May 22, 1945. O. S. FIELD 2,376,534

LIGHT SIGNAL FOR RAILROADS

Filed Oct. 14, 1940 8 Sheets-Sheet 1

FIG. 1.

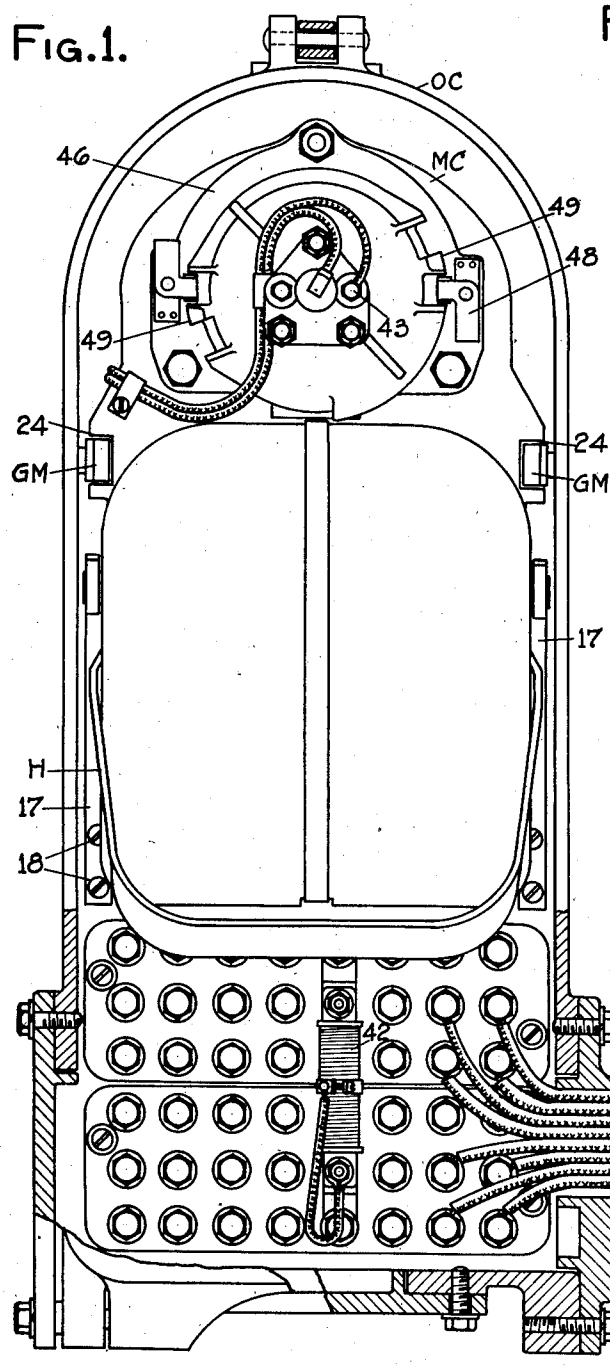


FIG. 18.A.

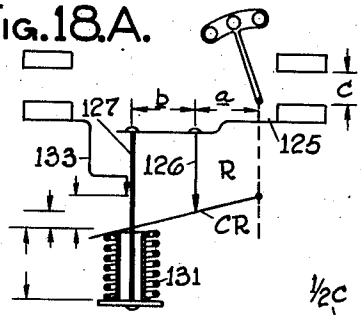


FIG. 18.B.

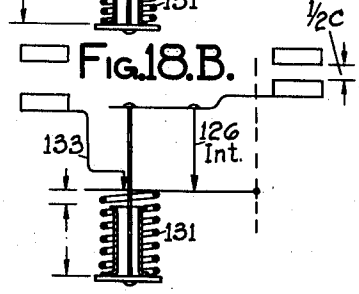


FIG. 18.C.

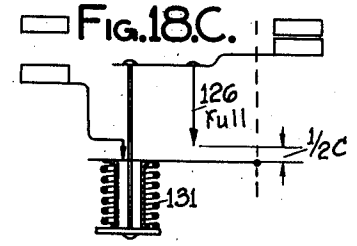
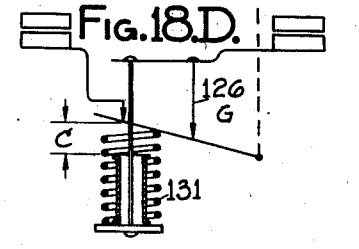


FIG. 18.D.



INVENTOR
O. S. Field.
BY
his Neil W. Preston,
ATTORNEY

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FIG. 2.

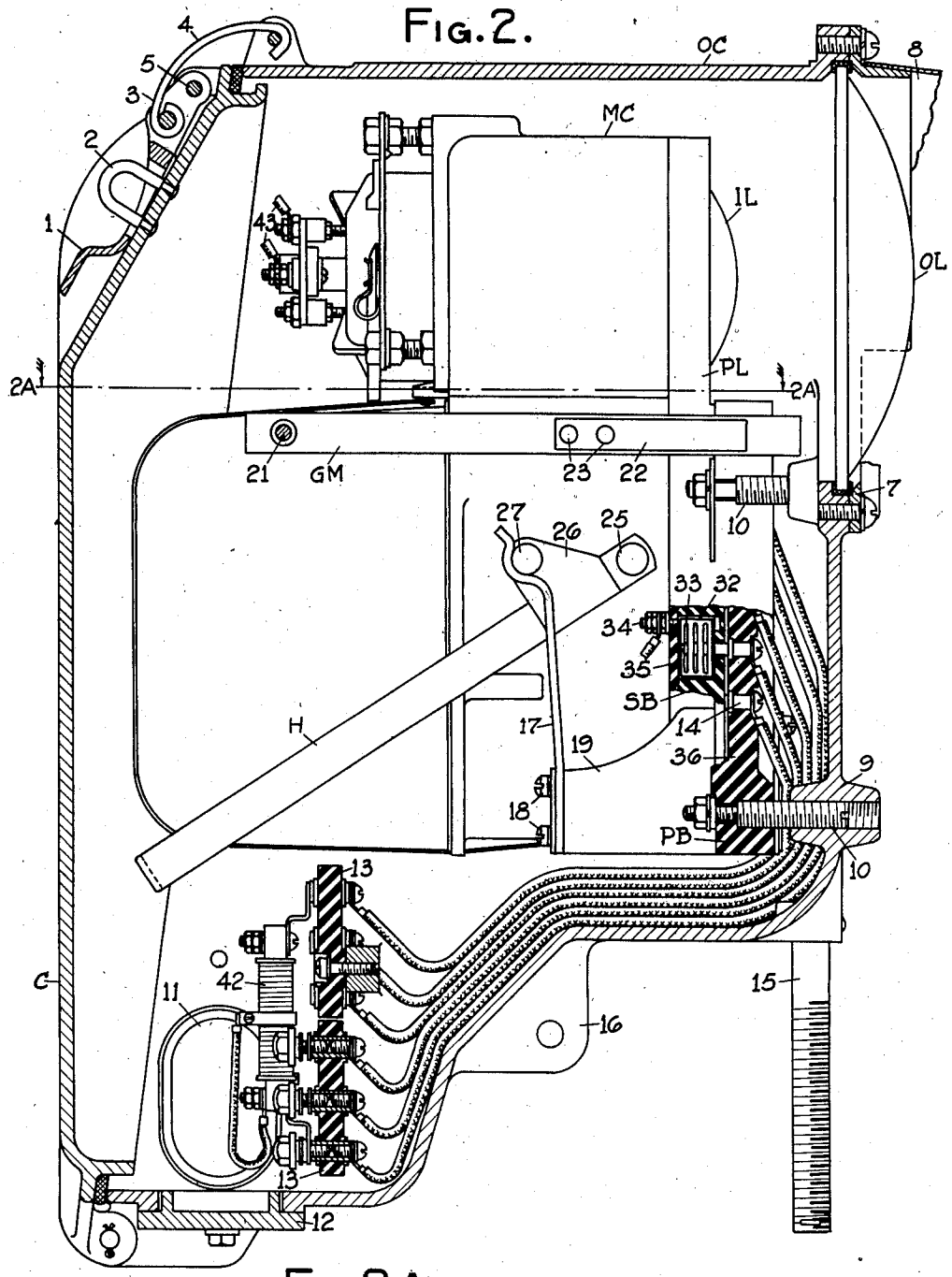
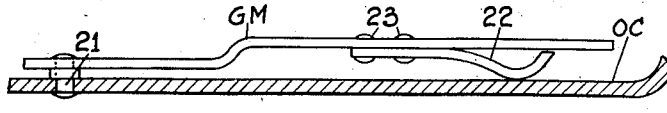


FIG. 2.A.



INVENTOR
O. S. Field,
BY
his Neil W. Preston,
ATTORNEY

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LIGHT SIGNAL FOR RAILROADS

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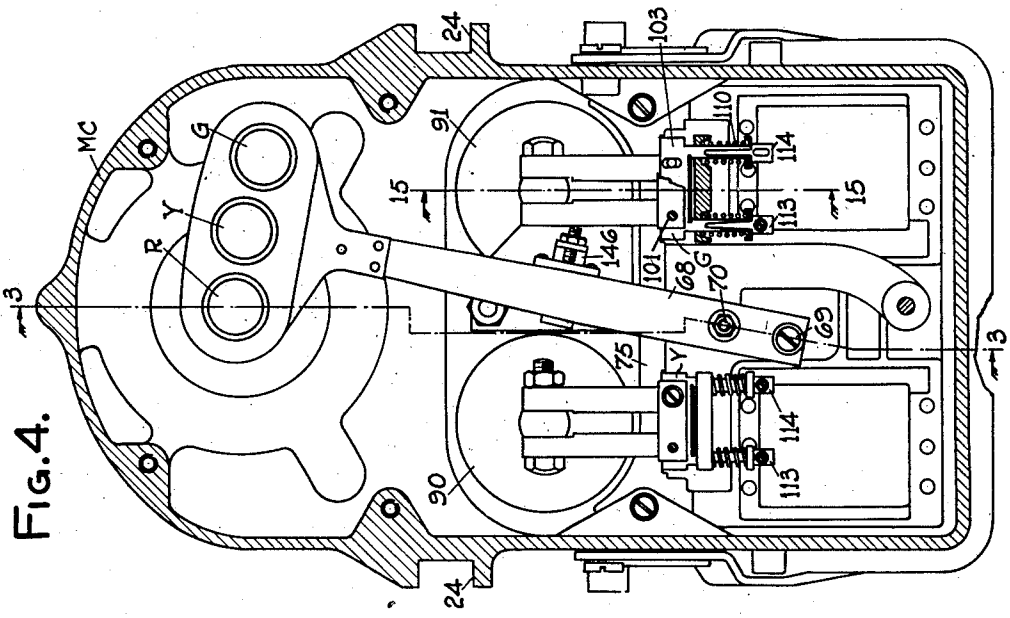

FIG. 4.

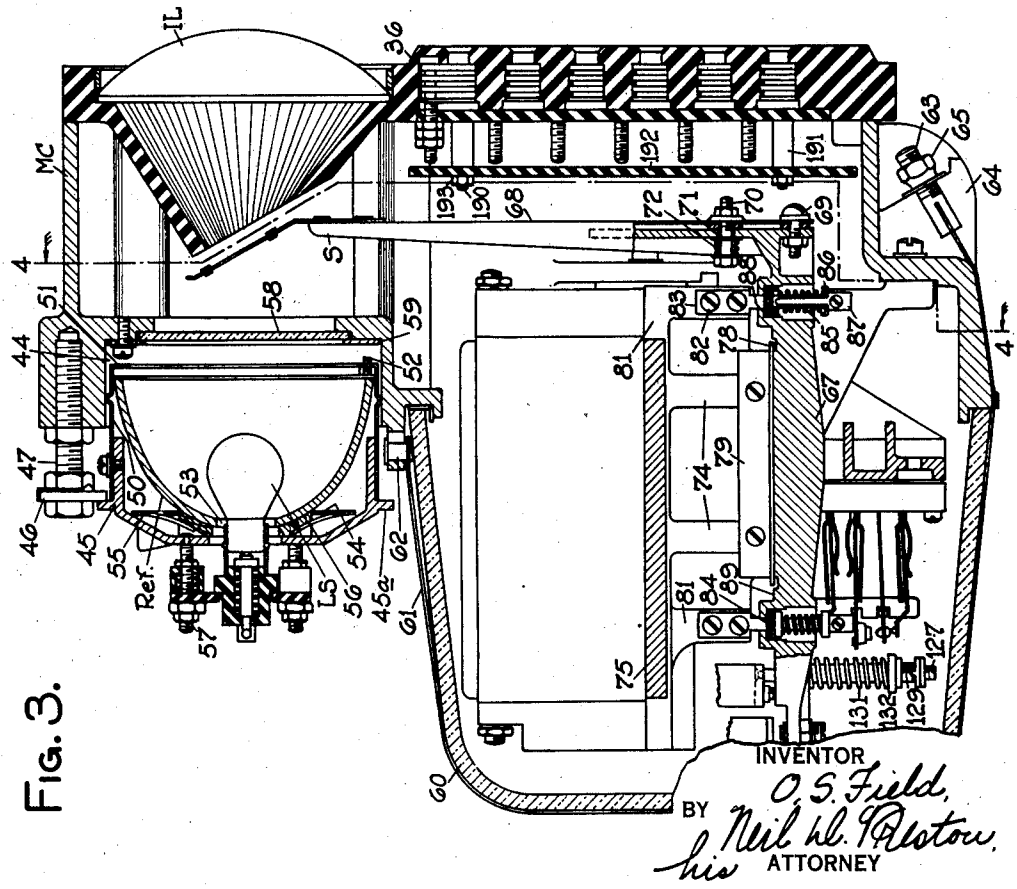

FIG. 3.

INVENTOR
O. S. Field.
BY
his Neil W. Preston.
ATTORNEY

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LIGHT SIGNAL FOR RAILROADS

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FIG. 5.

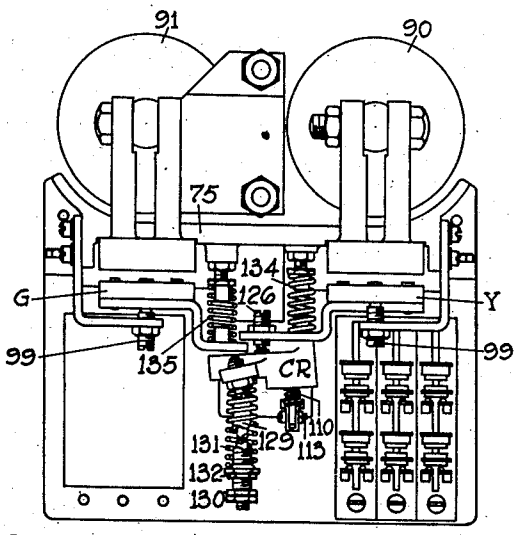

FIG. 7.

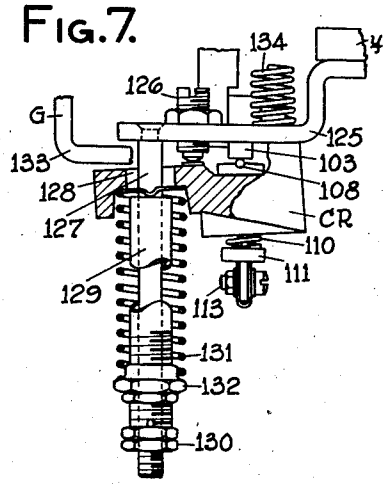

FIG. 6.

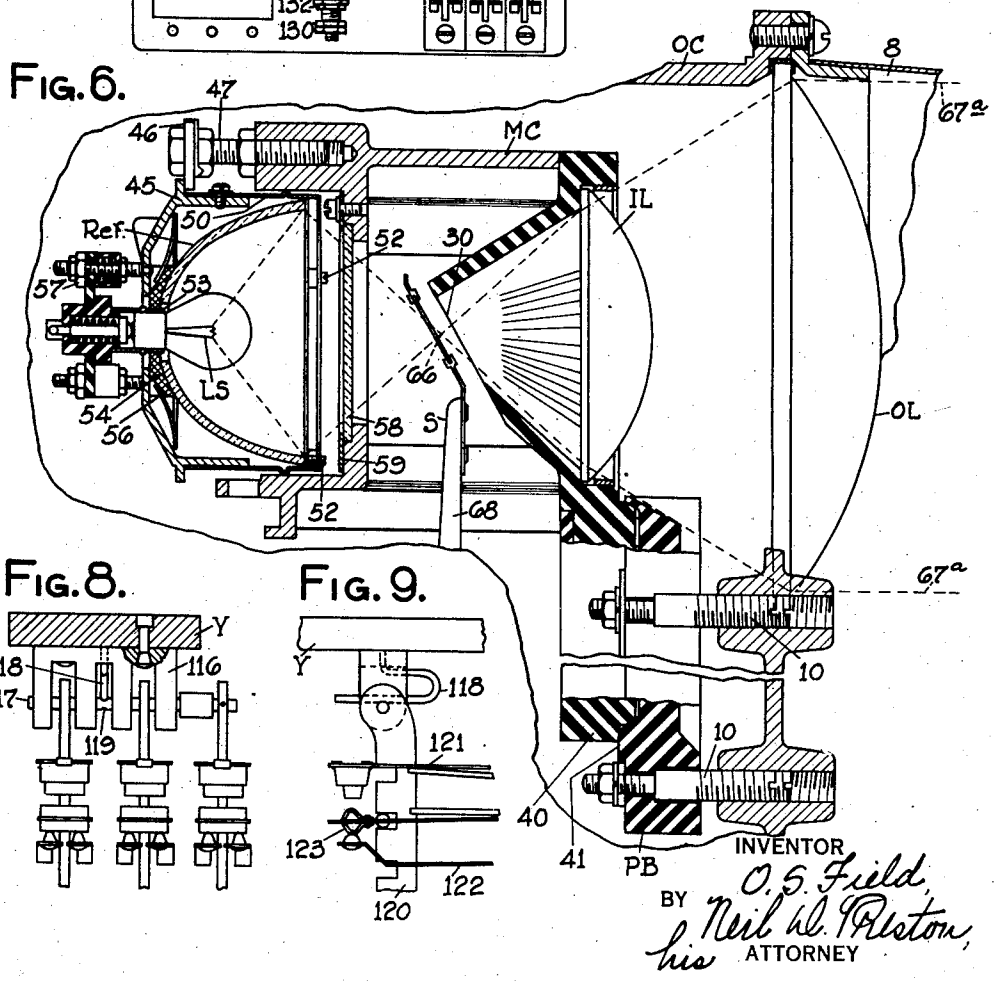

FIG. 8.

FIG. 9.

INVENTOR
O. S. Field,
BY
his Neil W. Preston,
ATTORNEY

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LIGHT SIGNAL FOR RAILROADS

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FIG. 10.

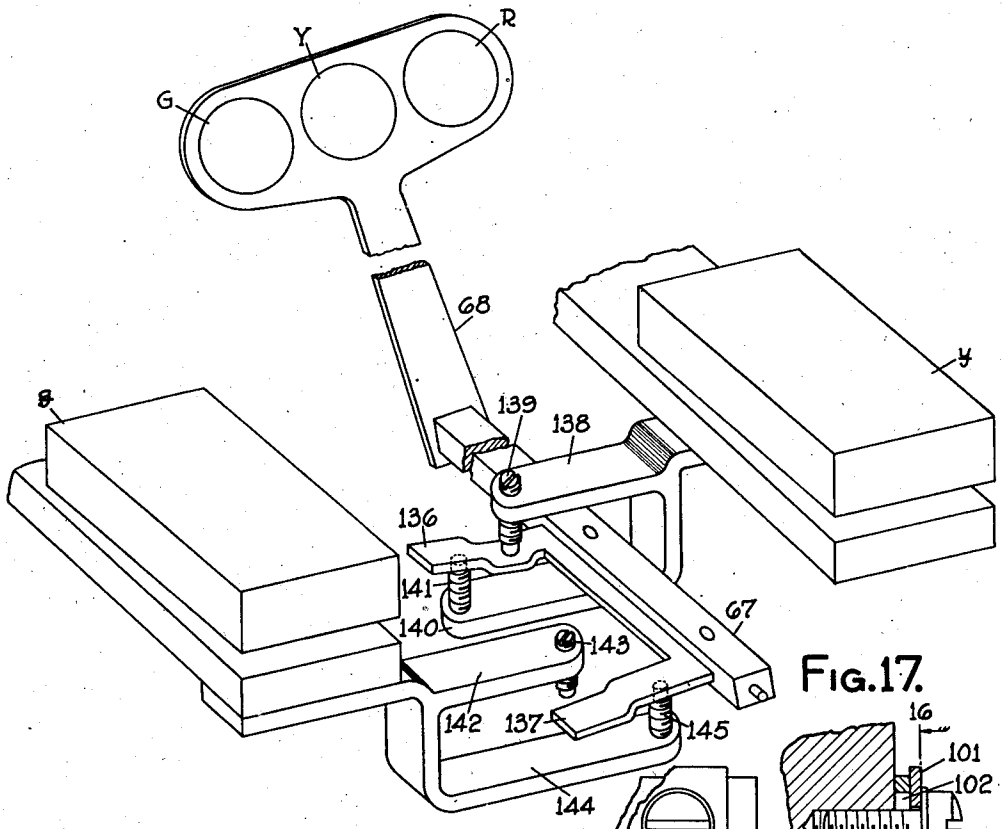


FIG. 15.

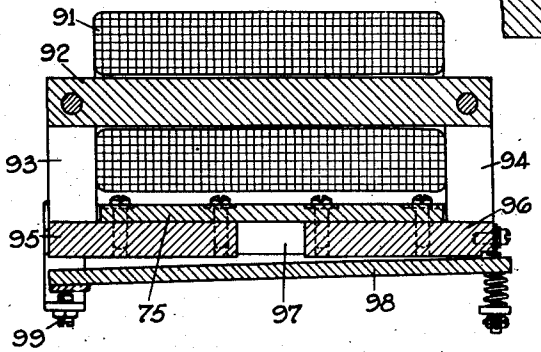
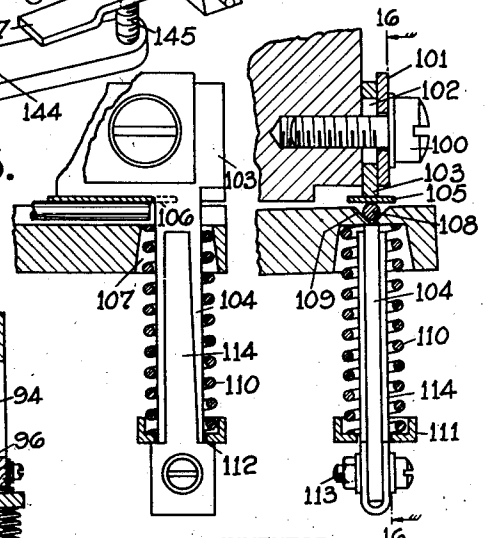


FIG. 16.

FIG. 17.



INVENTOR
O. S. Field,
BY his Neil W. Preston,
ATTORNEY

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LIGHT SIGNAL FOR RAILROADS

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FIG. 11.

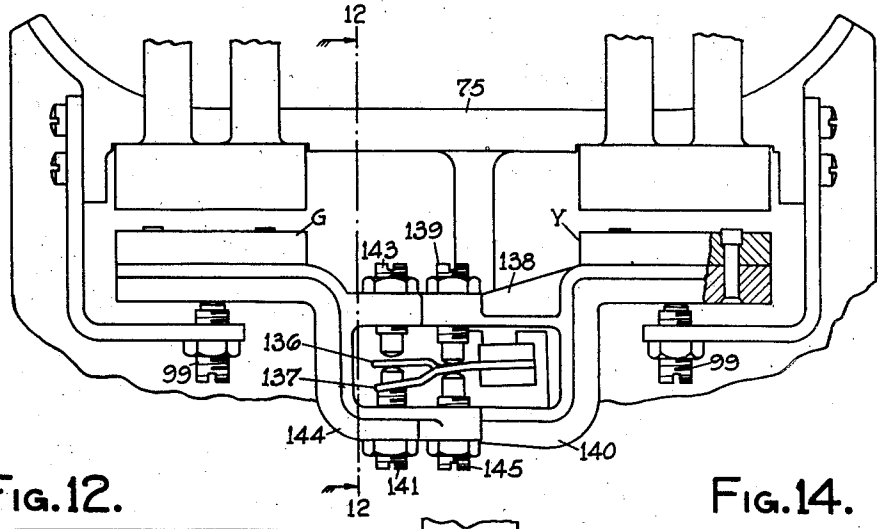


FIG. 12.

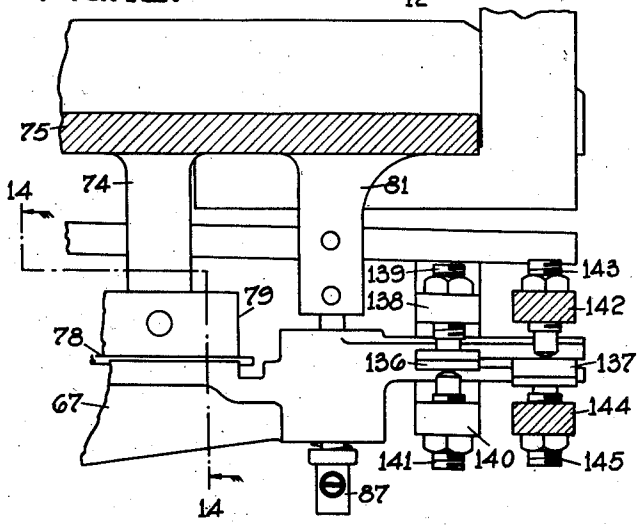


FIG. 14.

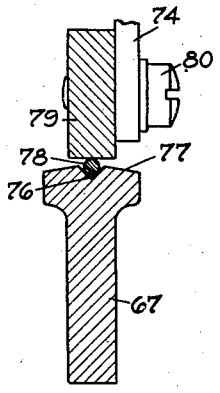
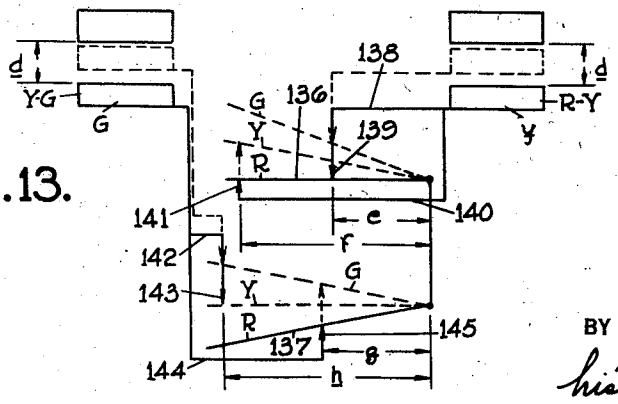


FIG. 13.



INVENTOR
O. S. Field,
BY his Neil W. Preston,
ATTORNEY

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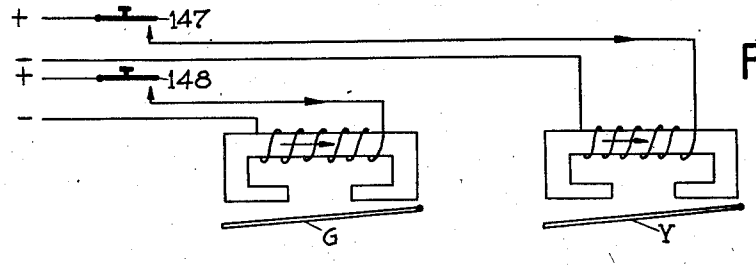

FIG. 19.

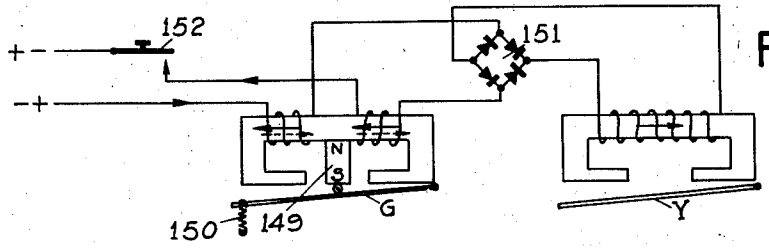

FIG. 20.

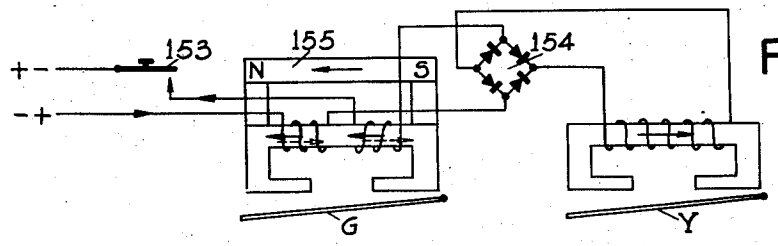

FIG. 21.

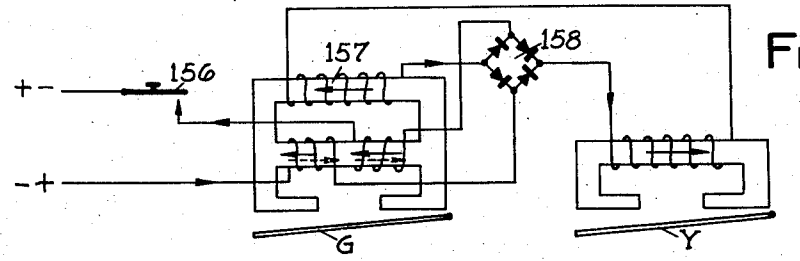

FIG. 22.

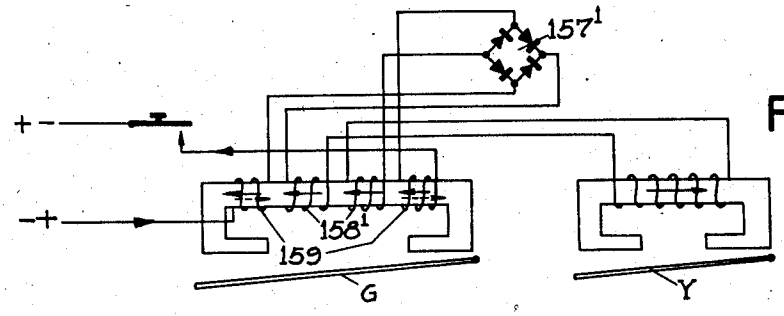

FIG. 23.

INVENTOR
O. S. Field,
BY his Neil W. Preston,
ATTORNEY

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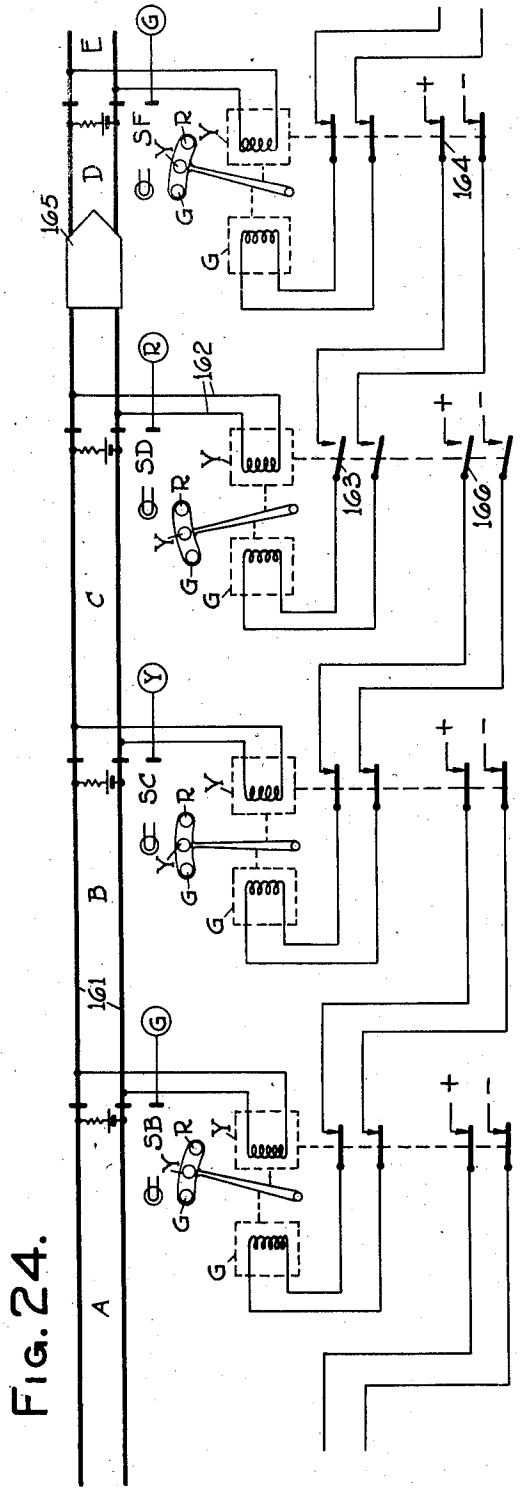

FIG. 24.

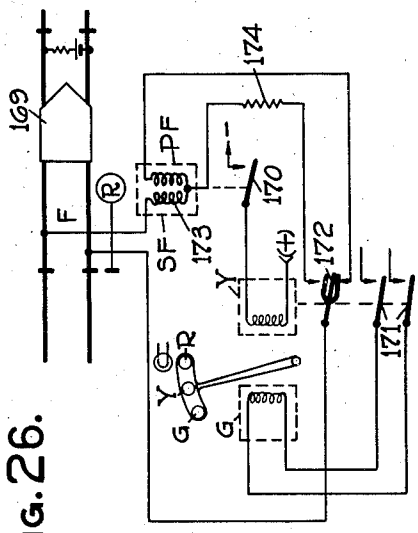

FIG. 26.

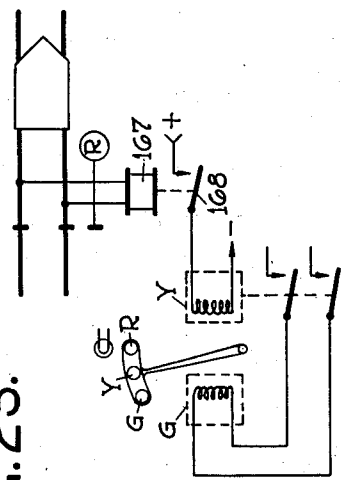

FIG. 25.

INVENTOR
O. S. Field.
BY his Neil W. Preston,
ATTORNEY

Patented May 22, 1945 2,376,534

UNITED STATES PATENT OFFICE

2,376,534

LIGHT SIGNAL FOR RAILROADS

Oscar S. Field, Rochester, N. Y., assignor to General Railway Signal Company, Rochester, N. Y.

Application October 14, 1940, Serial No. 361,060

22 Claims. (Cl. 177—327)

This invention relates in general to light signals for use on railways, and has more particular reference to a light signal of the search light type wherein a spectacle, carrying different colored roundels, is moved with respect to a single light source, to display different signal aspects.

One of the objects of this invention is to provide an improved light signal of the general type disclosed in my prior Patent No. 2,103,251, dated December 28, 1937, and also in my prior Patent No. 2,097,785, dated November 2, 1937.

In a light signal of the above mentioned type, a movable spectacle carrying different colored roundels is selectively operated to its different positions to determine the different indications displayed by the signal. In effecting the operation of such a movable spectacle, it is highly desirable that it be operated progressively from its most restrictive indication selecting position to its least restrictive indication selecting position to thereby avoid an erroneous flash of an undesired indication. This is quite different from the usual light signal of this type as disclosed for example in my above mentioned patents.

One object of the present invention is to provide a light signal of the above generally described type with a movable spectacle which is progressively operated by a mechanism including two separate electromagnets of the tractive type which may be readily adapted for use in various types of signalling systems.

Another object of the present invention is to provide mechanical operating means for interconnecting the armatures with the movable spectacle in such a way as to dampen the tendency of the movable spectacle to oscillate or rebound upon its operation to its different positions.

Another object of the present invention is to provide a mechanical interlock between the two separate tractive type armatures so as to require that a particular armature be operated before the other armature can be operated to thereby provide a signal organized to display the proper and desired indication under various conditions of control.

Another object of this invention is to provide an electro-magnetic operating means for the spectacle which is readily adapted to being changed, so as to permit the signal being employed in various types of track signalling systems.

Further objects, purposes, and characteristic features of this invention will appear as the description progresses, reference being made to the accompanying drawings, showing in a wholly diagrammatic manner, and in no way whatsoever in a limiting sense several forms of the invention. In the drawings—

Fig. 1 is a rear elevational view of the signal with the outer casing cover removed.

Fig. 2 is a side sectional view, with parts shown in elevation.

Fig. 2A is a fragmentary sectional view on line 2A—2A, viewed in the direction of the arrows.

Fig. 3 is a sectional view on line 3—3 of Fig. 4, viewed in the direction of the arrows.

Fig. 4 is a sectional view on line 4—4 of Fig. 3, viewed in the direction of the arrows.

Fig. 5 is a front elevation of one form of operating mechanism for the spectacle.

Fig. 6 is a side sectional elevation of the optical system, and associated parts.

Fig. 7 is a fragmentary view, on an enlarged scale, of a portion of a first form of spectacle operating means.

Fig. 8 is a front view of contact operating means.

Fig. 9 is a fragmentary side view of contact operating means.

Fig. 10 is a perspective view of a second form of spectacle operating means.

Fig. 11 is a front elevational view of the second form of spectacle operating means.

Fig. 12 is a section, on line 12—12 of Fig. 11, viewed in the direction of the arrows.

Fig. 13 is a diagrammatic view of the second form of spectacle operating means, showing different operative positions.

Fig. 14 is a fragmentary sectional view, showing the pivoting means for the movable spectacle.

Fig. 15 is a side sectional elevation, showing the mounting of one of the spectacle operating electro-magnetic structures.

Fig. 16 is a fragmentary sectional view, on line 16—16 of Fig. 17, viewed in the direction of the arrows.

Fig. 17 is a fragmentary side sectional view of the pivot mounting means of one of the armatures of the spectacle operating mechanism.

Figs. 18A, 18B, 18C and 18D are diagrammatic illustrations of different operative positions of one form of spectacle operating means.

Figs. 19, 20, 21, 22 and 23 are diagrammatic views of different electro-magnetic spectacle operating means, with their associated circuits.

Fig. 24 is a diagrammatic view of a wayside signal system employing this signal.

Fig. 25 is a diagrammatic view of a second form of wayside signal system employing this signal.

Fig. 26 is a diagrammatic view of a third form of wayside signal system employing this signal.

Referring now to the drawings, the signal constituting the present invention includes an outer receiving casing OC, of general box-like form, having a rear opening for receiving a cover C which can be securely closed by a hasp. The hasp includes a handle which is movable over a locking staple 2, and operates when in closed position to move the free end 3 of a spring 4 beyond

the handle pivot 5, whereby to hold the cover on the casing by a toggle effect.

The outer casing has an opening at its front upper portion for receiving an outer lens OL of the convex type, and held in place by a ring 7, and is adapted to receive a usual sun visor 8. The lower front portion of the outer casing is provided with three symmetrically arranged threaded lugs 9, for receiving studs 10 to the inner ends of which is clamped a plug board PB, and comprises the plug member of a quick detachable plug coupler. The position of the inner face of plug board PB can be accurately adjusted, and maintained by adjusting the studs 10 in their bosses 9, and when in proper position the slots in the outer ends of the studs are leaded to prevent tampering.

The lower side of the outer casing is provided with wire inlet openings 11, closable if not to be used, by caps 12. In the signal illustrated the various lead-in wires are fastened to a terminal board 13 from which they pass to the outer face of plug board PB to there be fastened to plug members such as 14.

The casing can be mounted in an adjustable manner by means of the threaded rod 15 and ears 16, so as to be tilted in a vertical plane in a manner similar to that disclosed in the Field patent, No. 2,103,251, dated December 28, 1937, if it be a high signal, and as in the Field Patent No. 2,239,316, dated April 22, 1941, if it be a low signal.

The outer casing with its wire inlet openings and terminal board, and adjustably positioned plug board, and outer lens OL, is adapted to receive a mechanism casing MC. With this end in view, two stiff, generally vertical springs 17 are fastened at 18 to a support member 19 which in turn is fastened to the plug board PB. These springs 17 at their upper ends are bent backwardly in a half-loop form, as shown, in a direction toward the rear of the outer casing.

As seen most clearly in Fig. 2A, the outer casing on each side at the inner side has fastened to it a guide member GM, fastened by a stud 21 at its rear end and supported by a bent leaf spring 22 at its forward end, the spring bearing against the outer casing and being fastened to the guide means by rivets 23.

Considering now the mechanism casing MC, it is seen that this casing has a groove 24 in each side, in a position to be received on guide means GM, and thus be guided into the outer casing. The mechanism casing also has pivoted to it at 25, a U-shaped handle H having an ear 26 at each end, carrying a roller 27.

Fastened to the front opening of the mechanism casing is a plate PL, which is fastened to cover the front of the mechanism casing. This plate in its upper portion is furnished with an opening to receive an inner lens IL of the convex type, held in place by suitable means, as shown. Extending rearwardly of this inner lens opening and integral with the plate, is an inwardly tapering fluted light conducting means terminating in a plane inclined to the vertical, at substantially 30°, in order to parallel the adjacently located spectacle as will be described below.

The lower portion SB of plate PL constitutes the socket board of the plug coupler. This socket board is furnished with a plurality of sockets 32, receiving spring coupling members 178, for connecting the plug members, such as 14, with socket wire connecting means such as 34, whereby to connect the incoming wires with the mechanism in the mechanism casing by means of the detachable plug coupler constituted by this plug board PB, carried by the outer casing, and the socket board SB carried by the mechanism casing. The connecting means in the sockets of the socket board are held in place by a cover plate 35, removably connected to the socket board.

The socket board on its forward end has a beveled outline 36, receivable in a complementary beveled depression 37 in the plug board. It should be noted that the inner faces of the plug board and socket board do not contact, but are spaced slightly apart, due to laterally extending lugs 40, three in number, on the socket board, contacting with three inwardly projecting raised pads or portions 41, on the plug board, whereby to position the two boards in a vertical plane, regardless of any warping which might occur near the central portions of the boards, all for a purpose to be more fully described below.

The inlet wires that energize the light source employed in this signal are connected through an adjustable resistor 42, and are led past the plug coupler to be connected to the light source as at 43.

From the above description it follows, that when the mechanism casing is to be inserted into the outer casing, it is necessary merely to hold it by the aid of the handle H, while it is slid into the casing on the guide members GM, and with the handle H in raised position the rollers 27 pass over the upper ends of the springs 17, and when the plug coupler parts have engaged and the beveled portions on the two boards have interengaged the handle H can be dropped to the position shown in Fig. 2. In this way, the rollers 27 force backwardly against the stiff springs 17, and are received in the upper curved ends of the springs, to thereby force the mechanism casing forward so that the plug coupler boards have their cooperating lugs and raised pads firmly pressed against each other. With the handle H in its lowered position, the rollers 27 pass slightly below a horizontal line through the handle pivots 25, whereby a toggle holding effect is produced by the spring.

It is thus seen that the mechanism casing is supported by the two stiff springs 17, and the engaging beveled portions of the plug board and socket board. Furthermore, it is accurately positioned in a vertical plane and at a given distance from the front of the outer casing by the engaging lugs and pads on the coupler boards to form a three-point vertical plane support.

The rear side of the mechanism casing MC, at its upper portion, has a socket 44 for receiving a barrel 45, carrying a light source LS and reflector Ref. The barrel 45 is held in fixed position by means of a support frame 46, adjustably carried on three studs 47, threaded into the mechanism casing. The means for holding the barrel within the socket comprise spring clips 48 on frame 46 and slidable ears 49 on the barrel, in much the same manner as disclosed in the Field patent, No. 2,097,785, referred to above.

The barrel 45 has a flange member 50 with an inturned portion 51, carrying three adjusting screws 52, for adjusting the position of the reflector Ref. The reflector has an opening 53 to receive the light source and is supported on a felt pad 54 of annular form in turn supported on an annular plate spring 55, having inturned teeth 56 which dig into the felt and anchor the felt to the plate spring.

The lamp can be adjusted in the barrel, and

with respect to the reflector, by adjusting means 57, in substantially the same manner as disclosed in the patents above referred to. A cover glass 58 is suitably held in place by a ring 59 for closing this portion of the mechanism casing, even though the reflector barrel be removed.

The lower rear portion of the mechanism casing is open, and can be closed by a transparent cover of glass or the like 60, and held in place by a chin-strap 61, fastened at one end by a stud 62 to the mechanism casing, and removably held in place at its other end by a stud 63, receivable in a slot 64 in the casing, and readily removable upon turning nut 65 back on the stud.

Referring now more particularly to Fig. 6, and considering the adjusting means for the optical system, it is clear that, by means of the studs 10 in the outer casing, the position of the plug board PB with reference to the outer lens, can be accurately adjusted. This also accurately adjusts the distance between the outer lens and the inner lens, when the two plug coupler boards are in contact through their three-point support.

By adjusting the lamp in its barrel by adjusting means 57, and adjusting the reflector, both by rocking it, and if necessary, by moving it inwardly or outwardly slightly, by means of the three adjusting screws 52, the light source can be accurately positioned at one of the foci of the eliptical reflector. This brings the reflected light to a sharp point, and with an optical axis truly perpendicular to the barrel flange 45*a*, and by adjusting the position of the reflector without varying its relation to the light source, this point where the reflected light meets can be accurately positioned on the optical axis, as at the point 66.

Now by means of studs 47, the entire reflector barrel can be moved relatively to the inner lens so that the light spreading out from the point 66 will just fill the entire area of the inner lens and the virtual image of the reflector assembly accurately positioned at the proper focal point of the lens. Further, by means of the adjustment described above, between the inner lens and the outer lens, the light emanating from the inner lens can be arranged to have angles of incidence to the outer lens so as to emerge therefrom in a substantially horizontal beam. These various adjustments result in light travel in general along the dashed lines 67*a* of Fig. 6.

Refer now more specifically to Fig. 3, and consider the spectacle S which carries at its upper end an elongated member carrying differently colored roundels, as R, Y and G, to display red, yellow and green indications respectively, when the spectacle is properly positioned with respect to the light source. The spectacle is carried on a horizontally rockable axle 67, and is operated in a manner to be described below, by electromagnetic means constituting a part of this invention. The spectacle arm 68 is channel shaped, or tubular, or other suitable rigid form, and is pivotally connected to the axle at its lower end by bolt means 69, and upwardly of its lower end, is slidably fastened, to an upstanding arm on the axle by bolt means 70, passing through an enlarged hole 71 in the web portion of the channel, and a snug fitting hole in the arm of the axle, and carrying a spring 72 on the bolt whereby to form a spring pressed slip clutch between the axle and spectacle. This permits a slight amount of over-run on the part of the spectacle with respect to the axle when the spectacle is moved to either extreme position. This construction cushions jars and shocks, and the movement is so slight in extent as to not interfere with the positioning of the roundels to give the proper light indications.

The axle supporting the spectacle is carried by two legs 74 extending downwardly from an intermediate shelf portion 75, which is fixed to the mechanism casting and is formed of suitable non-magnetic material. The axle 67 has a V notch 76 in its upper face with slightly downwardly tapering faces 77 at either side thereof to receive a needle bearing 78 which on its upper element bears against an upper flat faced bearing member 79, fastened to the legs 74 by holding means 80.

Other supporting legs 81 extending downwardly from shelf 75 have fastened to them as at 82, support members 83, which extend downwardly through slots 84 in the axle, and have sleeved thereon, springs 85 held in place by washers 86. These washers, in turn, are held in place by shoulders on a clip 87, which clip extends upwardly inside of the spring to terminate to a very short distance below the underface of the slot in the axle, so as to form a stop 88 to prevent movement of the axle 67 downwardly, against the spring tension, far enough to allow the needle bearing to be moved out of its bearing groove.

This spring supported bearing means for the spectacle axle furnishes a very simple and durable bearing which is practically frictionless, and has a very long life. The needle is prevented from moving out of its groove in an endwise direction by shoulders 89 on the axle. Since the bearings and support means for the armatures of the two electro-magnetic operating members are constructed substantially the same as those for the spectacle bearing, and since these are illustrated to an enlarged scale in Figs. 15–17, the disclosure of the spectacle axle bearing and support will be supplemented by the following description of the support and bearings for the armatures of the electro-magnetic means here involved.

As can be most clearly seen in Fig. 4, the shelf portion 75 carries two electro-magnets, having coils 90 and 91, placed side by side and extending from rear to front of the mechanism casing. Since these two devices in the simplest form of the signal are identical so far as their coil, core, and armature structure is concerned, but one of them will be described in any detail.

Referring now to Figs. 15–17, it can be seen that a core 92 carries a winding 91, and is positioned above the shelf 75, and is connected in a magnetic circuit including downwardly extending legs 93 and 94, carrying pole shoes 95 and 96, with an air gap 97 between their inner ends. Thus, upon energizing a winding, flux tends to pick up the pivoted armature 98 away from its back stop 99 in order to reduce the reluctance of the magnetic path, in the usual way for tractive type relays.

The armature 98 is pivoted at its rear end in much the same manner as described above in connection with the pivot for the spectacle axle.

A stud 100 passes through a hole in a holding plate 101 and through a slot 102 in a U-shaped flat member 103. This U-shaped member 103 has two depending legs, one only, 104, of which is shown in detail. In assembly, an upper bearing plate 105, having slotted ends 106, is first passed between the two legs, and against the cross portion of the U, and then the two legs are inserted through two spaced slots 107 near the

rear edge of the armature to thereby bring the plate 105 against the top element of a needle bearing 108, which is received in a V-shaped slot 109 in the top face of the armature, and is held against endwise movement by the legs, as at 104.

The armature is held against its bearing by a spring 110 for each leg, bearing at its lower end against a stop 111, held in place by shoulders 112, on a U-shaped slip, fastened at its lower end by bolt 113 to the leg and extending upwardly as at 114, to terminate just short of the inner face of the socket in the armature. These portions 114 thus prevent the armature from being pulled downwardly against the spring tension, a sufficient distance to lift the needle bearing out of its V-shaped notch.

Each armature, at its forward end, operates a plurality of contacts as well as operating the spectacle. The armature, as shown in Fig. 8, has fastened to it, depending lugs 116 through which passes a pin 117 anchored against endwise movement by a spring latch 118 carried at one end by the lugs and at its other end springing into a notch 119 in pin 117. On the pin 117 are carried contact pushers 120 which are slidable, for example, through front and back contact fingers 121 and 122, and on movement, moves a movable contact 123 to break back contact and make front contact in the usual manner. With this arrangement, a large number of contacts can be operated by each armature without altering the design and proportions of the light signal as a whole.

Coming now to the mechanism whereby the armatures operate the spectacle to its various positions, the two armatures, as seen in Fig. 5, can be considered as the yellow armature Y, and the green armature G, inasmuch as they operate to produce the yellow, and the green indications respectively, under proper energization conditions. Each armature, when the device is deenergized, rests upon an adjustable back stop 99, and in general, upon the yellow armature picking up, the spectacle is moved from its biased red position to its yellow position, and then, while maintaining the yellow armature up, if the green relay be energized, the green armature picks up and moves the spectacle to its green position. It is arranged, however, that with the yellow relay deenergized, energization of the green relay will not move the spectacle from its red position. The spectacle is biased, by its own weight, and by armature weight, to normally assume its red position so as to display the red indication, as shown in Fig. 4.

The spectacle, as can be noted in Fig. 3, has its roundel carrying portion inclined so as to be substantially parallel with the inner opening of the conical fluted light transmitting portion, at an angle of substantially 30° to the vertical. This is an important feature for insuring accurate signal indications. With the spectacle at right angles to the light beam, that is, in a vertical plane, direct sun light entering the signal, and striking the colored roundels, produces a considerable amount of surface reflection, which emerges from the signal as white light and thus washes out the colored light produced, for example, by the light source, and passing through the roundel. Since the sun light is very strong compared to the light source employed in the signal, a small percentage of sun light emerging as white light may so seriously wash out the color of the emerging beam as to cause a confusing or inaccurate indication. Furthermore, this may occur, when the roundels are at right angles to the optical axis of the signal, whether or not the light source be energized at the time.

Referring now more particularly to Figs. 5, 7 and 18A–18D, the mechanism whereby the yellow and green armatures move the spectacle to its various positions, will be discussed.

The Y, or yellow armature, has connected to it an operating arm 125, carrying an adjustable front stop 126 intermediate its ends, and a pin 127 at its end, which passes freely through an opening 128 in the crank arm CR of the spectacle axle, which, as explained above, rocks on a pivot. Sleeved on the pin 127 is a rigid tubular sleeve 129, bearing at its upper end against the crank arm CR, and at its lower end against adjusting nuts 130. Surrounding the sleeve 129 is an operating spring 131, trapped between the crank arm and adjusting nuts 132, whereby, with the yellow armature held by its own weight against its back stop, and with the operating arm 125 substantially horizontal, the spring 131 urges the crank arm against the stop 126.

On the G, or green armature, is an operating arm 133 positioned somewhat above the free end of the crank arm when the green armature is resting against its back stop.

The horizontal distance from the crank pivot to the front stop 126 and designated by *a*, is substantially equal to the horizontal distance *b*, between stop 126 and the pin 127. Thus, upon the crank arm CR swinging upwardly in a clockwise direction the portion below the stop pin 126 will travel substantially one-half the distance that the outer end of the crank arm travels. The stop arms are backed up with positioning springs 134 and 135.

This arranging of parts is shown diagrammatically in Figs. 18A–18D in order to facilitate explanation of the operation.

Fig. 18A represents the parts in the positions assumed when the spectacle is positioned to display the red indication.

In Fig. 18B is shown the positions of the parts when the yellow armature has been attracted and has moved toward its pole shoes substantially one-half of its total travel, which total travel can be represented by *c*. By considering Fig. 18B, it can be seen that, as the stop 126 moves vertically upwardly a distance of

$$\frac{c}{2}$$

the crank arm is urged by the spring 131 to follow it, and remain in contact with the stop 126. The pin 127, however, has moved twice the vertical distance

$$\frac{c}{2}$$

whereby to strike against the green operating arm 133, which acts as a stop arm. In this position, the spectacle has moved to the right, that is, in a clockwise direction to display the yellow indication.

The yellow armature continues its picking up movement to reach the position shown in Fig. 18C and since the crank arm is held against further movement by the green armature stop 133, the stop 126 is positioned a distance approximately

$$\frac{c}{2}$$

above the crank arm, while the spring has

been re-tensioned and the collar 129 has been moved up to bear at its two ends, against its adjustable stop and the crank arm. Thus, in the yellow position, the spectacle is rigidly connected to the yellow armature, and the spring is re-tensioned preparatory to its further moving of the crank arm.

In Fig. 18D the condition is shown where the green armature has moved against its pole shoe, which is a distance *c*, whereby the spring 131 has expanded, and moved the outer end of the crank arm a distance of *c*, to retain it against the stop arm 133. The crank arm, at the point vertically below the stop 126, being closer to the pivot, has moved a distance approximately

$$\frac{c}{2}$$

to thereby bring it against the stop 126.

On deenergizing the operating magnets, the armatures release and move the spectacle back to its red position.

By means of this intermediate tensioning of the operating spring, the spectacle, in moving from clear to stop, does not need to build up a spring tension of any considerable value, and hence the device is more dependable than those hitherto provided, in returning to the stop position upon deenergization.

It can be noted that energization of the green magnet merely moves the stop arm 133 upwardly, and unless the yellow magnet has first been energized, and has remained energized, the crank cannot move because of the stop 126. Thus, energization of the yellow magnet moves the spectacle to the yellow position, and with this yellow magnet energized the green magnet when energized can cause the spectacle to move to the green position, but the energization of the green magnet alone cannot cause the spectacle to move from its red position.

Refer now more particularly to Figs. 10, 11 and 13 for disclosure of the second form of spectacle operating means. In this second form, the Y and the G magnets, with their armatures, are the same as before. The spectacle axle is substantially the same although is varied somewhat. The axle has a double crank comprised by an arm 136, operated on by the Y magnet, and an arm 137, operated on by the G magnet, the first arm being substantially horizontal, and the second arm somewhat downwardly inclined when the spectacle is in its red position.

The Y armature has a vertically bifurcated operating arm, comprised by an upper short leg 138 having at its end an adjustable stop 139 bearing on the upper face of crank arm 136, and a lower long leg 140 having an adjustable stop 141 at its end bearing against the lower face of the crank arm 136. In a similar manner the G armature has a vertically bifurcated operating member, comprised by an upper short leg 142, carrying at its end an adjustable stop 143 which is fixed above the upper face of the crank arm 137, and a lower long leg 144 having at its end an adjustable stop 145 bearing against the lower face of the crank arm 137.

As shown in Fig. 13, in a diagrammatic manner, the stop 139 of the yellow armature is positioned at a distance *e* from the axis of rotation of the spectacle axis while stop 141 of the same armature is positioned at a distance *f*, from the axis of rotation, with distance *f* substantially twice as great as distance *e*. With regard to the G armature, the stop 145 is positioned at a distance *g* from the axis of rotation, while the stop 143 is positioned at a distance *h* from the axis of rotation, wherein distance *h* is substantially twice as great as distance *g*. The distance *g* is slightly greater than the distance *e* in order to compensate for the difference in vertical travel of the armature operating arms. It can be seen in Fig. 10 that the G armature operating arm is spaced slightly further from the armature axis than is the other arm, and hence will move a slightly greater distance when the armature picks up, although the spacing in Fig. 10 is exaggerated for clarifying the showing.

Upon the Y armature being picked up, following energization of its coil, the armature moves the arms 138 and 140 in a vertical direction, a distance substantially equal to *d*, to thereby rock the spectacle crank clockwise, to bring it to the Y position, where the crank arm 137 bears against the crank stop 143. The spectacle in this position is arranged to display the yellow indication.

Upon energizing the G magnet, the G armature picks up to move the stop 145 against the crank arm 137 during the first half of its total movement and then to move the crank clockwise to position the spectacle for displaying the green indication. The G armature drives the spectacle only during the last half of its travel, and the stop 143 has been away from the crank arm the full distance of its travel, but since it is substantially twice as far from the axis of rotation as is the driving pin, when the spectacle is positioned for the green indication the two crank arms are in the position indicated by "G," and are against the Y stop member 139, and against the G stop member 143.

The spectacle also is provided with a stop 146, fixed to the mechanical casing, and cooperating with the spectacle carrying channel, and ordinarily this stop will become effective at the same time as do the armature stops, or slightly before, if there be any time difference.

In the case as with the operating mechanism of the first form, described above, if the G magnet is energized when the Y magnet is deenergized, the spectacle will not move from its red position since to do otherwise it would be necessary for the G armature to pick up not only itself and the spectacle, but also the Y armature, and such a load is excessive. Thus, as before, energization of the yellow magnet gives the yellow indication, and energization of both the yellow and green magnets, gives the green indication.

As thus far described, the yellow and green magnets are separate devices, both physically and with regard to their energizing circuits, and this arrangement is shown disagrammatically in Fig. 19, where the yellow magnet Y has a winding energized through a circuit controlled by the switch 147, of any desired character. In like manner, the G magnet is energized through a circuit controlled by a switch 148 of any desired character. Thus in this form, two neutral relays are involved of the tractive type, and the energization is not dependent upon the polarity applied.

This form of signal can replace the usual semaphore signal by merely connecting the Y and G circuits to the 45° and 90° circuits of the semaphore and obviate any need for additional relays, etc.

Furthermore, the signal can be used to advantage in coded track circuits, wherein the Y and G relays are connected directly to the usual tuned

circuits as the 75 cycle and 180 cycle circuits of the decoder.

In Fig. 20 is shown a modified form, wherein the yellow magnet is non-polarized, but is connected in series with the green magnet, which is polarized by a permanent magnet 149, and has its armature biased by a spring, or counterweight, or the like, 150, to retracted position. A full-wave rectifier 151 is inserted in series with the winding of the yellow magnet, whereby to cause current to flow in the yellow magnet always in the same direction, regardless of the applied polarity, so that a change of polarity on the energizing circuit for the two magnets will not cause the yellow armature to release. The winding of the G magnet is split so as to place its two parts on opposite sides of the rectifier, whereby to provide a choke on each side of the rectifier to protect against lightning, and the like. The energizing circuit is obvious from the drawings and is controlled by a switch 152 of any desired character. When the switch is closed, the yellow magnet will always pick up to give a yellow indication, and if the applied polarity be of the character to make the left pole shoe a north pole, the south polarized armature will be attracted and the green armature will pick up and give the green indication. However, if the polarity be the reverse of that considered just above, the polarized armature will be repelled, and so will remain in its biased retracted position. The direction of flux which picks up the green armature is shown by a full arrow, and that which urges it to its retracted position is shown by a dotted arrow.

In Fig. 21 is shown another form of magnetic structure and circuit connection, wherein the yellow magnet, as before, is a neutral magnet, and picks up when the switch 153 is closed, regardless of the applied polarity, and does not release upon the polarity being reversed, due to the rectifier 154. This rectifier is connected, as described above, for protection against lightning. In this form, the green armature is not polarized as before, but a permanent magnet 155 is magnetically connected in multiple with the electromagnetic core so as to substantially saturate the core. Thus, when the electro-magnetism is in the direction of the full arrow, the core shunt on the permanent magnet is choked out, and the armature picks up, but when the electro-magnetism is in the reverse direction it has no effect to speak of, since the permanent magnet has saturated the core and the armature remains retracted.

In Fig. 22 is shown a slightly modified form wherein the circuit for energizing the magnets is controlled by a switch 156. This form differs from the form of Fig. 21 only in that the permanent magnet is replaced by an electro-magnet 157, which acts as shown and is connected to the rectifier 158, so as to be energized always in the same direction, regardless of the applied polarity. The operation is the same as described above in connection with Fig. 21.

Another form of magnetic structure, and associated circuits, is shown in Fig. 23, wherein the yellow magnet is non-polarized, as before, and is prevented from releasing upon a change in the polarity of the applied energy by means of its connection to the output side of the full-wave rectifier 157^1. In this form, the core of the green magnet has a bucking winding comprised of two portions 158^1, so connected on opposite sides of the rectifier (for lightning protection as before) as to always be energized in the same direction regardless of the polarity of applied energy. There is also the operating winding 159, on this same core, which likewise is in two parts, for lightning protection of the rectifier, and which is energized in different directions, with different applied polarities. When the two sets of windings are energized so as to aid each other, the armature picks up, and when energized to oppose each other, the armature remains retracted.

Referring now to Fig. 24, there is here shown a trackway signalling system for railways, employing the light signal of this invention. A stretch of track 161 is shown, divided into usual signalling blocks A, B, C, D and E, at the entrance end of each of which is a signal, as SB, SC, SD and SE, the entrance end of block A not being shown.

The signal employed in this system is of the simplest form, above described, wherein the yellow and green magnets are neutral and are controlled by separate circuits. The winding of the yellow magnet is connected across the entrance end of its track section, and thus serves as a track relay, while the winding of the green magnet is energized through a circuit including front points of its yellow magnet, and front points of the yellow magnet of the signal next in advance. For example, considering the signal SD, its yellow winding is connected, by wires 162, across the track rails, while the corresponding green winding is energized through a circuit including contact finger 163 and front point, and contact finger 164 and front point. These contacts 163 and 164 are contacts built into the light signal, and accordingly, for this three-position signalling system, no track relays, or line relays, are needed, since contacts are available in the signals themselves, and the signals are of the progressive type, moving in the same direction from most restrictive to least restrictive indication, so as to permit of their use in this system.

With a car 165 occupying the block D, the yellow winding of signal SD is shunted out, and its contact 163 in retraced position, deenergizes the green winding, whereby the signal at the entrance to the occupied block displays a red indication.

At the entrance to block C, the first block to the rear of the occupied block, the yellow winding is energized, but the green winding is deenergized due to contact finger 166 being in retracted position so that the signal displays a yellow indication.

The signal immediately to the rear and all signals further to the rear have both windings energized, and hence display green indications.

Referring to Fig. 25, there is here shown a signalling system similar to that described just above except that the yellow winding of the signal, which may in some cases not be suitable to function as a track relay, is connected to repeat a usual track relay 167. With the track relay 167 deenergized, the yellow winding of the light signal is deenergized, due to the retracted position of contact finger 168 of the track relay.

In Fig. 26 is shown a system wherein the yellow winding of the light signal functions as the secondary relay of a usual "primary-secondary" track relay, such, for example, as shown in the Field patent, No. 1,942,141, granted January 2, 1934.

In this system, the track section F is occupied by a car 169 and the primary relay PF is deenergized to position its contact finger 170 in retracted position, whereby to deenergize the yel-

low winding of the light signal SF. With the yellow winding deenergized, the signals green winding is deenergized, due to the retracted position of the yellow contact fingers 171 to thereby position the spectacle to display a red indication. The system is of the same type as described above in connection with Figs. 25 and 26. It should be noted that the primary relay PF is connected with only a portion 173 of its winding in series with the resistance 174, across the track section through a front contact 172 of the yellow winding, which is of the make-before-break type, when its section is not occupied. When, however, its section is occupied, as illustrated in the figure of drawings, it releases to deenergize the yellow winding and connect its full winding, exclusive of the resistance 176 across the track section through a back point of the make-before-break contact 172. Thus, the usual primary-secondary characteristics are obtained, and the desirable make-before-break contacts as 172, are included among the contacts built into the light signal. Furthermore, the yellow magnet, when energized, is slow to pick up, due to its proportions and construction, as described above, and accordingly, as an occupying car passes through the section, some slight loss of shunt, which might pick up the primary relay will not persist long enough to follow through and pick up the yellow armature, and thus momentarily change the signal indication.

With regard to the three signalling systems discussed just above, it should be noted that, in the first case, the usual track relays and line relays have been dispensed with, since they are replaced by the yellow relays of the light signals, which relays are equipped with contacts for controlling the necessary circuits, and which otherwise would have to be supplied as contacts of track relays and line relays.

In the form shown in Fig. 25, where a track relay is employed, it is clear that the usual line relays that would otherwise be needed, are dispensed with and the contact control is carried by contacts on the yellow relay which contacts are already included in the signal.

In Fig. 26, where the yellow winding functions as the secondary relay of a primary-secondary combination there is again no need for line relays since the contacts which they would ordinarily supply are provided already in connection with the yellow relay, and the slow pick-up characteristics of the secondary relay, and the make-before-break type of contacts are already present in the light signal itself, since the signal is so constructed with a large number of conventionally operated front, back and movable contacts, as to permit of any desired contact arrangement.

The above rather specific description of several forms of the present invention are given solely by way of example, and are not intended, in any manner whatsoever, in a limiting sense. It is to be understood that various modifications, adaptations, and alterations, can be applied to meet the requirements of practice without in any manner departing from the spirit or scope of the invention, except as limited by the appended claims.

Having described my invention, I now claim:

1. A multiple aspect color light signal of the character described comprising, a spectacle having a plurality of colored roundels and movable to bring each of said roundels to a predetermined point for the different indicating positions of said spectacle, an actuating element for said spectacle, electro-magnetic means for operating said actuating element to different predetermined positions corresponding with the different indicating positions of said spectacle, means having a limited degree of lost motion for operatively connecting said actuating element and said spectacle, and means for frictionally opposing movement of said spectacle relative to said actuating element so as to absorb the momentum of said spectacle as it is shifted to its different indicating positions by said actuating element.

2. A multiple aspect color light signal of the searchlight type comprising, an actuating axle supported on a horizontal axis, means including two tractive type electro-magnets for actuating said axle to three different predetermined positions corresponding with the different indications of the signal dependent upon the energization of one or both of said electro-magnets, a spectacle having roundels of different colors and acting in its different indicating positions to cause the signal to display its different aspects, and means for operatively connecting said spectacle with said axle to support said spectacle and move it to its different indicating positions, said connecting means including friction elements having a limited amount of relative motion and spring pressed together to provide a predetermined amount of frictional opposition to the movement of the spectacle relative to said axle, whereby the momentum of said spectacle is gradually absorbed without jar and vibration as it is moved to its different indicating positions.

3. A multiple aspect color light signal of the character described comprising, a spectacle having roundels of different colors and movable in a vertical plane to different indicating positions, two tractive type electro-magnets for moving said spectacle having their armatures disposed in parallel relationship, each of said armatures being pivotally mounted at one end to move vertically about a horizontal axis, operating means connecting the free ends of said armatures of said electro-magnets with said axle to move said axle to one extreme biased position in response to the movement of both of said armatures to their retracted positions, said operating means acting to move said axle to an intermediate indicating position when one of said armatures is in its attracted position and to another indicating position when both of said armatures are in their attracted positions, stop means for arresting movement of said armatures and said axle in predetermined positions corresponding with the active indicating positions of said spectacle, and means including friction elements for connecting said spectacle and axle for a limited amount of relative movement and for absorbing the momentum of said spectacle when the motion of said armatures is arrested by said stop means upon movement of the spectacle to an indicating position.

4. In a searchlight signal of the multiple aspect type, a movable spectacle operable to different indicating positions, a pivoted drive axle, frictional clutch means for mounting said spectacle on said drive axle for permitting only limited movement of the spectacle with respect to said drive axle, two tractive type relays associated with said drive axle and each having a pivoted armature with definite attracted and released positions and operating means jointly connecting said relay armatures to move said drive axle and spectacle from a normal position to an in-

termediate position upon the energization of one of said relays and to move said drive axle and said spectacle to an extreme position beyond said intermediate position upon the energization of both of said relays, whereby the limit of movement of the spectacle to the intermediate position is determined by the released position of said armature of said other relay, and whereby energy stored in said spectacle during its movement is dissipated by said frictional clutch means without causing movement of the relay armature of said other relay from its released position.

5. In a multiple aspect color light signal of the searchlight type for railway signalling systems, a vertically movable spectacle having colored roundels for giving the different color aspects of the signal, electro-responsive mechanism including two tractive type electro-magnets for moving said spectacle from one extreme biased position in the same direction to other indicating positions progressively, each of said electro-magnets having a pivotally mounted armature moving in a vertical plane to its attracted position, means operatively connected with the free ends of said armatures for moving said spectacle to different indicating positions in response to the energization of one or both of said electro-magnets, and a permanent magnet disposed in shunt relationship to the armature of one of said electro-magnets to render that armature responsive only to the energization of that electro-magnet by current of a particular polarity.

6. In a multiple aspect color light signal of the character described, a spectacle having colored roundels for the different aspects of the signal and tilted in a vertical plane to its different indicating positions, means including two tractive type electro-magnets for operating said spectacle from a biased position in the same direction progressively to different indicating positions, said electro-magnets having armatures in parallel relationship pivotally mounted on horizontal axes, a permanent magnet associated with one of said electro-magnets to render its armature responsive only to the energization of that electro-magnet by current of one polarity, and means associated with the other electro-magnet for delaying the response of its armature to its energization.

7. In a multiple aspect color light signal of the character described, a spectacle having different colored roundels and supported to tilt in a vertical plane to different indicating positions, operating mechanism including two tractive type electro-magnets for positioning said spectacle in an extreme biased position when both of said electro-magnets are deenergized, said mechanism operating said spectacle from its biased position in the same direction to different indicating positions when one and then both of said electro-magnets are energized, a plurality of movable contact fingers operatively connected to each of said armatures, and means for rendering the operation of one of said armatures to its attracted position dependent upon movement of the other armature to its attracted position.

8. In a multiple aspect color light signal of the character described, a spectacle having colored roundels for giving the different aspects of the signal, an axle mounted to turn on a horizontal axis for supporting and tilting said spectacle in a vertical plane to its different indicating positions, operating mechanism including two tractive type electro-magnets for moving said axle and spectacle from a biased position in the same direction progressively to other different indicating positions, said electro-magnets having armatures in parallel relationship pivotally supported at one end for vertical movement on a horizontal axis, a plurality of movable contact fingers horizontally disposed under each of said armatures, stationary contacts cooperating with said contact fingers in both the attracted and retracted positions of the associated armature, means connecting the free ends of said armatures with each of the associated contact fingers, and means for rendering the movement of one armature to its attracted position dependent upon the movement of the other armature to its attracted position.

9. In a spectacle operating mechanism for a searchlight multiple aspect type signal, a spectacle movable in a vertical plane about a pivot point, two tractive type relays associated with said spectacle and each having an armature pivoted at one end, operating means jointly connecting said armatures to said spectacle for progressively moving it to its different positions from one extreme biased position, said operating means moving said spectacle to an intermediate position when one of said armatures is in an attracted position by reason of energization of its relay, and to the other extreme position when the other of said armatures is also attracted due to the energization of its relay, and means preventing the attraction of said other armature by the energization of its relay unless said one armature is in an attracted position by reason of the energization of its relay.

10. In a spectacle operating mechanism for a searchlight signal of the multiple indication type, a spectacle movable in a vertical plane about a pivot point, two tractive type relays associated with said spectacle and each having an armature pivoted at one end, front and back contacts associated with each armature and operatively connected to its other end, operating means jointly connecting said armatures for progressively actuating said spectacle to its different positions from one extreme biased position, said operating means actuating said spectacle to an intermediate position when one of said relays is energized and to the other extreme position when the other of said relays is also energized, and means preventing the response of the armature of said other relay to energization of that relay except when said one relay is energized and its armature is in an attracted position, whereby the actuation of said spectacle and said contacts associated with said other relay is prevented by energization of that relay unless said one relay is energized first.

11. In a multiple aspect color light signal of the character described, a spectacle having colored roundels for giving the different aspects of the signal, an axle mounted to turn on a horizontal axis for supporting and tilting said spectacle in a vertical plane to its different positions, a tractive type relay on each side of the axle and each having an armature pivoted at substantially right angles to the axle, a substantially horizontal crank arm on the axle, a first operating arm extending inwardly from the armature of one of said relays and having a stop positively engaging said crank arm on its upper surface when that armature is released but moving out of engagement when that armature is in an attracted position, another operating arm extending inwardly from the armature of the other of said relays to a position beneath and engageable

with said first operating arm when that armature is attracted and such another operating arm having a stop positively engaging said crank arm on its upper surface when that armature is released and said crank arm is in an intermediate position but moving out of such engaging position when that armature is in an attracted position, whereby said crank arm is normally biased to an extreme position by the armature of said one relay, and whereby the attraction of the armature of said other relay is prevented unless the armature of said one relay is also attracted, and operative connections between said operating arms and the crank for moving it to an intermediate position when the armature of said one relay is attracted and for moving it to another extreme position beyond the intermediate position when the armature of both said relays are attracted.

12. In a multiple aspect color light signal of the character described, a spectacle having colored roundels for giving the different aspects of the signal, an axle mounted to turn on a horizontal axis for supporting and tilting said spectacle in a vertical plane to its different indicating positions, a tractive type relay on each side of the axle and each provided with a pivoted armature, a substantially horizontal crank on the axle extending to one side thereof, a first bifurcated operating arm on one armature straddling the crank and contacting the crank on its upper surface relatively near the axle pivot point when that armature is retracted and also contacting the crank on the under surface and relatively far from the axle pivot point, and another bifurcated operating arm on the other armature straddling the crank and contacting the crank relatively near the axle pivot on its under surface and spaced from but contactable with the upper surface of the crank relatively far from the axle pivot, said space between such bifurcated operating arm and the upper surface of the crank being substantially equal to the movement of the crank when said one armature is moved from its released to its attracted position, whereby said one armature can move to its attracted position without moving the other armature from its released position but said other armature can move to its attracted position only if said one armature is also moved to its attracted position, said bifurcated operating arms being of such lengths that the distance between the points where such bifurcated arms contact the crank relatively near the axle pivot with respect to the distance between the points where such bifurcated arms contact the crank relatively far from the axle pivot is of a ratio of approximately one to two, whereby the spectacle is operated from one extreme position progressively to an intermediate position and another extreme position in accordance with whether said one armature is attracted or both said armatures are attracted and said another bifurcated operating arm furnishes a stop for preventing over-run of the spectacle when it is operated to its intermediate position by the attraction of said one armature.

13. In a multiple aspect color light signal of the searchlight type of the characted described, a spectacle having a plurality of colored roundels and movable to bring each of said roundels to a predetermined point for the different indicating positions of said spectacle, two tractive type relays associated with said spectacle and each including a core, an energizing winding, and a pivoted armature, operating means operatively connecting said armatures with said spectacle for moving it to one extreme biased position when both of said armatures are in their retracted positions, to an intermediate indicating position when said armature of one of said relays is in its attracted position, and to another extreme position when both of said armatures are in their attracted positions, means associated with the core of the other of said relays to render its armature attracted only in response to the energization of the associated winding by energy of one particular polarity, rectifier means associated with said relays, and circuit means connecting said other relay winding through said rectifier means in series with said one relay winding, whereby energy of one polarity causes both said relays to attract their armatures while the application of the opposite polarity causes only said one relay to attract its armature, and whereby the quick reversal of polarity does not result in the dropping of the armature of said one relay and an unnecessary operation of said spectacle.

14. In a light signal of the multiple aspect searchlight type, a movable spectacle having a plurality of colored roundels and movable to bring each of said roundels individually to an active indicating position, two electro-magnets associated with said spectacle and each including an energizing winding and a pivoted armature biased to a released position, operating means operatively connecting said armatures to bias said spectacle to one extreme indicating position when both of said armatures are in their released positions, said operating means acting to move said spectacle to an intermediate indicating position when one of said armatures is attracted and to move said spectacle to an opposite extreme indicating position when both of said armatures are attracted, means polarizing one of said electro-magnets for causing it to attract its armature only in response to the energization of its associated winding with current of one polarity, rectifier means, and circuit means for connecting the windings of said electro-magnets in series and so including said rectifier means as to cause the non-polarized electro-magnet to be energized with the same polarity of current when either polarity of current is applied to said circuit means.

15. In a light signal of the multiple aspect searchlight type, a movable spectacle having colored roundels for giving the different color indications of the signal, electro-responsive mechanism including two tractive type relays for moving said spectacle from one extreme biased position in the same direction to other indicating positions progressively, each of said relays having a core, an energizing winding and a pivotally mounted armature biased to a retracted position, means operatively connecting said armatures for moving said spectacle to different indicating positions in response to the attraction of one or both of said armatures by their respective relays, a permanent magnet connected magnetically in multiple with the core of one of said relays to render the armature of that relay responsive only to the energization of its energizing winding by current of a particular polarity, a full-wave rectifier, and circuit means including said full-wave rectifier for connecting said energizing windings in series in a manner to supply the relay not having an associated permanent magnet with unidirectional current regardless of the polarity of current supplied to said circuit means.

16. In a light signal of the multiple aspect

searchlight type, a movable spectacle having colored roundels for giving the different color indications of the signal, electro-responsive mechanism including two tractive type relays for moving said spectacle from one extreme biased position in the same direction to other indicating positions progressively, each of said relays having a core, an energizing winding and a pivotally mounted armature biased to a retracted position, means operatively connecting said armatures for moving said spectacle to different indicating positions in response to the attraction of one or both of said armatures by their respective relays, an auxiliary electromagnet having a winding and a core, said core being connected magnetically in shunt relationship to the core of one of said relays, a full-wave rectifier, and circuit means including said full-wave rectifier for connecting said energizing windings of said relays and said auxiliary electro-magnet in series and so including said rectifier as to provide uni-directional current for the energizing winding of the auxiliary electro-magnet and the opposite relay, whereby said relay having the auxiliary electromagnet is effective to attract its armature only in response to the energization of its energizing winding with current of a particular polarity flowing through said circuit means while the other relay attracts its armature in response to energization of either polarity.

17. An electroresponsive device comprising two electromagnets each provided with an armature, a polarized energizing circuit for said electromagnets, means for causing the flux to traverse the one electromagnet in the same direction regardless of the polarity of the current supplied to said energizing circuit, means for preventing the armature of the other electromagnet from moving to its attracted position when said circuit is supplied with current of one relative polarity but not when it is supplied with current of the other relative polarity, and a member controlled jointly by said two armatures.

18. An electroresponsive device comprising two electromagnets each provided with an armature, a polarized energizing circuit for said electromagnets, means for causing the flux to traverse the one electromagnet in the same direction regardless of the polarity of the current supplied to said energizing circuit, means for preventing the armature of the other electromagnet from moving to its attracted position when said circuit is supplied with current of one relative polarity but not when it is supplied with current of the other relative polarity, and a member operatively connected with said armatures and movable thereby to a first, second, or third position according as both armatures are released, one armature is picked up and the other released, or both armatures are picked up.

19. An electroresponsive device comprising two electromagnets each provided with an armature, an energizing circuit for said electromagnets including the windings of both electromagnets in series, means for supplying current of one polarity or the other to said circuit, means for causing the flux to traverse the one electromagnet in the same direction regardless of the polarity of the current supplied to said circuit, whereby the armature of said one electromagnet will pick up when said circuit is supplied with current of either polarity and will remain picked up during reversals of the polarity of the current supplied to said circuit, means for preventing the armature of the other electromagnet from picking up when the circuit is supplied with current of one relative polarity but not when it is supplied with current of the other relative polarity, and a member controlled jointly by said armatures.

20. An electroresponsive device comprising two electromagnets each provided with an armature, an energizing circuit for said electromagnets including the windings of both electromagnets in series, means for supplying current of one polarity or the other to said circuit, asymmetric means connected in said energizing circuit and associated with the winding of said one electromagnet in a manner to cause current of one polarity only to flow in such winding when said circuit is energized with current of either polarity for causing the flux to traverse said one electromagnet in the same direction regardless of the polarity of the current supplied to said circuit, said asymmetric means being effective to retard the decay of flux in the magnetic circuit of said one electromagnet when the polarity of the current supplied to said circuit is reversed, means for preventing the armature of the other electromagnet from picking up when the circuit is supplied with current of one relative polarity but not when it is supplied with current of the other relative polarity, and a member controlled jointly by said armatures.

21. An electroresponsive device comprising two electromagnets adapted to be energized in series from a polarized control circuit and each provided with an armature, means for supplying the one electromagnet with current of the same relative polarity regardless of the relative polarity of the current supplied to the other electromagnet, whereby the armature of the one electromagnet will pick up on current of either polarity but that the flux induced in the armature of said one electromagnet will always traverse the armature in the same direction, means for rendering the armature of the other electromagnet effective to pick up when said other electromagnet is supplied with current of one relative polarity but not when it is supplied with current of the other relative polarity, and a member operatively connected with said armatures.

22. An electroresponsive device comprising two electromagnets adapted to be energized in series from a polarized control circuit and each provided with an armature, means for supplying the one electromagnet with current of the same relative polarity regardless of the relative polarity of the current supplied to the other electromagnet, whereby the armature of the one electromagnet will pick up on current of either polarity but that the flux induced in the armature of said one electromagnet will always traverse the armature in the same direction, means for rendering the armature of the other electromagnet effective to pick up when said other electromagnet is supplied with current of one relative polarity but not when it is supplied with current of the other relative polarity, and a member operatively connected with said armatures and movable thereby to a first, second or third position according as both armatures are released, one armature is picked up and the other released, or both armatures are picked up.

OSCAR S. FIELD.