axial hole large enough to provide space around the shaft 15 for a coil spring 39 which serves merely to spread the members 32 and 30 when the nut 24 is loosened. The pin 40 fastened to the front cover plate of the box, and a spring plunger 41, better shown in Fig. 3 acts as stops to constrain the rotation of the cam 30 to a small central angle including its tripping and release position.

Referring now to Fig. 3, the cam 30 is shown as having a radial projection 42, one side of which bears against the stop pin 40 to prevent any further counter-clockwise rotation of the cam than shown. The opposite side has a cavity 43 to receive the head of the plunger 41. The plunger is mounted in a bracket 44 which is secured to the front cover plate of the box by a bolt 45. The plunger 41 is provided with a coil spring 46 so that when a clockwise torque is applied to the cam 30, it rotates through an angle large enough to cause the tripping of a contact arm, compressing the spring, and then, when the torque is released it springs back against the stop pin 40.

The electrical contact members are supported by a block of insulating material 47 which is spaced from the top of the box by spacers 48 and fastened thereto by screws 49. At one end of the block 47 there are fastened two hinge blocks 50 to which the contact arms 51 and 52 are fastened by ears 53 and hinge pins 54. On the opposite end of the block 47 there is fastened another insulating block 55 to which are attached contact holders 56. Screwed into the end of the holders are adjustable contact points 57, one of which is directly behind the other in Fig. 3 and consequently is not shown. The contact arms 51 and 52 have contact buttons 58 and 59 on their ends to contact with the points 57. In Fig. 3, the button 58 contacts with one of the points 57, while the button 59 contacts with the other point, not visible, behind this point. Midway between the contact buttons and the hinges, the arms are provided with rollers 60 which roll on the cam surfaces when the arms are being tripped. The contacts are normally kept closed by the pressure of the springs 61 on the contact arms.

Referring now to the functioning of the mechanism described, the two switches shown in Figs. 3 and 4, that is contacts 58 and 59, are connected in series with the operating coil of a magnetic reversing switch 62, and contacts 57 and 59 are connected in series with the operating coil of a magnetic switch 62*a*, said magnetic switch controlling the direction of rotation of an electric motor. The tripping of either of the arms 51 or 52 will break its respective circuit and stop the rotation of the motor. An automatic solenoid brake (not shown) is usually employed to stop the drum immediately when the motor circuit is broken. The motor circuit also includes a main switch and fuses (not shown) and there is a two-button switch 63, 63ª by which the circuit may be initially closed to either coil of the magnetic switches by pressing one of the buttons for hoisting and the other for lowering.

In Fig. 3, the open switch 52 is actuated by cam 27 to stop the gig at a fixed level in its descent, and the switch 51 shown as closed is tripped by cam 30 to stop the gig in its ascent at a level indicated on the dial 13. Thus, referring to Fig. 3, the cam 27 is shown as having just completed a counterclockwise rotation tripping the roller of the arm 52 against the cam surface 64, which would stop the gig at the floor level. Obviously, the cam 27 can be set to stop the gig each time at the desired fixed level by the proper adjustment of the gear 8 on the drive shaft 6.

When it is desired to elevate the gig, button 63 is pressed, closing the circuit to the operating coil of magnetic switch 62, causing the motor to start drum 7 in a direction to raise the gig. This movement allows the arm 52 to spring back against the contact 57. The gig now rises and when it reaches a tier corresponding to that indicated on the dial, the cam 30 has rotated in a clockwise direction sufficiently far to engage the drive flange 32 through the engagement of the pins 34 and 35. The friction grip between the drive flange and the cam 30 now causes the latter to rotate slightly in a clockwise direction

against the pressure of the spring plunger 41 and to trip the arm 51, opening the contacts 57 opening the circuit to the operating coil of magnetic switch 62 and thus breaking the motor circuit and stopping the gig. If the gig has traveled to its maximum height, the cam 27 will have rotated through almost a complete revolution, and the pin 37 will have engaged the pin 38 to insure positive tripping of the arms 51.

In lowering the gig, the button 63*a* is pressed, closing the circuit to the operating coil of magnetic switch 62*a*, which closes the motor circuit to cause a down motion of the gig. This motion allows the cam 30 to spring back against the stop pin 40, allowing the arm 51 to spring back against the contact 57. The gig is then lowered and the cam 27 rotates in a counterclockwise or reverse direction back to its starting point, where it again trips the arm 52 and stops the gig at the floor level.

It should now be clear that the interval between the releasing of the arm 51 and the tripping of the arm 52 depends on the initial angular displacement between the pin 35 in the cam 27 and the pin 34 in the drive flange 32. Thus if it were desired to stop the gig at the second tier, the dial would be rotated until the pointer indicated 2. This would bring the pin 34 around to a position just ahead of the pin 35 where the cam 27 would engage the drive flange 32, after rotating through only a small angle. The maximum rise of the gig would evidently be obtained by rotating the drive flange to a position where the cam 27 would have to make almost a complete revolution before the pin 35 engaged the pin 34. With the flange in this angular position, the pin 37 would engage the pin 38 in the cam 30 so that a positive engagement of the flange and cam in addition to the frictional grip between them is provided at this point. In case the maximum travel of the gig in its frame is less than that which would be permitted by one almost complete revolution of the cam 27, the pin 37 would be placed in a different angular position relative to the pin 34 to limit the maximum tripping intervals between the two cams accordingly. When the dial shaft is rotated by means of the knob 24, the drive flange obviously tends to carry the cam 30 around with it, but rotation of the cam is prevented by the stops 40 and 41 so that after the torque on the knob exceeds the frictional torque between the flange and the cam, the flange rotates with respect to the cam to its proper position.

The switch mechanism described thus provides automatic means for breaking a motor circuit at two different intervals, one of said intervals corresponding to a fixed position in one direction of the motor driven part or unit, and the other adjustable to correspond to any desired position, within limits, in the opposite direction. The dial and pointer obvously make possible a very fine adjustment to stop the unit at exactly the desired position.

Although this switch control unit is especially adapted to control the travel of a gig in ice tiering machines, it may be very advantageously employed to control any motor driven carrier which travels in opposite directions between two points. In case it is desired to vary the stopping point in either direction of travel, this may be accomplished by a combination of two of the dial elements described.

In the event the cable on drum 7 stretches, the gig will not stop at exactly the right point, either in hoisting or when descending. To make possible an adjustment of the angular position of both the cams, without affecting their relative position, and without rotating the drum and motor or taking up the cable on the drum, the gear 8 is slidable on shaft 6, as previously described, thus making possible instantaneous disengagement of gear 8 from gear 9 and rotation of shaft 6 through any desired angle, thus rotating both cams in the direction to cause proper functioning of the apparatus.

Obviously, the present invention is not restricted to the particular embodiment thereof herein shown and described. Moreover, it is not indispensable that all the features of the invention be used conjointly, since they may be employed advantageously in various combinations and sub-combinations.

What I claim is:—

1. In a switch actuating mechanism for controlling an electric motor circuit, the combination of a pair of rotating cams adapted to trip switches, one of the cams being geared to the motor, and the other cam being adapted to be engaged by the first and rotated to its tripping position after a predetermined and variable angular advance of the first with respect to the second.

2. In a switch actuating mechanism, the combination of rotating cams, a driving member between two of the cams adapted to be engaged by the first cam after a predetermined angular advance of the first with respect to the second cam, and to transmit said rotary motion to the second cam, said driving member being angularly adjustable with respect to both cams to vary the said predetermined angular advance of the first.

3. In a switch actuating mechanism, the combination of rotating cams and a driving member to link the rotation of one cam to the other after an initial angular advance of one cam with respect to the other; and dial means to indicate and adjust said angular advance of the one cam with respect to the other before linking occurs.

4. In a switch actuating mechanism adapt-

ed to control the travel of an electric motor driven gig or the like, the combination of rotating cams adapted to trip switches in the motor circuit; safety engagement means to limit the maximum rotation of one cam with respect to the other to conform to the maximum travel in one direction of the motor driven gig, said maximum rotation of the one cam with respect to the other corresponding to a maximum interval between the tripping of the two switches by the cams.

5. A switch actuating mechanism for electric motor operated gigs and the like comprising, in combination, a pair of contact arms and points connected to control the stopping of an electric motor; a cam gear driven from the motor, adapted to trip one of the contact arms at a point in the reverse rotation of the motor corresponding to a limiting position of one direction of the travel of a gig driven by the motor; a second cam adapted to trip the other contact arm at a predetermined, indicated and variable point in the forward rotation of the motor corresponding to a position of the gig in a travel oppositely directed from the limiting position; means interposed between the two cams to link the rotation of the first cam to the second after a predetermined angular advance of the first cam with respect to the second; additional safety link means between the two cams to limit the maximum possible rotation of the first cam with respect to the second to conform to the maximum travel in one direction of the gig; and dial means to indicate and determine the interval between the releasing of one contact arm by the first cam and the tripping of the other contact arm by the second cam.

6. A gig travel limit switch, comprising, in combination, automatic means comprising a pair of motor driven cams, and a pair of switch contact arms arranged to be lifted by the cams, to break an electric motor circuit at a point in the reverse rotation of the motor corresponding to a fixed position of the motor driven gig, and at a point in the forward rotation of the motor corresponding to a variable and indicated position of the gig, said breaking of the motor circuit being brought about by the rotating cams in conjunction with said switch contact arms, one of said cams being geared to the motor, and the other being adjustable to be engaged by the first cam and turned to its tripping position after a variable and indicated angular advance of the first cam from its release position.

7. A switch actuating mechanism adapted to be gear driven from an electric motor and having cams to trip switches which will break the motor circuit; a cam shaft geared to the motor; an insulating cam secured to the cam shaft and having an edge adapted to engage and trip a switch contact arm at the end of a reverse rotation of the cam and motor; a dial shaft colinear with the cam shaft; a dial keyed on the outer end of the dial shaft; a clutch member keyed on the inner end of the dial shaft; a second insulating cam adapted to be turned with the dial shaft by the friction grip of the clutch member and having an edge adapted to engage and trip a switch contact arm at the end of a forward rotation of the cam and motor; means on the dial shaft to tighten the clutch member against the second cam; stops adapted to restrain the rotation of the second cam to a small central angle including the tripping and release positions of the cam, one of said stops having spring means to hold the cam normally in a release position; and driving pins in the first cam and drive flange whereby the second cam is engaged by the drive flange and rotated to its tripping position by the first cam after a variable and adjustable angular advance of the first cam from its release position.

8. A switch actuating mechanism of the class described comprising, in combination, a driven shaft having a slot for a key; a cam geared to the driven shaft; a key; a spur gear secured to the shaft and adapted to mesh with a drive gear to be driven thereby; said spur gear having hubs on both sides, one hub having a bore to fit the driven shaft, and a slot for the key, and the other hub having a larger bore ending in a shoulder at the other bore; a coil spring around the driven shaft within the larger bore; a circular disk at the end of the driven shaft secured thereto; said spring acting against the disk and the shoulder to hold the gear normally in mesh; said gear being slidable towards the disk end of the shaft to permit disengagement of the spur gear from its driving gear and rotation of the driven shaft with respect to the drive gear; said arrangement permitting proper adjustment of the cam relative to the drive gear.

9. In a device of the character described, the combination of a motor; a motor-driven gear; a second gear meshing with the motor-driven gear; a shaft carrying the second gear; co-operating means on the shaft and second gear so that the second gear is slidable on the shaft and disengageable from the driven gear; yieldable means to hold the second gear in meshing position; a worm on the shaft; a worm gear driven by the worm and secured to another shaft; a pair of cams secured to the second-named shaft; a pair of spring-closed switches each adapted to be opened by one of said cams; and a circuit comprising the motor and the switches whereby the motor is stopped by said switches, and reversing connections whereby two-way travel of the motor is governed.

10. A switch control mechanism comprising, in combination, a shaft; a reduction

gearing driven by the shaft; a cam rotated by the reduction gearing; a normally closed switch opened by said cam; a motor whose circuit comprises said switch and which drives said shaft through a set of gears; one of the gears being secured to said shaft and being disengageable by hand from the meshing position, so that its shaft may be rotated by hand and the gear then restored to meshing position.

11. A gig travel limit switch and switch actuating mechanism comprising, in combination, a box-like housing; a pair of switches within the housing connected in series in an electric motor circuit and adapted to be tripped open by rotating cams; a cam geared to the motor and adapted to trip one of the switches at a point in the reverse rotation of the motor corresponding to a fixed position of the gig; a second cam adapted to trip the other switch at a variable point in the forward rotation of the motor corresponding to a variable and dial indicated position of the gig; a dial shaft colinear with a cam shaft carrying the first cam, projecting through the front of the box and journaled in the same and carrying the second cam; a friction disk secured to the cam shaft between the two cams and adapted to be tightened against the second cam and rotate the same; an indicating dial on the outer end of the shaft; pins in the first cam and friction disk whereby the first cam can engage the friction disk and thereby the second cam after an adjustable angular advance of the first cam from its release position; safety engagement pins in the friction disk and second cam which engage each other when the friction disk has been rotated with respect to the second cam to a position where the maximum tripping interval between the two cams is obtained, said pins serving also to limit the maximum tripping interval between the two cams to conform to the maximum continuous travel of the gig; the initial angular displacement of the two cams from their engaging position adjustable by means of the friction dials which can be rotated with respect to the second cam by means of the dial and set to cause the tripping of the second cam switch at a point indicated on the dial.

12. A motor driven switch actuating mechanism comprising, in combination, a housing box; a cam shaft geared to the motor; a cam pinned on the cam shaft adapted to operate in a central angle less than 360° and to trip a switch arm at a point in the reverse rotation of the motor corresponding to a fixed position of the carrier under control; means in the cam shaft gearing by which the cam may be set to trip the switch at a point corresponding to a limiting position of one direction of the carrier travel; a dial shaft colinear with the cam shaft; a dial outside the box keyed on the end of the dial shaft; a second cam mounted on the dial shaft rotatable with respect to the same; stop means to restrain the rotation of the end cam to a small central angle including its tripping and release position and to hold the end cam normally in a release position; a friction flange keyed on the dial shaft between the two cams; means on the dial shaft to tighten the friction flange against the second cam to provide a friction grip whereby the flange can drive the cam; a driving pin in the first cam; a driving pin in the friction flange engageable by the pin of the first cam; safety stop pins in the friction flange and second cam which provide positive means of engagement in addition to the friction grip between the two members when the friction flange is set in a position to cause a maximum interval between the tripping points of the first and second cams, said interval corresponding to a maximum travel in one direction of the carrier; the second cam adapted to trip a second switch in the motor circuit at a point in the forward rotation of the motor after a variable interval from the releasing of the first cam switch; the interval between the closing of either of the switches and the tripping of the other being variable and dependent on the dial setting, said dial indicating the point where the carrier will stop.

13. A switch actuating mechanism comprising, in combination, a housing; switches within the housing connected in series in an electric motor circuit and having switch arms normally closed by spring pressure but adapted to be tripped open; a cam shaft, one end of which is journaled in the housing, and the other end in the axial bore of a colinear dial shaft; a dial shaft colinear with the cam shaft having an axial bore in one end to serve as a sleeve for the inner end of the cam shaft and having its outer end projecting through the housing and journaled therein; a drive shaft at right angles to the cam shaft bearinged in one end of the box and having on one end a spur gear outside the box by which the drive shaft may be driven by an electric motor, and on its inner end a worm; a worm wheel secured on the cam shaft to engage said worm; an insulating tripping cam secured on the shaft; said dial shaft having keyed on its inner end a driving flange having a hub adjacent the pinned cam of the cam shaft; an indicating dial keyed on the dial shaft; said dial shaft having a threaded portion; a hand nut which may be tightened against the dial hub; a flanged bushing between the drive flange and the housing, a portion of which projects through the housing and contacts with the inner side of the dial hub, and having a friction grip with the same; a second insulating tripping cam secured to the flange of the bushing, both cam and bushing being rotatable with respect to the cam shaft and to the housing; said last-mentioned cam having an edge

to contact with a switch arm, and diametrically opposite the tripping edge, a radial projection to restrain the rotation of the cam to a small central angle including the tripping and release positions of the cam; stops secured to the front cover plate, one stop consisting of a pin to limit the reverse rotation of the cam to a release position; the other stop comprising a spring plunger which is compressed by the rotation of the cam to its tripping position and which snaps the cam back against the stop pin when the tripping torque is released; said first-mentioned cam having an edge oppositely inclined to that of the second cam and adapted to trip a contact arm in the reverse rotation of the cam; driving pins, one projecting at right angles from the inner face of the pinned cam, and the other projecting radially from the hub of the drive flange; said pins furnishing means whereby the first cam can engage the drive flange and thereby the second cam after a variable and adjustable angular advance from its tripping position of the first cam with respect to the second; and safety engagement pins, one projecting radially from the drive flange, and the other projecting at right angles from the adjacent face of the second cam, to limit the maximum angular advance of the first cam with respect to the second.

In testimony, that I claim the foregoing as my own, I have hereto affixed my signature.

HAROLD E. HALLENBECK.