Feb. 28, 1950 G. C. CROM 2,498,651

ACTUATING HANDLE ASSEMBLY FOR SWITCHES

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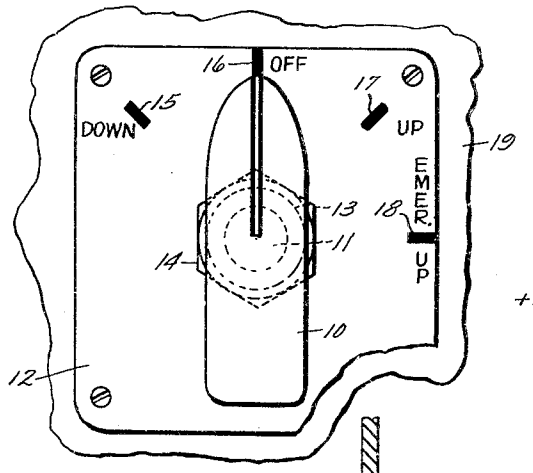


Fig 1

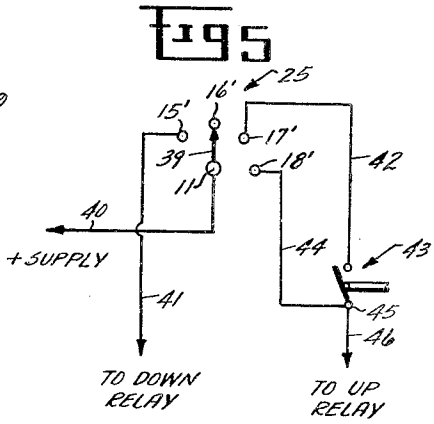


Fig 5

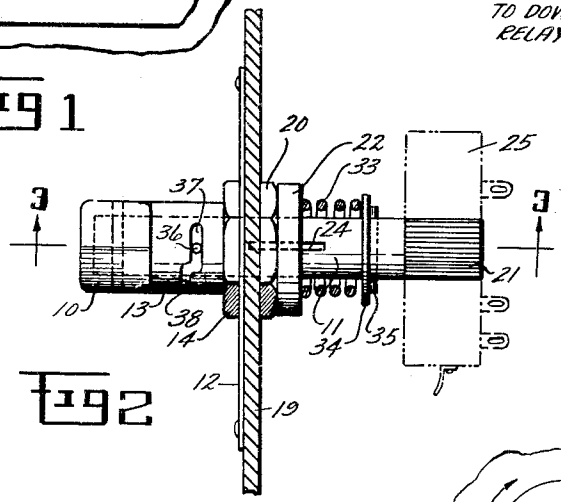


Fig 2

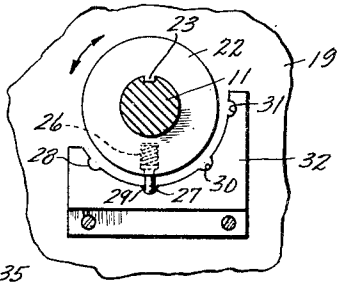


Fig 4

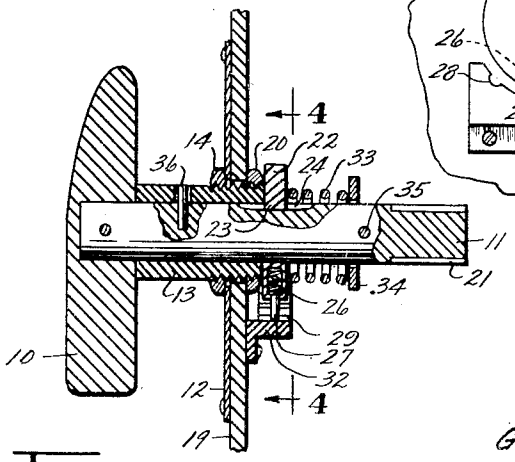


Fig 3

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ACTUATING HANDLE ASSEMBLY FOR SWITCHES

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3 Claims. (Cl. 74—504)

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The invention described herein may be manufactured and used by or for the Government for governmental purposes without payment to me of any royalty thereon.

This invention relates to a handle for assembly actuating a switch. While the assembly is adapted for general use and may be employed to actuate either electric or hydraulic switches, it is especially suitable for operating electrical landing-gear operating switches for airplanes.

The landing-gear of an airplane is frequently the cause of an accident resulting from its unintended actuation. It is a serious matter which may cause a crash if a landing gear is folded while the plane is standing or taxiing or if the wheels are let down while the plane is in full flight at high speed. Landing gear switches have, in the past, been actuated by mistake because they were confused with other switches.

One object of the present invention is to provide an actuating handle assembly that identifies the switch to which it is connected by having different operating characteristics in the emergency position than other switch handles. It therefore can hardly be operated subconsciously.

Another object is to provide a handle assembly that requires considerable physical effort to operate so that it probably cannot be operated subconsciously.

Another object is to provide a handle assembly in the operation of which the different stations or stages are felt definitely and positively by the operator, and the emergency position is differentiated from the normal working and "off" positions by its greater resistance.

Briefly stated, the invention comprises a switch handle mechanism involving four contact making positions and so constructed that a two-way motion of the switch handle must be made to arrive at the fourth or last contact position. The mechanism comprises a bushing fixed to the switch panel and having a bayonet-type slot in which rides a pin carried by the switch-actuating shaft. A compression spring maintains the shaft in position when turned to make the first three contacts and considerable outward pull on the switch handle is required to compress the spring to permit shifting the shaft-pin by the step in the bayonet slot of the bushing to position the shaft for effecting the fourth or last contact. Accidental rotation of the switch arm into the last position is thereby prevented. A greater or lesser number of contacts may be provided.

Referring now to the accompanying drawings:

Fig. 1 is a front or plan view of the handle assembly and indicating panel over which it operates. The latter is shown partly broken away;

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Fig. 2 is a plan view of the handle assembly and working parts thereof, the operating spring and the panel being sectioned. An electric switch operatively attached thereto is shown in dashed lines;

Fig. 3 is a vertical section of the handle assembly and operating parts including the panel. It is taken on the line 3—3 of Fig. 2;

Fig. 4 is a rear view of the detent which the handle actuates. It is taken on the line 4—4 of Fig. 3; and

Fig. 5 is a schematic diagram of an electric circuit suitable for landing gear operation by the switch shown in Fig. 2.

In Fig. 1, 10 is a handle which is mounted on a shaft 11 over a panel 12. The shaft 11 is surrounded by a bushing 13 which is attached to the panel by a nut 14. On the panel are indicated three positions, reading from left to right "down" 15, "off" 16, "up" 17 and "emer up" 18 (emergency up), over which the pointed end of the handle 10 can be moved.

In Fig. 2 the handle 10 is seen from below and the panel 12 is shown to be affixed to a wall 19. A second nut 20 cooperates with nut 14 to hold the bushing 13 to the wall 19 and so support the shaft 11. The latter has a splined end 21 to which is operatively attached an electric switch 25. The latter is a four position switch of the kind in which an arm 22 (see Fig. 5) is moved over a number of contacts arranged in a circle or partial circle.

In Figs. 2 and 3, 22 is a disk mounted slidably on shaft 11. It is keyed to that shaft by means of a slidable integral key 23 which fits an elongated keyway 24. A strong spring 26 (Fig. 4) is fitted into its lower periphery and presses a detent 27 into notches 28, 29, 30 and 31 which are cut into a plate 32. The detent acts strongly and positively.

Referring again to Fig. 2, 33 is a strong coil spring mounted concentrically with the shaft 11. It is so attached between the bushing 13 and a second disk 34 that these members are being constantly pushed apart. Pins 35 and 36 are recessed into the shaft 11 to resist this push. Pin 36 is arranged to project from the shaft 11 into a slot 37 in which there is a jog 38 in the direction of handle 10.

Referring now to the circuit shown in Fig. 5, contact 11' corresponds to the shaft 11 of the other figures. Contacts 15', 16', 17' and 18' correspond to the positions of the handle 10 so numbered in Fig. 1 and also to detent notches 28,

29, 30 and 31 in Fig. 4. Actually the contacts 15', 16', 17' and 18' are parts of the electric switch 25. Contact 11' can be successively connected to any one of contacts 15', 16', 17' or 18' by the angular traverse of a conductive arm 39. The circuit is so arranged that a lead 40, which may be from the positive terminal of a D. C. power supply, energizes the contact 11'. From this contact, the arm 39 can energize a "down" relay (not shown) by connecting the contacts 11' and 15' to energize a lead 41 and thereby lower the landing gear. As the circuit is shown in Fig. 5, the arm 39 is on contact 16', therefore it is in the "off" position since there are no other connections to contact 16'. When the arm 39 is on contact 17' the "up" relay (not shown) which may be connected to contact 17' through a lead 42 if an oleo-strut-pressure actuated switch 43 is closed, otherwise not. The switch 43 is located on the landing-gears-strut oil pressure line, so that with a load (the weight of the airplane) on a strut, the switch 43 will be held open. The purpose of this switch is to prevent actuation of the landing gear while the airplane is parked and is in itself a known device and forms per se no part of this invention.

There is one situation in which it is imperative to be able to pull up the landing gear even when it is sustaining the weight of the airplane. This situation occurs when a heavily-loaded airplane is taking off and one or more motors fail before the airplane has left the ground. In such case the airplane must be stopped within the field before it has a chance to collide with obstacles on the ground outside the field. The quickest way of making the stop is to make a belly landing. Therefore a means of bypassing the strut safety switch 43 is provided. Such means comprise the contact 18' (the "emergency up" position), a lead 44 connected to a contact 45 below the switch 43, with a final connection 46 to the "up" relay (not shown).

The handle assembly, which has been described, operates as follows. Assuming that the pin 36 is in the extreme left side of slot 37, the handle 10 will then be turned so that it points to the "down" position in Fig. 1. The bushing 13 cannot move during operation, but the shaft 11 and pin 36 both move angularly when the handle 10 is moved. On Fig. 4, the detent pin 27 first occupies notch 28 when the handle 10 is on "down."

For the first three positions, i. e., "down," "off" and "up" the operation of the handle assembly is like that of a conventional multi-position switch. Since the "emergency-up" position is only to be operated under conditions that occur with extreme infrequency and serious trouble would result if it were operated at the wrong time, the handle assembly is made so that this position cannot be dialed except deliberately. It is intended that a strong force must be employed to place the handle in the "emergency-up" position although only moderate effort is needed to shift from one of the remaining positions to the other. To provide the necessity for a strong force is the function of the jog 38 in slot 37. A force sufficient to turn the shaft 11 enough so that the pin 36 comes to the far end of jog 38 must compress the spring 33 a distance equal to the offset in the jog. This involves outward movement of the shaft 11 and such movement is accommodated by the keyway 24 which allows the shaft 11 to slide under the key portion 23 of disk 22. The latter is held at all times against nut 20 regardless of the position of shaft 11, by the spring 33. Notch 31 is provided to detain the disk 22 and shaft 11 in the "emergency-up" position. Motion in the electric switch 25 to set arm 39 on contact 18' is caused by the rotation of the splined end 21.

While the electrical circuit in Fig. 5 has been arranged for D. C. operation, any skilled electrician can adapt it to operation by a 3 wire A. C. system, for example, the 400 cycle system used in B-29 bombers.

I claim as my invention:

1. In a handle assembly for switch operation, a handle, a shaft attached thereto and rotatable thereby, a detent and a detent plate operatively associated therewith, a plurality of notches in said detent plate and means including a jog-slotted bushing encircling said shaft between said detent and said handle, and a pin projecting into said shaft and through the slot in said bushing whereby a plurality of detent-indexed stations may be attained by the angular movement of said shaft and handle at little effort to engage the various detent notches which define said stations, and spring means located between said detent and the outer end of said shaft whereby a handle indexing movement into a final detent position can be attained only by partial retraction of said shaft by said pin in following a jogged portion of said slot at considerably greater effort.

2. In combination, a panel, a shaft extending through said panel and capable of limited longitudinal movement therethrough, a handle attached to said shaft in front of said panel, a bushing encircling said shaft and also extending through said panel said bushing having a crosswise slot jogged at one end thereof, a nut on each side of said panel threadedly cooperating with said bushing to mount the latter and the shaft in the panel, a detent and a detent plate bearing notches, one of which is an asymmetrically located final notch, said plate being cooperatively mounted behind said panel, a coil spring encircling said shaft, fulcrum means on the outer end of said shaft whereby said spring urges said shaft beyond the rear of said panel, a key and keyway connection between said detent and said shaft, the key being adapted to slide in said keyway, a pin mounted to project into said shaft crosswise thereof and into the jogged slot, the jog being so arranged that the spring must be compressed by the action of the jog upon the pin and shaft to retract the latter in order that the pin may enter the jogged portion of the slot and that the shaft may be rotated sufficiently that the detent may enter the asymmetrically located final notch on the detent plate.

3. In combination, a switch, a panel before said switch, a shaft extending through said panel and operatively connected to said switch, a bushing surrounding said shaft and attached to said panel, said bushing having a bayonet-type slot, a crosswise pin projecting into said shaft and said slot, a detent mounted on said shaft behind said panel, a detent plate mounted behind said panel to cooperate with said detent, stations in said detent plate corresponding to switch positions, a compression spring normally urging said shaft through said detent, a sliding key connection between said shaft and said detent, a handle on that end of said shaft which is in front of the panel, said handle abutting said bushing, said handle being adapted to turn said shaft in said bushing to accomplish a plurality of set-

tings of said detent with normal effort and a final one with abnormally great effort, the slot being provided with a jog at a point corresponding to the location of the station preceding the final station whereby the shaft will be necessarily displaced along its longitudinal axis against the action of the spring to give the operator reason to put forth abnormal effort after passing the station preceding the final station in order to displace the shaft sufficiently to set the detent at the final station.

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