Jan. 16, 1940. J. Q. HENRY 2,187,202

SWITCH CONTROL

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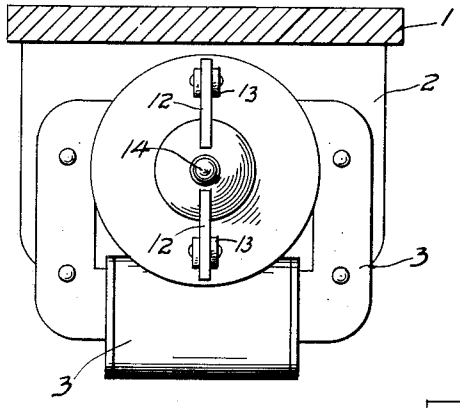

Fig. 3.

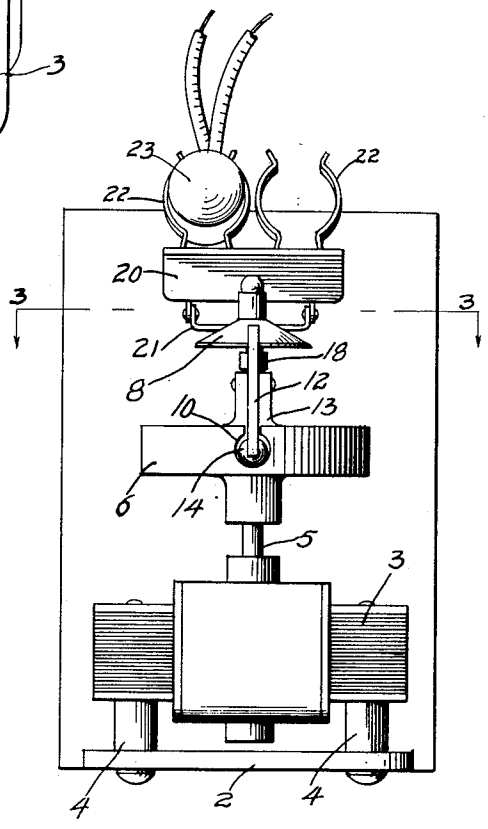

Fig. 2.

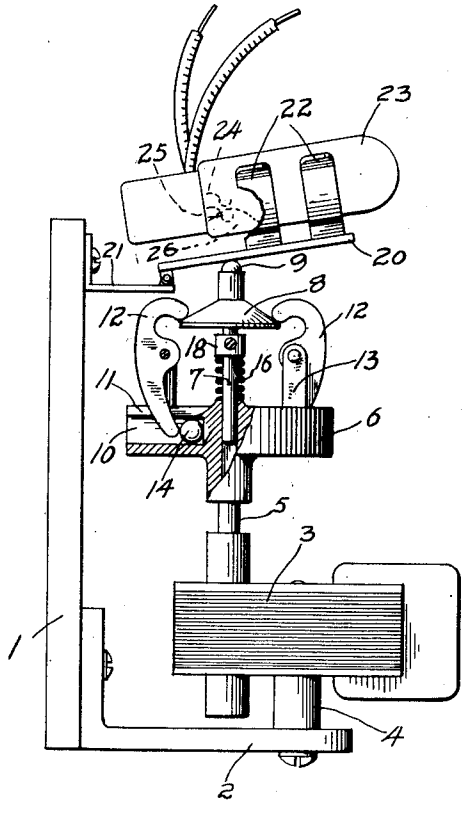

Fig. 1.

INVENTOR:
JAMES Q. HENRY

BY O O Martin

ATTORNEY.

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Fig. 4.

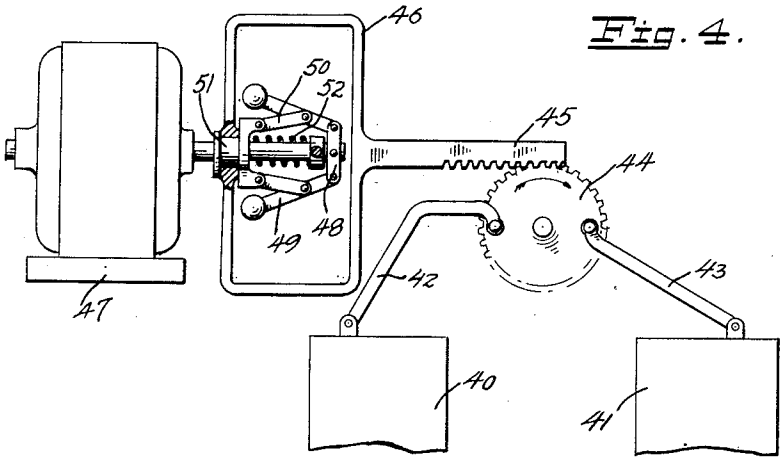


Fig. 6.

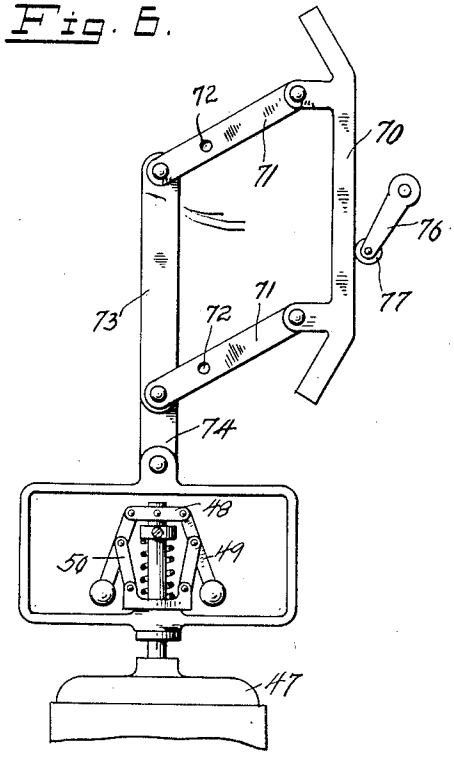
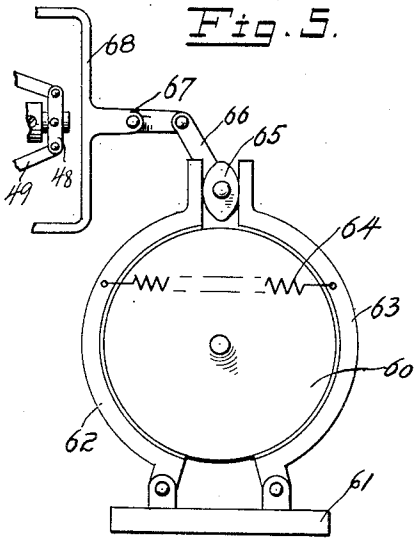


Fig. 5.



INVENTOR:
JAMES Q. HENRY,
BY
ATTORNEY.

Patented Jan. 16, 1940 2,187,202

UNITED STATES PATENT OFFICE

2,187,202

SWITCH CONTROL

James Q. Henry, Los Angeles, Calif.

Application September 26, 1938, Serial No. 231,775

4 Claims. (Cl. 200—80)

The present invention relates to time controls and has particular reference to means for operating switches as well as other mechanisms in definite, predetermined and nonvarying timed relation to mechanisms associated therewith.

For convenience in explaining the purport of the invention, the devices herein described apply to automatic door controls for elevators, but it is specifically pointed out that the invention is equally applicable to many other classes of mechanisms.

One of the great problems in operating elevator doors automatically is to time the operation of opening and of closing the door. This is usually done electrically. If a simple switch is employed to energize a motor or magnet, the result is that the door will move instantly, leaving no time for a passenger to enter or leave the elevator and that for this reason life and limb of passengers may be endangered. To overcome this difficulty, it is customary to employ complicated and expensive electrical and mechanical controls, liable to get out of order or adjustment.

With the foregoing in view, it is the general object of this invention to provide a simple and inexpensive device capable of controlling the timing of operations of devices such as elevator doors or other mechanisms requiring exact, unvarying timing, or of operating such mechanisms in exact timing. To this end, it is the object of the invention to provide a control mechanism including a member expansive and contractive in response to speed variations and a control element movable by said member, upon attaining a predetermined speed to set mechanism into action or to operate such mechanism. A further object is to provide means, associated with the member for determining the speed at which the member may be set to commence moving said element.

With these objects in view, the invention consists in the novel combinations hereinafter fully described, and drawings are hereto annexed in which a preferred form of the invention is illustrated.

In the drawings:

Fig. 1 is a side elevational view of a device embodying the invention;

Fig. 2 is a substantially corresponding front elevation;

Fig. 3 is a plan view of the lower portion of the device, taken substantially on a line 3—3 of Fig. 2; and,

Figs. 4, 5 and 6 are diagrammatic views showing the application of the device of the invention to various mechanisms.

On a panel 1 is mounted a bracket 2, supporting a small single phase electric motor 3 on posts 4, see Figs. 1 and 2. The rotor shaft, 5, of this motor, carries a fly wheel 6, provided with an axial bore in which a stem 7 is seated to slide. This stem is made with a conical shoulder 8 and it terminates at the top in a socket in which a ball 9 is shown seated to spin freely. The fly wheel is provided with radial bores 10, in continued alignment, and the upper surface of the wheel is slotted at 11 to admit a pair of pawls 12, pivotally mounted on posts 13 of the fly wheel. A weighted element, such as a ball 14, is placed within the bore 10, behind each pawl 12, and a spring is shown encompassing the stem 7, above the fly wheel.

The motor 3 is energized to rotate the flywheel, and the centrifugal force developed, acting against the elements 14, causes the pawls 12 to swing on their pivots against the tension of the spring 16, when the flywheel has attained a certain, predetermined speed, as will be more fully explained presently.

A plate 20 is shown pivotally mounted above the stem 7 on a bracket 21, and it is made with clips 22, shaped to receive switch elements 23, only one of which is, for the shake of simplicity, here shown. Each switch element comprises a glass tube, within which contacts 24, 25 are seated, and a small quantity of mercury 26 is held confined within the tube. Preferably, as much air as possible is exhausted from the tube.

Normally, the tube 23 is held sufficiently tilted to cause the mercury to sink to the end of the tube in which the contacts are mounted but, when the flywheel attains a predetermined speed and the pawls 12 commence to swing on their pivots, it is seen that the stem 7 is depressed and the plate 20 thereby freed for downward movement. This tilting movement continues until the tube moves sufficiently in the opposite direction to cause the mercury to flow to the other end of the tube, thereby to open the circuit through the two contacts. When the motor is deenergized, the tension of the spring 16 operates to raise the stem 7 and to tilt the tube 23 back into its normal position.

It was stated that this downward tilting movement of the tube commences when the motor attains a predetermined speed, and this speed control is governed by three factors. One is the angle of inclination of the shoulder 8, which is shown to be about sixty degrees from the axis of

the stem, and the angle of the upper end of the pawl 12, contacting the shoulder, relative to its pivotal point, which is about 30 degrees. If the shoulder inclination is made more steep and the angle of the pawl smaller, it is seen that much greater pressure of the pawls will be required to depress the stem and greater speed of rotation necessary to obtain this greater pressure. From which it follows that the time it takes to commence depressing the stem is proportionate to the angular relation between the two parts and to the speed attained.

Another factor is the tension of the spring 16. This may be adjusted by means of a collar 18 or any mechanical equivalent of this collar. The third factor is the voltage of the motor which, through the medium of a variable transformer, conventionally indicated at 30, may be adjusted to vary the speed of the fly wheel.

The switch element 23 is shown positioned normally to maintain a circuit open, but it is to be noted that it is merely required to turn this element end for end in order to reverse the function thereof. The device above described is used primarily to control a circuit connected to open or to close a door, but it may be used in connection with any other mechanical movement where exact timing is essential. Where a synchronous motor, such as used in electric clocks, is employed, it is seen that exact, unvarying timing of operation is attainable.

Instead of operating a switch as described, the device of the invention may be mechanically connected to perform some other mechanical operation, as in the diagrammatic Fig. 4, in which the numerals 40, 41 denote an elevator door movable into closed position by means of arms 42, 43 pivotally mounted on a central disc 44, having gear teeth on its circumference. A rack 45 is held in mesh with these teeth, and this rack forms part of a frame 46, riding on the shaft of a motor 47 but held against rotation by said motor in any suitable manner, not shown. On the motor shaft is a cross-head 48, which is perforated at the ends to receive arms 49, and links 50 connect these arms to a sleeve 51, rotatably seated on the motor shaft and in the frame 46. When a button is pressed to close the elevator door, a circuit through the motor is closed, causing the latter to rotate, and when a predetermined speed is attained, an expansion of the arms and links commences, causing the frame 46 to move away from the motor axially and to commence to impart rotation to the disc 44 to close the door.

The important feature of this mechanism is that a fixed, predetermined dwell between the closing of the motor circuit and the movement of the door always is present. The door may be maintained in open position by springs, counterweight or the like, the resistance of which, to the closing of the door, should be calculated to give the exact lapse of time required. If desired, an adjustable resistance, such as a spring 52, may be introduced to facilitate this timing.

In Fig. 5, another embodiment of the invention in a mechanical device is diagrammatically shown to comprise a brake drum 60, mounted for rotation on a base 61. Brake shoes 62, 63 are hung on this base and normally held set by a suitable spring 64. A cam 65 is provided to spread the shoes and thereby to release the brake, and this cam is shown made with an arm 66, connected to the frame 68 of the invention by means of a link 67. Also in this case, it is important to note that the motor must attain a predetermined speed before the frame 68 commences to move axially and that in this manner sudden and jerky starting of the elevator is prevented. The setting of the brake is similarly retarded, permitting the elevator to come to a stop gradually and gently.

As shown in Fig. 6, a device 70, in elevator practice, termed the retiring cam, is hung on levers 71, pivotally secured to the elevator cage (not shown) at 72 and journaled on a bar 73 which in turn, by means of a link 74, is operatively connected with the device 75 of the invention. An arm 76 is hung adjacent to the door at each floor, and its outer end carries a wheel 77 for contact with the cam 70, when the motor is energized. This arm is in any well known manner (not shown) connected with the door lock, which cannot be operated until the time dwell of the device of the invention has elapsed. This time dwell also makes it impossible for the passenger to open the door from within until the elevator has come to a full stop at the designated floor.

Numerous other instances might be mentioned, where the device of the invention will function to perform a given operation within a certain, specified time. It is, for example, useful in starting the elevator cage, because it prevents sudden and jerky starts. And it is furthermore important for the purposes enumerated because of its flexibility. It is seen that, even when it commences to function, its operation is accelerating and yieldable to sudden resistances. It is simple and inexpensive, whereas the devices usually employed in such connections are complicated and expensive. And it may be applied to any mechanism requiring such timed, flexible operation as above outlined.

I claim:

1. A support, a shaft rotatably held thereby, a flywheel on the shaft, a projecting stem axially movable in said flywheel in continued alignment with the shaft, a conical head on the outer end of said stem, a frame pivotally mounted on the shaft support, a mercury switch held in said frame, levers hung on the face of the flywheel and having the outer ends in contact with the cone surface of said head, the inner ends of said levers riding in grooves of said flywheel, and weights radially movable in said grooves to swing said inner ends outward upon attaining a predetermined speed, thereby to move said stem axially to cause said frame to tilt and thereby to operate said switch.

2. A shaft, a flywheel on the shaft having an axial socket, a stem fitted to slide axially in said socket and having a conical head near its outer end, levers hung on the face of said flywheel and having relatively short outer ends riding on said conical surface, the inner ends of said levers being longer and caused by centrifugal force to swing outward when the shaft attains a predetermined speed, thereby to move said stem axially toward the flywheel, a frame pivotally mounted in front of said stem, a mercury switch held in said frame, and an anti-friction element between the end of the stem and the said frame.

3. A shaft, a flywheel on the shaft having an axial socket, a stem seated to slide axially in said socket and provided with a head, a switch mechanism operable by axial movement of said stem, levers on the flywheel engaging the head of said stem, there being radial sockets in said

flywheel and slots leading thereinto, the inner ends of said levers riding in said slots and sockets, and elements in the sockets movable by centrifugal force to swing said lever ends outward.

4. A vertically directed shaft, a flywheel on said shaft having an axial bore in continued alignment therewith, a stem seated to slide axially in said bore and terminating at the top in a head having a conical shoulder, a frame pivotally hung above said stem and resting on the end thereof, a switch element on said frame, a spring urging said stem upward, and centrifugally operated levers on the flywheel riding on said shoulder to move the stem downward upon attaining a predetermined flywheel speed against the tension of said spring, thereby to operate said switch element.

JAMES Q. HENRY.