July 16, 1935. A. S. NELSON 2,008,150

CONTROL MECHANISM

Filed March 29, 1932

Fig. 1

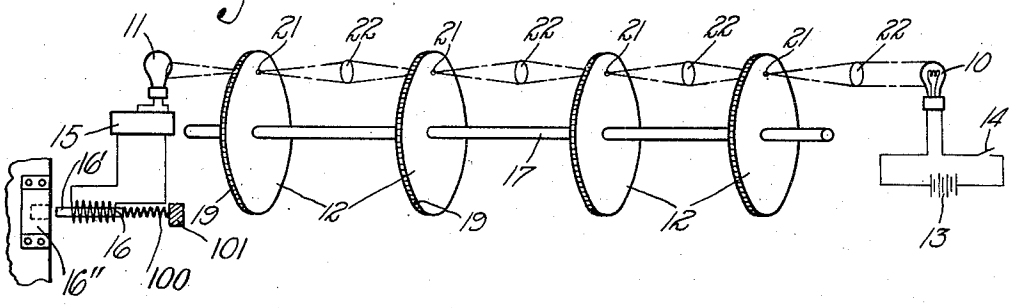


Fig. 2

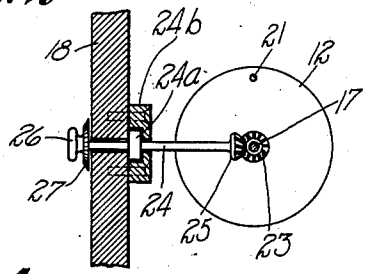


Fig. 4

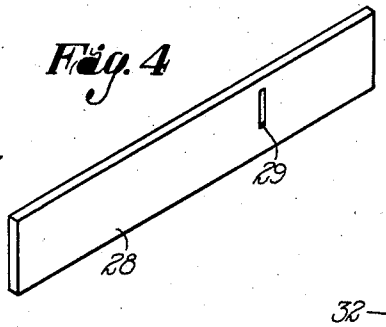


Fig. 1a

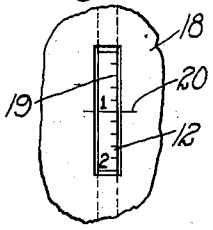
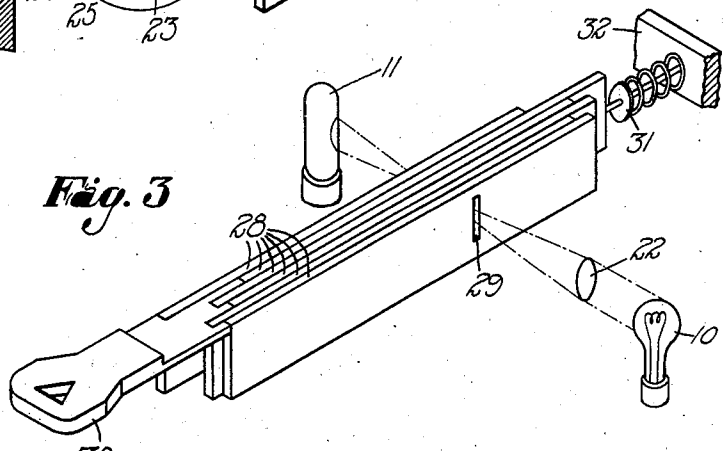


Fig. 3



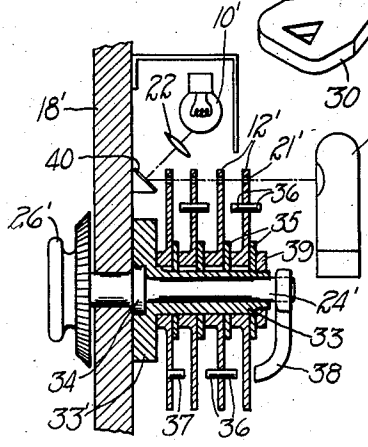


Fig. 5

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CONTROL MECHANISM

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4 Claims. (Cl. 70—50)

The present invention relates to control mechanism which, for instance, may be used with the locks of safes and vaults.

An object of the present invention is to provide an improved device of this kind which cannot be operated by unauthorized persons since there are included no elements the successful operation of which can be detected by touch, feeling or hearing.

Still another object of the present invention is to provide an improved device of this kind which is simple in construction, easy to manufacture, and reliable in operation.

Other objects will be in part obvious, and in part pointed out more in detail hereinafter.

The invention accordingly consists in the features of construction, combination of elements and arrangement of parts which will be exemplified in the construction hereinafter set forth and the scope of the application of which will be indicated in the appended claims.

In the accompanying drawing, wherein is shown, for illustrative purposes, several embodiments which the present invention may take,

Fig. 1 is a perspective view showing, more or less diagrammatically, a device constructed according to the present invention;

Fig. 1*a* is a detail view showing one of the disks and a portion of the casing;

Fig. 2 is a side elevation of a drive means for one of the disks;

Fig. 3 is a schematic view showing another embodiment of the present invention;

Fig. 4 is a perspective view of one of the slides shown in Fig. 3; and

Fig. 5 is a side elevation, partly in section, of another embodiment of the present invention.

In order that the detailed description set forth hereinafter may be more clearly and readily understood, it may be stated that the present invention broadly includes a source of light **10**, the rays of which are adapted to fall upon a light sensitive element **11**. Interposed between the source of light and the light sensitive element are a plurality of differentially movable elements **12** which are adapted in all positions, except one predetermined position, to intercept the rays of light from the source of light in order to prevent the same from falling upon the light sensitive element.

Referring more particularly to the drawing, the source of light **10** is illustrated as being governed by a battery **13** and a switch **14**. The light sensitive element **11** is shown in the drawing in the form of a photo-electric cell which is connected to a vacuum tube amplifier **15** which, in turn, may, for instance, be connected to an electro-magnet having a solenoid or coil **16** and an armature **16'**. The electro-magnet may be suitably connected to a bolt of a lock or the armature **16'** may itself constitute the bolt or locking means. In the present illustrative disclosure, the armature **16'** is shown as constituting a bolt which cooperates with a strike plate or keeper **16''**. The bolt is normally urged into locking position by a spring **100** located between the bolt and an abutment member **101**. When a ray of light falls on the light sensitive device **11**, the coil **16** is energized and the bolt is withdrawn against the pressure of the spring **100**. Electro-magnetically operated locks are illustrated in Patent No. 178,382 to H. L. Roosevelt, patented June 6, 1876 and in Patent No. 608,321 to H. G. Carleton, patented August 2, 1898. In Figs 1 and 1*a*, the differentially movable elements are illustrated in the form of disks **12** loosely mounted upon a shaft **17** supported by a casing **18** which may enclose the control mechanism or may, for instance, be a safe or vault to which the device is applied. The disks **12** are disposed within the casing **18** and a portion of the periphery of each disk protrudes outwardly beyond the casing so that the disk may be rotated from the outside of the casing. These disks **12** have their peripheral edges graduated, as at **19**, to cooperate with a fixed indicator **20** on the front wall of the casing. Each disk is provided with a blank portion and an open portion **21** which may be a round aperture, a slot, a recess, or of any desired shape, and these openings **21** are adapted to be brought into registry with one another and with the source of light and the light sensitive element.

Disposed in front of, and spaced from these disks are a series of lenses **22** for bringing the light from the source of light to a focus in the plane of each disk. The use of these lenses is optional since their purpose is to increase the quantity and intensity of the light passing through the apertures in the disks.

The operation of the apparatus described is briefly as follows: It is understood, of course, that the "combination" (that is, the relation of the openings in the disks to the indicating means on the peripheries of the disks) is known only to authorized persons. Assuming that the positions of the disks are such that the openings thereof are not on a line between the source of light and the photo-electric cell, and in which case the photo-electric cell circuit is open and that it is desired to close said circuit each of the

disks (the light having been turned on) will be rotated to a position where the selected or predetermined mark on its periphery is in registry with the associated pointer or indicating mark on the casing. When this is done in accordance with the predetermined combination at which the control mechanism has been set to operate, the openings are all brought into alignment between the source of light and the photo-electric cell. When the ray of light strikes the cell, the latter is affected so as to result in closing the photo-electric cell circuit to energize the solenoid 16 which in turn will operate whatever device the control mechanism is associated with, for instance, the bolt of a lock. When it is desired to "break the combination", this may be done by turning any one of the disks so that the passage of light from the bulb 11 to the photo-electric cell is obstructed. By preference, all of the disks will be disturbed in order to make it more difficult for any one to surreptitiously determine the combination. It will be observed that, aside from the markings on the disks, there is no way of determining, either by touch, sight or hearing, when any one of the disks has been brought to a position where the opening therein is properly located between the light and the photo-electric cell. In the embodiment shown in Fig. 1 there is no clicking, picking up of an additional element or dropping of an element which might lend assistance to unauthorized persons in determining the combination. Each disk has an infinite number of angular positions, but it is only in one combination of positions that the light can pass from the bulb to the photo-electric cell. Even the most expert locksmith or cracksman cannot possibly pick my improved arrangement or determine what the combination is by manipulating the disks.

In Fig. 2 is shown a different construction for moving the differentially movable elements or disks. In this case, each of the disks 12 is spaced inwardly from the front panel of the casing 18, and is provided with a miter gear 23. The casing 18 rotatably carries a shaft 24 which extends therethrough and beyond each side thereof. The inner end of the shaft 24 is provided with a miter gear 25 which is constantly in mesh with the miter gear 23 on the disk 12. The outer end of the shaft 24 is provided with an operating knob 26 and the dial 27 which may be similar to the dial used on safe locks. The shaft 24 is provided with a collar 24*a* adapted to seat in a recess in an element 24*b* secured to the rear face of the front panel of the casing 18 to prevent the shaft 24 from being pushed in or out. Similar means may be provided for moving each of the disks 12.

In Figs. 3 and 4 is disclosed another embodiment of the present invention. In this construction, the differentially movable elements are in the form of slides 28 having blank portions and open portions 29. These open portions 29 may be slots, recesses, or apertures of any desired shape, and the open portion of each slide is disposed on its blank portion at a different point along its length from the openings in the other slides. The slides 28 are disposed with their blank faces contacting and are adapted to have a differential sliding movement upon one another to bring their respective openings into registry with one another, with the source of light and with the light sensitive element. This sliding movement is brought about by means of a key 30 which may be inserted in a key hole, not shown, and brought into contact with the ends of the slides, as illustrated in Fig. 3. In this Fig. 3, the openings 29 are in alignment, and the photo-electric cell circuit is closed and the relay 16 is energized. The slides 28 are held normally with their apertures out of alignment by means of spring pressed plungers, one of which is shown at 31. This plunger is confined between the rear end of the slide and an element 32 of the casing 18. A plunger is provided for each slide.

The operation of this embodiment is clear. The key 30 is inserted through the keyhole and into engagement with the ends of the slides 28. The key is so formed that inward movement thereof will displace the slides against their spring pressed plungers a distance sufficient to bring the various openings in registry so that light may pass from the source of light through the slides to the light sensitive element. The arrangement shown in Figs. 3 and 4 has the same advantages as the preceding embodiments, but in this case the control mechanism is operated with a key.

In Fig. 5 is illustrated another embodiment of the present invention. In this instance, a casing 18' rotatably carries a shaft 24' which extends therethrough and beyond each side thereof. The inner end of the shaft is mounted in a tubular bearing 33 which is provided at its outer end with a flange 33' having a recess into which a collar 34 of the shaft 24' fits to prevent the shaft 24' from being pulled in or out. The outer end of the shaft 24' is provided with a combined knob and dial 26' by which the shaft is turned the proper amount. Loosely mounted upon the bearing 33 are a plurality of disks 12' having openings 29'. Disposed between each two adjacent disks and keyed to the bearing is a spring washer 35 which, due to friction, prevents the accidental rotation of the disks. The first three disks on the right of Fig. 5 are each provided with two driving pins 36 one extending from each face of each of these three disks. The last disk has only one driving pin 37 extending therefrom toward its adjacent disk. A dog 38 is rigidly secured to the inner end of the shaft 24' in any suitable manner and is adapted to rotate therewith. A nut 39 is threaded upon the inner end of the bearing 33 to hold the disks and washers in place on the bearing and the bearing 33 may be secured to the rear face of the casing 18' by screws or other suitable fastening means not shown.

In order to bring the openings 29' of the disks 12' into proper alignment, the combined knob and dial 26', together with the shaft 24' and dog 38, is rotated in one direction until the dog 38 engages the adjacent driving pin 36 on the first disk. Upon further rotation of the shaft in the same direction, the first disk will be rotated and its other pin 36 will engage the adjacent pin on the second disk to rotate the same. Continued rotation of the shaft, until the dial has been rotated a predetermined amount, will cause the successive engagement of the remaining pins on the succeeding disks thereby causing the rotation of all of the disks until the outermost disk is in operative position. The shaft is now rotated in an opposite direction until the next disk is brought to operative position, when the direction of rotation of the shaft is again reversed until the next disk is brought to operative position. This rotation of the shaft in opposite directions is continued until all of the apertures in the disks are brought on a line with the light sensitive element 11' and the rays from the source of light

10'. The pins 36 and 37 are so angularly disposed in relation to their respective openings that proper movement of the knob and dial will align the openings in the disks. When the openings are in alignment, the rays of light from the bulb 10' will pass to the photo-electric cell 11' by means of a lens 22 and a reflector 40. The position of the pins 36 and 37 on the disks may be changed to vary the combination of the device.

As many changes could be made in the above construction and many apparently widely different embodiments of this invention could be made without departing from the scope thereof, it is intended that all matter contained in the above description or shown in the accompanying drawing shall be interpreted as illustrative and not in a limiting sense.

It is also to be understood that the language used in the following claims is intended to cover all of the generic and specific features of the invention herein described and all statements of the scope of the invention which, as a matter of language, might be said to fall therebetween.

I claim as my invention:

1. In combination, locking means, a source of light, a light sensitive device spaced from said source and operatively connected with said locking means, supporting means, a plurality of manually adjustable differentially movable elements on said supporting means, said elements being normally stationary and in all their positions except one predetermined position preventing the rays of light from said source from falling on said light sensitive element, said manually adjustable elements having open portions therein adapted to register with one another upon manual adjustment and provide an unobstructed passage for the light rays from said source to said light sensitive element.

2. In combination, locking means, a source of light, a light sensitive device arranged to receive light rays from said source and operatively connected to said locking means, supporting means, a plurality of manually adjustable differentially movable and normally stationary light ray intercepting members on said supporting means and disposed in the path of the light ray between said source of light and said light sensitive element, each of said light ray intercepting members having a single light ray transmitting portion; said light transmitting portions, when said members are in a predetermined relation, transmitting the ray of light from said source to said light sensitive element, and said ray being interrupted in all other relative positions of said members; and means for manually adjusting said members to bring said portions into said predetermined relation.

3. In combination, locking means, a source of light, a light sensitive element spaced from said source and operatively connected with said locking means, supporting means, a plurality of differentially movable manually adjustable and normally stationary disks disposed on said supporting means and between said source of light and said light sensitive element; each of said disks having a single open portion and said open portions, when said disks are in a predetermined relation, forming a path for a ray of light from said source to said light sensitive element, said path being broken by said disks when said disks are in other than said predetermined relation, and means for manually adjusting said disks to said predetermined relation.

4. In combination, locking means, a source of light, a light sensitive element spaced from said source and operatively connected to said locking means, supporting means, and a plurality of differentially movable normally stationary slides on said supporting means which in all their positions except one predetermined position prevent the ray of light from said source from falling upon said light sensitive element, each of said slides having a single opening, said openings being normally offset with respect to one another, said slides being adapted to be operated by means for moving said slides to said predetermined position and wherein said openings register.

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