No. 801,543. PATENTED OCT. 10, 1905.

F. P. J. PATENALL & G. H. DRYDEN.

RAILWAY SIGNAL.

APPLICATION FILED MAY 23, 1905.

3 SHEETS—SHEET 1.

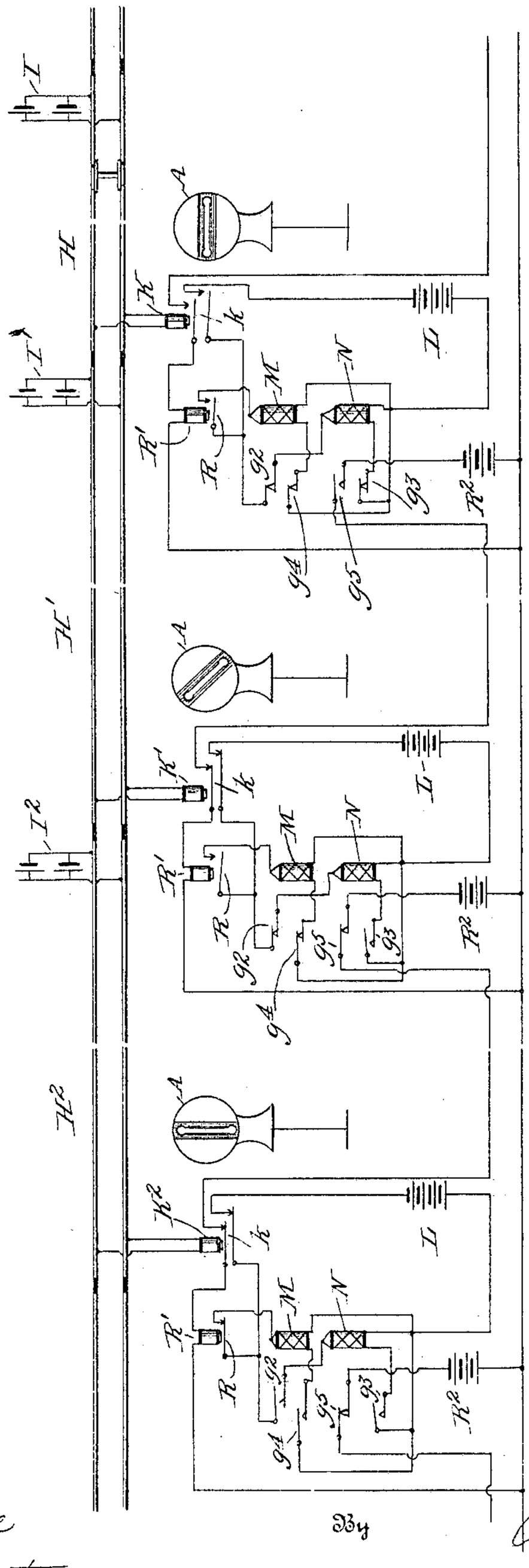

Fig. 1.

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3 SHEETS—SHEET 2.

Fig. 2.

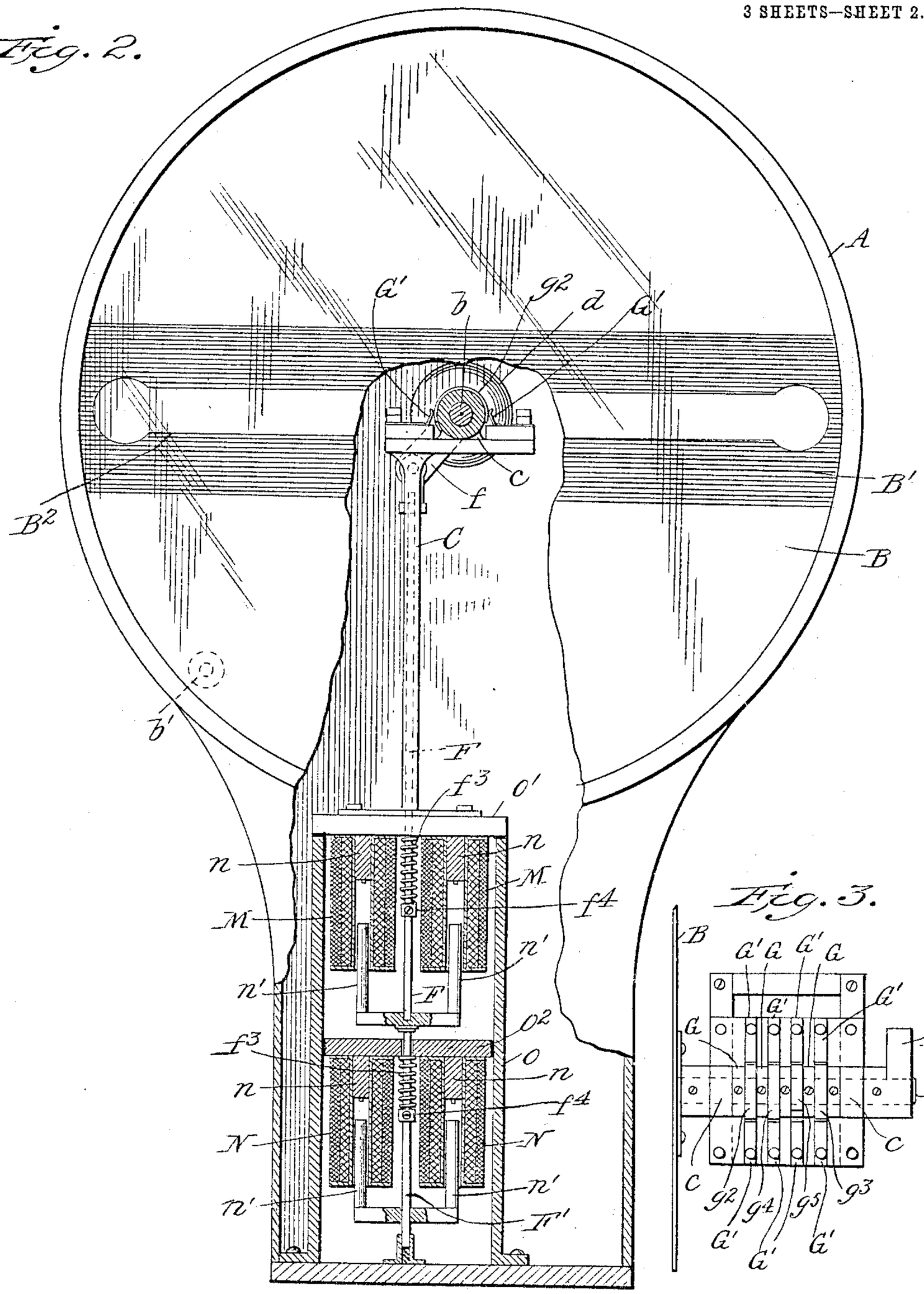

Fig. 3.

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3 SHEETS—SHEET 3.

Fig. 4.

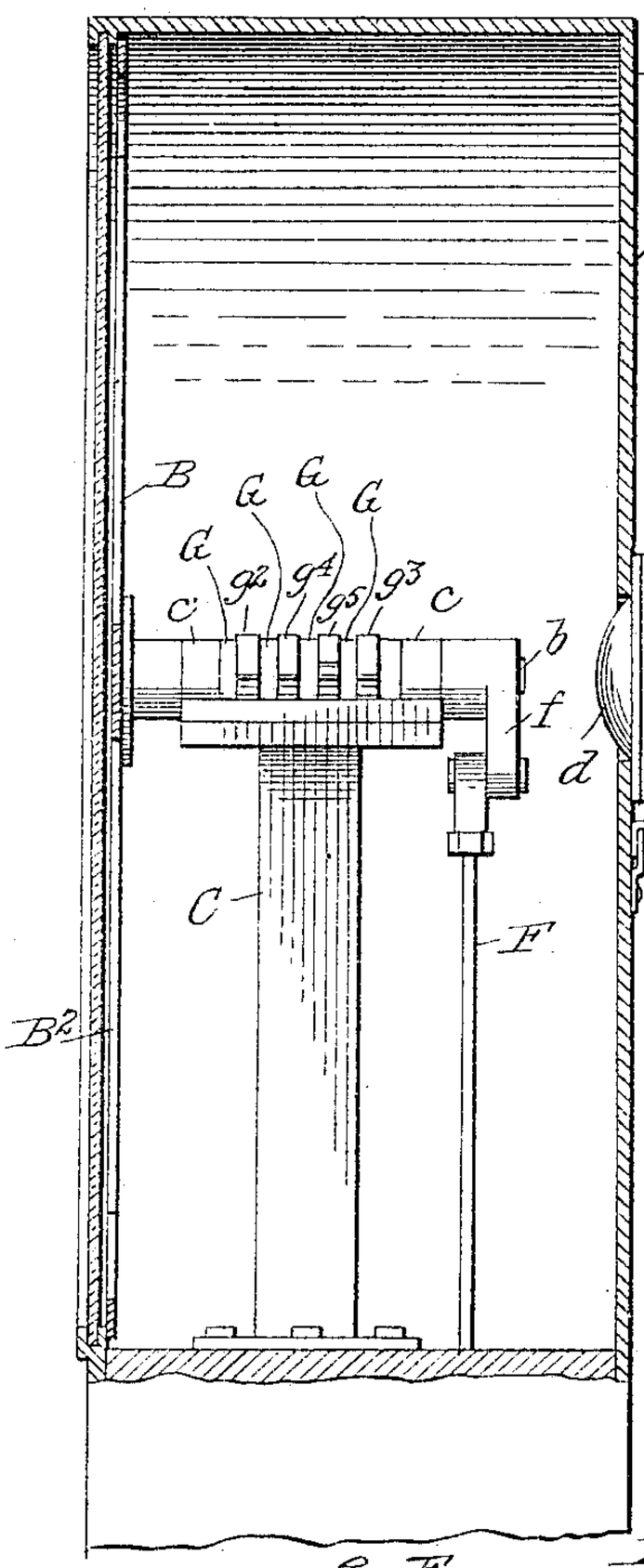


Fig. 5.

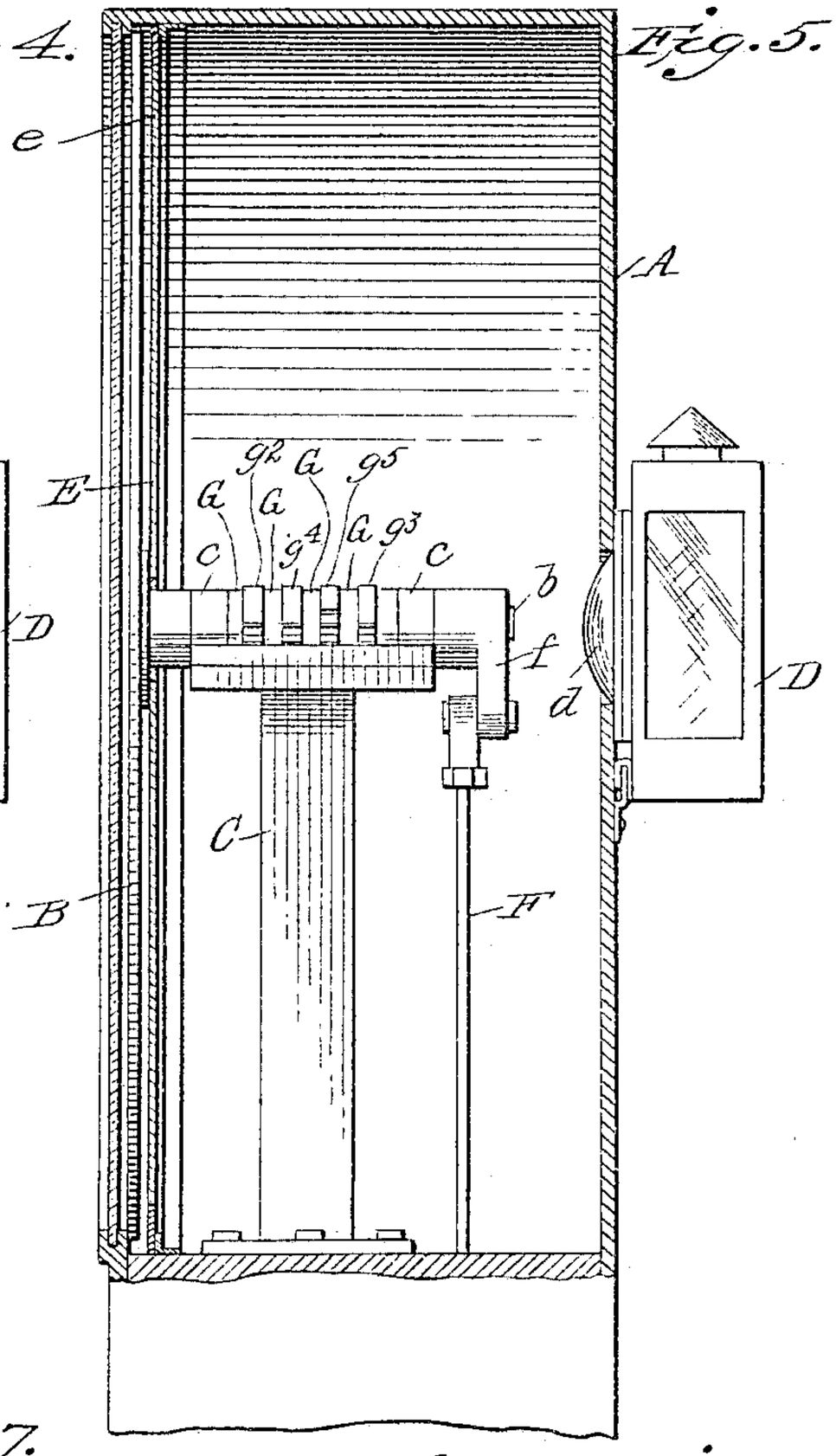


Fig. 6.

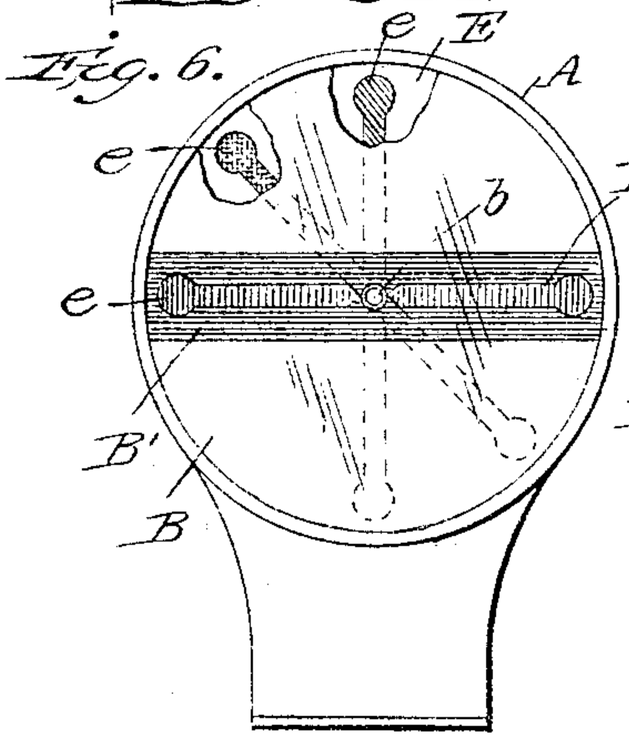


Fig. 7.

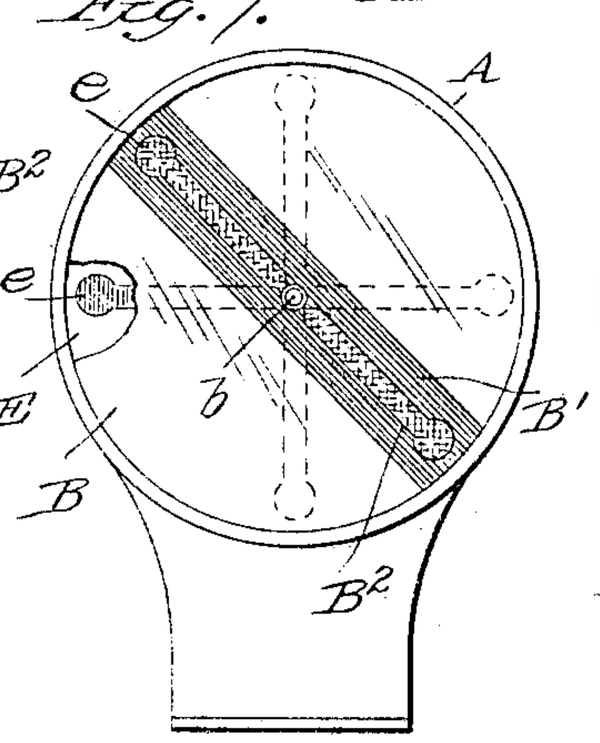
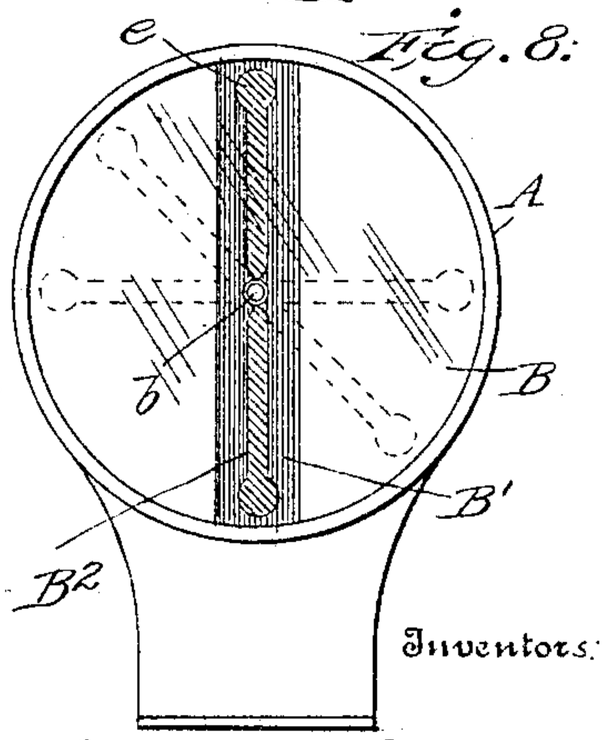


Fig. 8.



Witnesses
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UNITED STATES PATENT OFFICE.

FRANK P. J. PATENALL AND GEORGE H. DRYDEN, OF BALTIMORE, MARYLAND.

RAILWAY-SIGNAL.

No. 801,543. Specification of Letters Patent. Patented Oct. 10, 1905.

Application filed May 23, 1905. Serial No. 261,865.

To all whom it may concern:

Be it known that we, FRANK P. J. PATENALL and GEORGE H. DRYDEN, of the city of Baltimore, State of Maryland, have invented certain new and useful Improvements in Railway-Signals; and we do hereby declare the following to be a full, clear, and exact description of the same, reference being had to the accompanying drawings, forming a part of this specification, and to the letters of reference marked thereon.

The present invention relates to railroad signals and systems, and while the invention is particularly designed for an automatic signaling system features of the invention are capable of use in connection with many systems both automatic and manual, such as are now in use or are well understood by those skilled in the art.

The objects of the invention are to eliminate as far as possible all elements of uncertainty and to guard against false or erroneous signals no matter whether due to a breakdown in the controlling connections or to the action of the elements or accumulations of snow, ice, or dirt.

A further object of the invention is to guard against interference by unauthorized or meddlesome persons.

A further object is to provide a signal system adapted to give a more pronounced and certain indication—for instance, to indicate by position both during the day and at night and in the highest development to indicate both by position and color—thereby eliminating to a large extent danger of misreading the signals under unfavorable conditions or by reason of failure on the part of an engineer to appreciate differences in color or position alone.

The invention consists in certain novel details of construction and combinations and arrangements of the mechanical devices and electric circuits controlling the same, all as will be hereinafter described, and pointed out particularly in the appended claims.

In the accompanying drawings, Figure 1 is a diagrammatic view of a system embodying the present invention. Fig. 2 is a sectional elevation through one of the signals to show the operating-magnets and interior arrangement, the indicator being broken away to show the supporting and operating connections. Fig. 3 is a detail plan of the signal-operating shaft and switches for the electric circuits. Fig. 4 is a section through the signal in a vertical plane at right angles to Fig. 2. Fig. 5 is a view similar to Fig. 4, showing a slightly-modified and preferred form of the signal. Figs. 6, 7, and 8 are face views of a signal, showing the three positions of the indicator.

Similar letters of reference in the several figures indicate the same parts.

The invention will be best understood from a description, first, of the signal-head or indicating part of the system and shown particularly in Figs. 2 to 8 and then of the system for operating the signal, it being borne in mind that both the signal and system are designed with a view to economizing battery consumption both for operation and in maintenance.

The body of the signal-head is preferably round or circular in outline, with a suitable base for attachment to a mast or other support, and may consist of a casing A, having on its front side a circular face or opening covered by glass or other transparent material to form an inclosed chamber or box for the working parts, whereby they will be protected from the weather or from meddlesome interference. Within the casing and on a shaft *b*, journaled in bearings *c* on a standard C, is the indicator B. It is preferably of disk form, but so balanced on its center as to always tend to return to one position, for which purpose it may be provided with a light weight *b'* at one side of the center. Across the face of the disk is a broad arm or stripe B' of contrasting color to form the indicator proper and which by its position will give notice to the engineer of the conditions in the next succeeding blocks. For daywork the broad band of a color contrasting sharply with the exposed fields immediately adjacent it will be all that is necessary; but for nightwork it is desirable that the indicator should show an artificially-lighted band which by position and, if desired, by color also will give the desired information. The desired object may be accomplished by forming the band itself of translucent material or by forming elongated slots therein, as at B^2 in Figs. 2 and 4, through which the light from a lantern D may shine. The lantern D is located back of the

signal-head, and its light is directed by a lens *d*, so as to fall on the rear face of the disk. The inner faces of the signal-head and rear face of the indicator are white or arranged to reflect the light out through the slot in the indicator. In addition to the supporting-standard C being located to the left of the vertical center (see Fig. 2) the head of said standard and shaft with its connections are made as small as practicable to avoid interference with the light showing through the indicator.

Where it is desired to indicate by color in addition to position, translucent material of the proper color may be placed back of the indicator in position to be exposed through the indicator-opening. A convenient and preferred arrangement is shown in Figs. 5 to 8, wherein a stationary disk or partition E is located back of the indicator and is provided with slots or openings registering with the indicator-slot when in indicating position. These slots or openings are covered by glass or translucent material *e* of proper color. Thus the danger indication may be red, caution yellow, and clear green.

It is only necessary that the indicator have a range of movement equal to a quarter-turn on its axis. The direct connections for turning it preferably consist of a crank *f* on the end of the shaft and an operating-rod F, extending down from the crank to a suitable mechanism for lifting the rod or letting it drop the desired distance. The rod preferably parallels the supporting-standard at one side of the vertical center of the indication, and the means for operating it preferably consists of solenoid-magnets M and N, arranged in tandem, one serving to move or hold the signal at "caution" while the other serves to move or hold it at "clear."

The magnets may be conveniently mounted in a frame O, having cross-pieces O′ O², to which the magnets are directly attached. Each magnet has a fixed core *n* and a movable core *n*′, the movable core of the magnet M being preferably directly connected with the rod F and has a range of movement sufficient to throw the indicator from one extreme of its movement to the other. The movable armature of the lower magnet N is carried by a separate rod F′, guided at top and bottom in the frame and adapted to bear against the lower end of rod F, so as to lift the latter or hold it elevated sufficiently to position the indicator at "caution."

The windings of the magnets are preferably double—that is to say, there is a low-resistance winding and a high-resistance winding in each. Suitable switches are provided and controlled by the position of the indicator for directing the current through one winding or the other, depending upon whether the indicator is to be operated to a new position or simply held. The automatic switching mechanism is operated by the indicator-shaft, for which purpose a series of insulated disks G are adjustably mounted on said shaft and carry contact-strips or switches g^2 to g^5, adapted to bridge the spring-contacts G′, mounted on insulated blocks carried by the head, in which the shaft is journaled. Springs f^3 may be used to supplement the force of gravity in returning the indicator to "danger," and such springs preferably abut against adjustable collars f^4; thus they may be set under any desired tension.

The preferred circuit arrangement, including the switching mechanism, the magnets, and other connections, will be best understood from Fig. 1 of the accompanying drawings.

The system illustrated operates on what is known as the "normal clear principle"—that is to say, while the signals are so set that if free from all operating devices they will turn to danger position under the influence of gravity or suitable springs, yet the normal conditions with the track clear of trains are such that the signals are held by their operating mechanism at "clear;" thus if the operating mechanism should fail at any point no accident could result, although the trains would be blocked.

The track-rails are utilized as conductors and are divided into block-sections H H′ H², insulated from each other. Each section has a track-battery and a track-relay, these being indicated in Fig. 1 by the reference-letters I I′ I² and K K′ K², respectively. The batteries are adapted to be short-circuited by a train in the section, so as to deënergize the relay and cause the latter to release its armature or armatures.

Each track-relay through its armature or armatures *k* controls two circuits, one a local circuit including a local battery L, the home magnet N and a switch g^2, operated by the indicator-shaft to break the circuit to magnet N when the indicator is at safety or clear position. This local circuit includes the high and low resistance coils of the magnet in parallel; but the low-resistance branch includes a switch g^3, operated by the indicator-shaft to break the low-resistance branch as the indicator reaches caution position, leaving the parts held by the high-resistance portion of the magnet. Another branch of this local circuit controlled by the track-relay includes, first, a switch R, operated by a distant relay R′, and, secondly, the high and low resistance windings of the magnet M, the branch including the low-resistance winding including a switch g^4, operated by the indicator-shaft to cut out the low-resistance winding when the indicator is at safety or clear position.

The other circuit controlled by the track-relay is a distant circuit and includes the distant relay R′ at the home station, a battery R² at the next succeeding station, and a switch g^5 at the last-mentioned station adapted to be

operated by the indicator-shaft to close the circuit when the indicator is either at "clear" or "caution" or to break the circuit whenever the indicator is at "danger."

With the arrangement described the operation is as follows: With the track all clear of trains the track and distant relays are both energized; but the only current flowing in the local or signal-operating circuits is through the high-resistance coil of the distant operating-magnet M, as the local branches through the the low-resistance coils of this magnet as well as through both the high and low resistance windings of the home magnet N are broken by the signal-switches at g^2, g^4, and g^3; but the signal-switch controlling the distant relay-circuit is closed at g^5. Under these conditions the indicator will be held by the high-resistance side of the distant magnet in safety or clear position, as shown at the left-hand station in Fig. 1. The presence of a train in the block will short-circuit the track-battery, releasing the track-relay armatures and breaking both the local and distant circuits. As a consequence the indicator will move to "danger," as shown at the right-hand station in Fig. 1. With this signal in danger position the distant circuit leading back to the next preceding station is broken by the signal-switch at g^5, and consequently at the latter station the home magnet N alone is energized and the signal is held at "caution" until the train passes out of the block ahead. With this arrangement should the home side of the signal mechanism break down the signal will still be operated from "danger" to "safety" by the distant side, but the signal will remain at "danger" until the train has passed out of the next block ahead. On the other hand, should the distant side break down the signal will be operated to permit trains to run under "caution" only, as the signal will then normally stand at "caution" when no train is in the block and when a train is in the block it will stand at "danger."

The whole arrangement is such that not only is a minimum battery-power required to operate the signal, but the battery is conserved by cutting out all low-resistance circuits at all times when the parts are to be simply held in position. The construction of the signal is such that it will be uninfluenced by weather conditions, it cannot be tampered with by unauthorized persons, and may be operated with little power, so that it is practicable to utilize either the home or the distant side of the operating mechanism for operating it should the other side break down or become inoperative through any cause.

It is obvious that the invention is not limited to the particular form of motor mechanism or solenoid-magnets, as other well-known forms of motor mechanism for operating the indicator may be employed.

Having thus described our invention, what we claim as new, and desire to secure by Letters Patent, is—

1. In a block-signal system for railways the combination with the signal-operating mechanism for setting the indicator at caution, clear or danger, of a signal-head embodying a casing, a disk mounted on a central axis therein the face of said disk carrying an indicator arm or stripe extending diametrically of the disk and adapted to indicate by position; substantially as described.

2. In signals for block systems, a signal-head embodying an inclosing casing, a disk mounted in said casing on a central axis and carrying on its face a diametrically-arranged indicating arm or stripe adapted to indicate by position.

3. In signals for block systems, a signal-head embodying an inclosing casing, a disk mounted in said casing on a central axis and carrying a diametrically-disposed indicating arm or stripe through which light may be transmitted to indicate by position and a source of artifical light in rear of said disk; substantially as described.

4. In signals for block systems, a signal-head embodying an inclosing casing, a disk mounted in said casing on a central axis and having a diametrically-disposed opening forming an indicating arm or stripe adapted to indicate by position and a source of artificial light in rear of said disk; substantially as described.

5. In signals for block systems, a signal-head embodying an inclosing casing, a disk mounted in said casing on a central axis and having a diametrically-disposed opening forming an indicating arm or stripe adapted to indicate by position, colored translucent material in rear of the positions occupied by said opening when in indicating position and a source of artificial light in rear of the colored translucent material; substantially as described.

6. In signals for block systems, a signal-head embodying an inclosing casing, a disk mounted in said casing on a central axis and having a diametrically-disposed opening, the face of the disk and the portion of said face adjacent the opening being of contrasting color; substantially as described.

7. In signals for block systems a signal-head embodying an inclosing casing, a disk mounted in said casing on a central axis and having a diametrically-disposed band of contrasting color on its face and an opening longitudinally of said band to form an indicating arm or stripe and means for directing light through said opening, whereby the signal will indicate by position during either day or night; substantially as described.

8. In signals for block systems three-position visual indicators mounted on a shaft, two operating mechanisms for each indicator, one for moving the indicator from danger to cau-

tion position only and the other for moving the indicator from either the danger or the caution positions to clear position, electric circuits and switches governing said operating mechanisms, said switches being controlled in accordance with the movements of the indicators, the arrangement being such that the indicator is moved from danger to clear when two blocks in advance of the indicator are clear and the operating mechanism for moving the indicator from danger to caution has failed to perform its functions.

9. In signals for block systems an indicator-disk mounted on a central shaft; magnets for moving and holding the disk in position to indicate caution or danger and embodying high and low resistance coils, switches operated by the disk-shaft and included in the circuits of the low-resistance coils for breaking the latter circuits as the disk comes to rest whereby the disk is held through the medium of the high resistance only; substantially as described.

10. In signals for block systems, an indicator mounted on a central shaft and switches carried by said shaft in combination with electric motor mechanism for said indicator, controlled by the train service and embodying low-resistance windings for operating the indicator and high-resistance windings for holding the indicator in position, the circuits through the low-resistance windings being controlled by the switches on the indicator-shaft; substantially as described.

11. In a railway signal system, the combination of signal mechanism adapted to indicate danger, caution and clear, mechanisms for moving the indicator from the danger to the clear and caution positions, each capable of operation independently of the operation of the other and one controlled from the home and the other from both the home and distant stations and a switch controlled by the distant mechanism for cutting out the home mechanism; substantially as described.

12. In a railway signal system the combination of signal mechanism adapted to indicate danger, caution and clear, mechanisms for moving the indicator from the danger to the clear and caution positions, each capable of operating independently of the operation of the other and one controlled from the home and the other from both the home and distant stations and a switch operated by the indicator when moved by the distant mechanism for cutting out the home mechanism; substantially as described.

13. In a railway signal system the combination of stations each embodying an indicator adapted to indicate danger, caution and clear, two independent motor mechanisms for each indicator adapted to independently move the indicator different distances from the position assumed by the indicator when both motor mechanisms are inactive and switches moved by the indicator, one controlled by the indicator at the home-station indicator for cutting out one of said motor mechanisms and the other controlled by the indicator at the distant station for cutting out the other motor mechanism; substantially as described.

14. In a railway signal system, the combination of stations each embodying an indicator adapted to indicate danger, caution and clear, two independent motor mechanisms for each indicator adapted to independently move the indicator different distances from the position assumed by the indicator when both motor mechanisms are inactive and switches moved by the indicator, one controlled by the indicator at the home station to cut out the caution motor mechanism when the indicator is at clear and the other controlled by the indicator at the distant station to cut out the clearing motor mechanism when the distant indicator is at danger; substantially as described.

15. In a railway signal system the combination of stations each embodying an indicator adapted to indicate danger, caution and clear, two independent motor mechanisms for each indicator adapted to independently move the indicator different distances from the position assumed by the indicator when both motor mechanisms are inactive and switches moved by the indicator, one controlled by the indicator at the home station for cutting out one of said motor mechanisms and the other controlled by the indicator at the distant station for cutting out the other motor mechanism; and a track-relay operated by trains in the block-section of the home station and controlling the circuits to both of said motor mechanisms; substantially as described.

16. In a railway signal system, the combination with a plurality of blocks, a three-position indicator adapted to indicate danger, caution and clear for each block, two motor mechanisms one for moving the indicator from normal to an intermediate position only and the other for moving the indicator from either its normal or its intermediate position to the other extreme of its movement, one of said motor mechanisms being controlled from the home station and the other from an adjacent station, whereby upon failure of one motor mechanism the indicator will be operated by the other to permit the running of trains in safety; substantially as described.

17. In a railway block-signal system, the combination of a plurality of stations, a three-position indicator at each station adapted to indicate danger, caution and clear, two motor mechanisms for each indicator one for moving the indicator from danger to caution position and the other for moving the indicator from either danger or caution positions to clear position, controlling-circuits and switches controlled by the position of the home and distant indicators for completing

the circuit for the clearing motor mechanism and switches controlled by the position of each indicator for cutting out the caution motor mechanism at its own station and a track-relay at each station controlling the circuits for both motor mechanisms; substantially as described.

18. In a railway signal system, the combination of stations each embodying an indicator adapted to indicate danger, caution and clear, two independent motor mechanisms for each indicator adapted to move the motor one from danger to caution position only, the other from caution or from danger positions to clear position and switches moved by the indicator, one controlled by the indicator at the home station to cut out the caution motor mechanism when the indicator is at clear and the other controlled by the indicator at the distant station to cut out the clearing motor mechanism when the distant indicator is at danger; substantially as described.

19. In a signal such as described, the combination with the signal-head, centrally-pivoted indicator and a source of light located in rear of the indicator, of a bearing for the indicator-shaft and a support for said bearing located at one side of the indicating portion of the indicator when in indicating position whereby passage of light through the indicator will not be interfered with by the support; substantially as described.

20. In a signal such as described, the combination with the signal-head, centrally-pivoted indicator having a diametrically-arranged slot therein and a source of light located in rear of the indicator, of a bearing for the indicator-shaft located out of alinement with said slot when in indicating position; substantially as described.

21. In a signal such as described, the combination with the signal-head, centrally-pivoted indicator having a diametrically-arranged slot therein and a source of light located in rear of the indicator, of a bearing for the indicator-shaft and an operating-rod for the indicator, both located out of alinement with the slot when in indicating position; substantially as described.

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