Nov. 23, 1937. E. G. TOUCEDA 2,099,764

METHOD OF AND MEANS FOR CONTROLLING ELECTRIC APPARATUS

Filed July 30, 1932 2 Sheets-Sheet 1

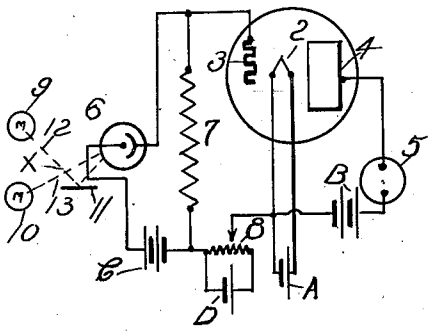

FIG. 1

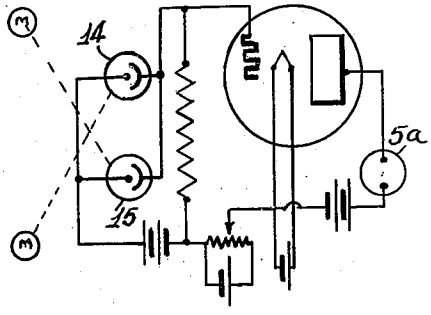

FIG. 2

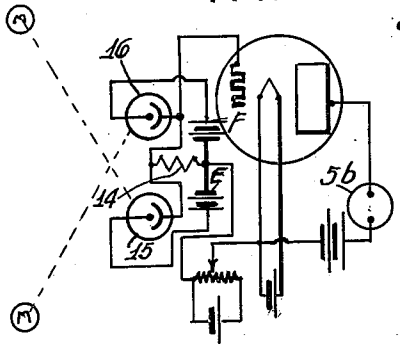

FIG. 3

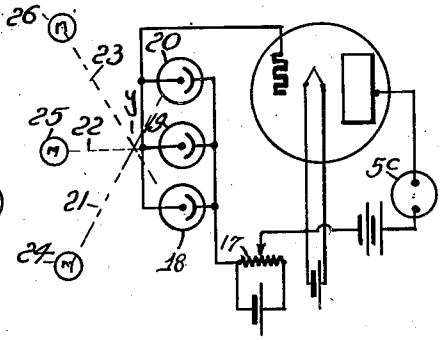

FIG. 4

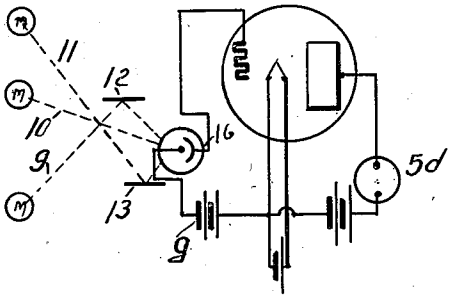

FIG. 5

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METHOD OF AND MEANS FOR CONTROLLING ELECTRIC APPARATUS

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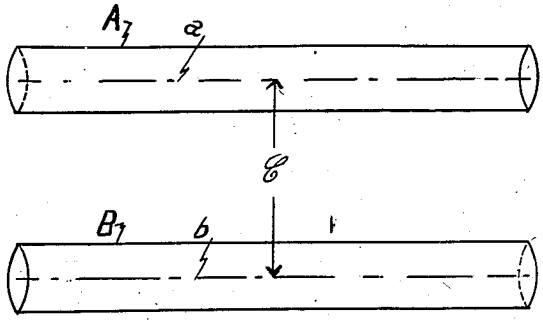

FIG. 6

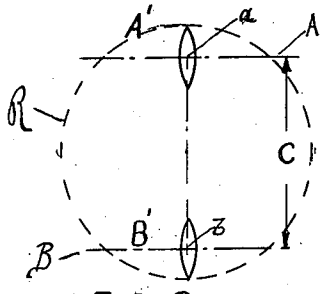

FIG. 8

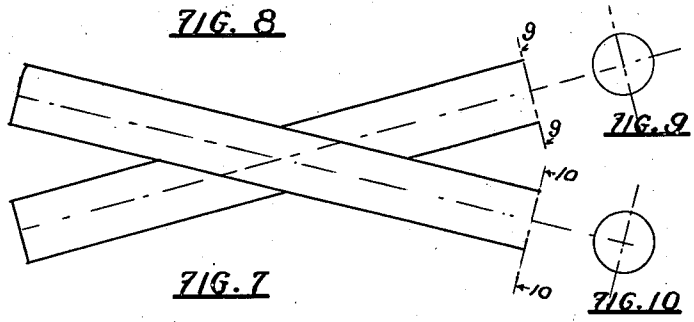

FIG. 7

FIG. 9

FIG. 10

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METHOD OF AND MEANS FOR CONTROLLING ELECTRIC APPARATUS

Enrique G. Touceda, Albany, N. Y.

Application July 30, 1932, Serial No. 626,863

18 Claims. (Cl. 250—41.5)

My invention relates to the method of and to the means for controlling electrical apparatus through the medium of a plurality of beams or streams of electrical waves or material, such as heat, light, electrons and the like, and one of the objects of the invention is to effectively fix an arbitrary region in space through the medium of such beams and to cause said apparatus to operate when an object such as a person, an animal, ship or the like arrives at, passes through or leaves such locality, as, for example, by having the beams cross each other within said region and then diverge and impinge upon beam responsive means, through the medium of which latter the said electrical apparatus is controlled, or by having said beams converge and approach to a minimum distance within said region, diverge and then impinge upon the said beam responsive means, which beams may in either case be intercepted simultaneously in said region by said object and said apparatus consequently operated or the beams allowed to again impinge upon said means and said apparatus again operated.

The foregoing and other objects of our invention will be understood in detail from the following description of the principles and methods involved, of the elements of said means, and of their arrangements and modes of operation, reference being had to the accompanying drawings, in which:

Fig. 1 is a diagrammatic representation of one form of apparatus of the invention.

Figs. 2 through 5 are similar representations of other forms of apparatus and circuits of the invention. Figs. 6 through 10 represent a pair of separate beams, the axes of which converge toward and pass through the region represented by the circle in Fig. 8, but do not intersect as in the other figures.

Referring in detail to Fig. 1, the apparatus comprises a thermionic tube having the usual filament 2, grid 3 and plate 4, all being located within a sealed container. I provide the usual filament battery A, the plate battery B in the output circuit, and the biasing batteries C and D for the grid in the input circuit. In the output circuit I also provide an electric device 5 such as an electromagnet or relay.

In the input circuit I provide a photo-electric cell 6 in series with the battery C and the potentiometer 8. As indicated, the cell and the battery C are shunted by the resistance 7. In connection with the cell 6 I provide suitable means comprising a mirror or other suitable reflecting means 11, adapted to reflect radiant energy (such as light) in the form of a stream or streams or in the form of a beam or beams (two beams 12 and 13 are indicated in Fig. 1) from any suitable source, as for example, from electric lamps 9 and 10 (which are merely indicative) in such manner as to cause such streams and beams to converge and approach nearest each other within the region (which I will assume for convenience to be spherical) or even intersect within said region, as indicated in Fig. 1, and in either case to impinge, beyond, upon the photo-electric cell 6. As indicated in Fig. 1, said beams originate in or come from widely separated localities, such as represented by the lamps 9 and 10, and converge upon a comparatively small region. Under conditions when the beams are not functioning a negative potential from battery D is impressed upon the grid by way of the resistance 7. Therefore the device 5 in the output circuit is not energized; but when the lamps or other sources are turned on, the beams or streams are projected upon the cell 6, as indicated in Fig. 1, whereupon the positive potential of battery C is applied to the grid and the device 5 becomes energized. The device 5 may be any suitable electric signalling means, such as a bell or a buzzer or a lamp, or it may be a relay or other form of electromagnet for operating some auxiliary mechanism or apparatus. For example, the device 5 may be a relay which, when the beams are projected upon the cell 6, remains energized and prevents the operation of a given signal, such as a light, a buzzer or a bell, and when the beams are removed from the cell, becomes de-energized, allowing the operation of the signal.

Or the relay may be used to automatically fire a gun previously trained upon the region X as a target, when an object arrives at that point and intercepts both beams. Or the gun may be fired by someone upon receiving a signal actuated by the relay as a result of the interception of both beams.

Or a mine, for example, located in a channel, may be set off in the same way when an object such as a submarine arrives at a point or locality designated by the intersection of the beams, and upon so doing intercepts both beams simultaneously.

Also the device may be used, for example, to operate a counter for counting theatre patrons as

they enter a theatre, or for counting vehicles passing along one side of a road.

In any of the cases mentioned in which the invention may be used, if the object passes outside the small region upon which the beams converge, the object may intercept one of the beams but not both. This will not cause the operation of the device 5, since the other beam will continue to maintain the cell 6 energized. For example if the submarine passes to one side of the region X it will only intercept one beam at a time and the mine will not be set off. The invention may be used for counting the number of patrons entering a theatre by arranging the beams so that the region where they cross, corresponding to region X, is on the entrance side. Each time a person passes through said region the counter, controlled by the electric device 5, is operated, whereas persons leaving the theatre and crossing the beams along the exit side will intercept only one beam at a time and therefore the counter will not be operated. The same means may be used for counting vehicles that pass a given region corresponding to region X, as, for example, the vehicles in a north and south highway that pass in one direction,—north, we will say—on the east side of the highway. The region X, if located on the east side of the highway, will operate the cell which can be made to operate a counter. The vehicles on the west side of the highway will not come within the region X and will not operate the device. But as soon as the person or object reaches the region X both beams will be intercepted simultaneously, thus causing the cell 6 to become de-energized and causing in turn the de-energization of the device 5, which de-energizing operation may be used to in turn cause, directly or indirectly, the counter to register, the mine to be set off or the gun to be fired.

I have found that if an attempt is made to use a single beam to operate, for example, a counter for counting theatre patrons, the passage of a patron may cause the counter to register more than once, due to one or more interruptions of the beam, one interruption being caused for example by the passage of the body of the person and another by a previous or subsequent interruption of the beam by members of the body such as the arms, by parts of the wearing apparel, or by articles carried by the individual.

Applicant's invention is free from any such objection inasmuch as such interference by the arms and the like can only affect one beam at a time and the counter will not function unless all of the beams are intercepted at the same time.

Referring to Fig. 2 it will be seen that the device of this figure differs from that of Fig. 1 only in the provision of two photo-electric cells 14 and 5, which are connected in multiple as indicated. With this modification of the invention each beam may be projected directly upon a corresponding cell as indicated, making it possible to dispense with the reflector 11 of Fig. 1.

Fig. 5 differs from Fig. 1 first, in that it has no element corresponding to the resistance 7 nor any element corresponding to the potentiometer 8 second in the use of three beams, 9, 10 and 11, instead of two, and in the use of two reflectors 2 and 13 instead of only one. With this form of apparatus the three beams must be interrupted simultaneously, and the interruption of two will not suffice to operate the device 5d.

Fig. 3 differs from Fig. 1 in that the resistance 4 which corresponds to resistance 7 in Fig. 1 is shunted by two branches instead of one, each having a photo-electric cell and a biasing battery. For example, one branch in Fig. 3 has a photo-electric cell 15 in series with the biasing battery E, and the other branch has a photo-electric cell 16 in series with the biasing battery F.

Fig. 4 differs from Fig. 5 first, in that a potentiometer 17, similar to that of Fig. 1, is substituted for the biasing battery G, corresponding to battery C of Fig. 1, second in the provision of a plurality of photo-electric cells 18, 19 and 20 connected in multiple, instead of a single cell in Fig. 5, and third, in the absence of all reflectors. By using the three cells 18, 19 and 20 three beams 21, 22 and 23, each impinging upon a separate cell, may be used, which beams originate in the lamps or projectors 24, 25 and 26. If desired, however, the number of photo-electric cells may be increased and the number of beams intersecting at the point Y, assumed to be spherical, correspondingly varied. As in the other forms of devices, all the beams must be intercepted simultaneously to operate the device 5c.

While I have shown the beams in the drawings as intersecting in the regions X or Y, this arrangement may be varied. For example, it is not necessary in every instance that the beams shall meet. For certain purposes it is desirable that although the axes of the beams, such as the axes *n* and *o* of beams N and O, Fig. 6, converge toward the region R for example, Figs. 6 through 8, they cross but do not meet. For example, it is sometimes desirable that objects below a given size shall not be able to operate the electromagnetic device even if such objects enter the region R, assumed to be spherical, which objects may be larger than either beam but smaller than the region. To accomplish this it is contemplated that each beam may have its axis in a different plane, for example, the axis *n* in plane N', and the axis *b* in plane O', the planes being parallel and separated by some arbitrary distance P, Fig. 8, whereby an object having a cross section equal to that of said region may intercept both beams and cause the operation of said device from within said region and from nowhere else, and whereby any object having a smaller cross-section is prevented from operating the device. In this form of the invention the beams cross a line perpendicular to both planes, such as line P, which line is located in the specified region represented by the circle in said figure. In Fig. 9 the cross-section of beam O, taken on line 9—9, is shown, and in Fig. 10, that of beam N, on line 10—10.

With the circuit arrangement of Figs. 1 through 3, the devices 5, 5*a* and 5*b* become energized when the beams are cut off from the photo-electric cells, but with the circuit arrangement of Figs. 4 and 5, the devices 5c and 5*d* become energized when the beams strike the photo-electric cells.

It will be understood that the beams indicated in the various figures may be produced in any suitable manner, as for example by parabolic or other reflectors. In the case of beams produced by parabolic reflectors the rays are substantially parallel and produce a round beam. In that case, if the beams are of the same size, the region fixed about the points X or Y has a diameter equal to the diameter of either beam. Also the light sources such as 9, 10, 25, 26 and 27 may be substituted by reflectors such as 11, 12 or 13 and the actual source may be elsewhere.

Two beams may of course be projected with their axes parallel. For example the axes may

be parallel to a third axis or line which may be formed by the intersection of two planes S and T perpendicular to each other, the axis of one beam being in one quadrant formed by the two planes and the axis of the other beam being in the quadrant diagonally opposite formed by the same planes. Both axes of the beams will, in such a case, be parallel to both said planes. The two beams may now be made to converge toward the plane S while still preserved parallel to plane T. This is the situation indicated in Figs. 7, 8, 9 and 10 in which the axes cross but do not intersect. But these beams, while thus converging on plane S, may be made to converge also on plane T. This is the situation in Figs. 1 and 3, in which case the axes of both beams intersect each other and may do so at a point in the line at the intersection of the two planes. In Fig. 3 this intersection of the two axes of the beams may be considered as the center of the region identified by the two beams.

Also it will be understood that my invention is not restricted to any one of the particular forms of apparatus or systems specifically illustrated and described in the specification and drawings or the method carried out exactly as specified, inasmuch as I contemplate modifications and variations of the invention within the spirit of the invention and the scope of the claims contained herein.

I claim—

1. In a device of the character described adapted to determine the passage of an object through a predetermined point in space, the combination with beam projecting means arranged to project a plurality of separate beams in substantially different directions through a zone about said point and which said beams will be intercepted by said object when positioned at said point, of beam responsive means positioned to intercept said beams after they pass said zone.

2. In a device of the character described adapted to determine the passage of an object through a predetermined point in space, the combination with beam projecting means arranged to project a plurality of separate beams in substantially different directions through a zone about said point and which said beams will be intercepted by said object when positioned substantially at said point, of beam responsive means positioned to intercept said beams after they pass said zone, and means controlled by said beam responsive means and actuated when all of said beams are intercepted by an object at said point.

3. In a device of the character described adapted to determine the passage of an object through a predetermined point in space, the combination with beam projecting means arranged to project cross beams of light through said point, of beam responsive means positioned to intercept said beams after they pass said point.

4. In a device of the character described adapted to determine the passage of an object through a predetermined point in space, the combination with beam projecting means arranged to project cross beams of light through said point, of beam responsive means positioned to intercept said beams after they pass said point, and means controlled by said beam responsive means and actuated when all said beams are intercepted at said point.

5. In a device of the character described adapted to determine the passage of an object through a predetermined zone in space, the combination with beam projecting means arranged to project a plurality of beams in substantially different directions through said zone; those portions of said beams within said zone being so correlated and directed that the object in passing through said zone will intercept all of them; of beam responsive means positioned to intercept said beams after they pass said zone.

6. In a device of the character described adapted to determine the passage of an object through a predetermined zone in space, the combination with beam projecting means arranged to project a plurality of beams in substantially different directions through said zone; those portions of said beams within said zone being so correlated and directed that the object in passing through said zone will intercept all of them; of beam responsive means positioned to intercept said beams after they pass said zone, and means controlled by said beam responsive means and actuated when all of said beams are intercepted in said zone.

7. In a device of the character described, the combination with beam responsive means, of means for projecting at least two separate beams on said beam responsive means; said projecting means and said beam responsive means being spaced to provide a passageway therebetween, and being relatively positioned to provide a zone of limited extent in said passageway in which the distance between said beams is substantially less than in any other zone of said passageway; whereby a total eclipse of said beam responsive means by the movement through said passageway of an object approximating in maximum size the minimum distance between said beams will definitely indicate that said object passed through said zone of limited extent.

8. In a device of the character described, the combination with beam responsive means, of means spaced therefrom for projecting at least two beams to said responsive means in directions which cross each other within the space between said projecting and said responsive means; whereby the minimum distance between those portions of said beams in said space lies in the zone of their crossing, and objects having a maximum dimension slightly exceeding said minimum distance and moving through said space will effect a total eclipse of said beam responsive means only when passing substantially through said zone.

9. In a device of the character described, the combination with beam responsive means of means for projecting a plurality of beams from different points and in substantially different directions to said responsive means; said projecting and responsive means being so spaced and relatively disposed that the sphere of minimum size to which all of said beams will be substantially tangent will be positioned in a zone between said projecting and said responsive means; whereby all of said beams will be intercepted at the same instant by the passage of an object between said projecting and said responsive means and approximating said sphere in dimensions only when the passage thereof is substantially through said zone.

10. In a device of the character described, the combination with beam responsive means of means spaced therefrom for projecting at least two cross beams to said responsive means and which substantially intersect at a point within the space between said projecting and said responsive means; whereby small objects passing

through said space and which intercept both beams at the same instant are definitely positioned as passing at or near the point of substantial intersection of said beams.

11. In a device of the character described adapted to determine the passage of an object of substantially predetermined size through a zone of limited extent in space, the combination with beam projecting means arranged to project a plurality of beams in substantially different directions through said zone; said projecting means being so positioned and directed that all of the beams therefrom will be intercepted by said object when in said zone; of means for bringing said beams to a common focal point after passing said zone, and beam responsive means positioned at said focal point.

12. In a device of the character described adapted to determine the passage of an object of substantially predetermined size through a zone of limited extent in space, the combination with beam projecting means arranged to project a plurality of beams in substantially different directions through said zone; said projecting means being so positioned and directed that all of the beams therefrom will be intercepted by said object when in said zone; of means for bringing said beams to a common focal point after passing said zone, beam responsive means positioned at said common focal point, and means controlled by said beam responsive means and actuated when all of said beams are intercepted by an object in said zone.

13. Those steps in the method of determining the passage of an object through a precise point in space which comprises projecting a plurality of beams of light in substantially different directions through a zone about said point so that all of said beams will be intercepted by said object when positioned at said point, and bringing all of said beams to a common focal point after they pass said zone.

14. Those steps in the method of determining the passage of an object through a zone of limited extent in space which comprise projecting a plurality of beams of light through said zone in substantially different directions but closely spaced in said zone whereby all of said beams will be intercepted by said object but only when in said zone, and intercepting said beams after they pass said zone; whereby a simultaneous occultation of all of said beams where intercepted after passing said zone will definitely position said passing object as being in said zone.

15. An indicating device comprising, means for projecting relatively crossing beams of light for creating a combined active zone at said zone of the crossing of the beams, electric energizers sensitive to light rays and upon which said beams of light are directed, an indicator, and means actuated by said energizers for operating said indicator only when an object is passed through said combined active zone.

16. An indicating device comprising, means for projecting relatively crossing beams of radiant energy to create a combined active zone at the zone of their crossing energizers sensitive to said beams and mounted so as to be acted upon one by one beam and the other by the other beam, an indicator, and means actuated by said energizers for operating said indicator only when an object is passed through said combined active zone.

17. In a device of the character described adapted to determine the passage of an object through a predetermined zone in space, the combination with means for projecting a plurality of relatively crossing beams of radiant energy toward said zone and in such relative directions that said object in passing through said zone will pass through all of said beams, beam-responsive means positioned to intercept said beams after they pass said zone, and means controlled by said responsive means and actuated only when said object passes through all of said beams.

18. That step in the method of determining the passage of an object through a predetermined zone in space which comprises projecting a plurality of beams of radiant energy in directions so correlated to each other that said object will pass through all of said beams only when said object passes through said zone; whereby the intersection of all of said beams by said object will definitely indicate such passage.

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