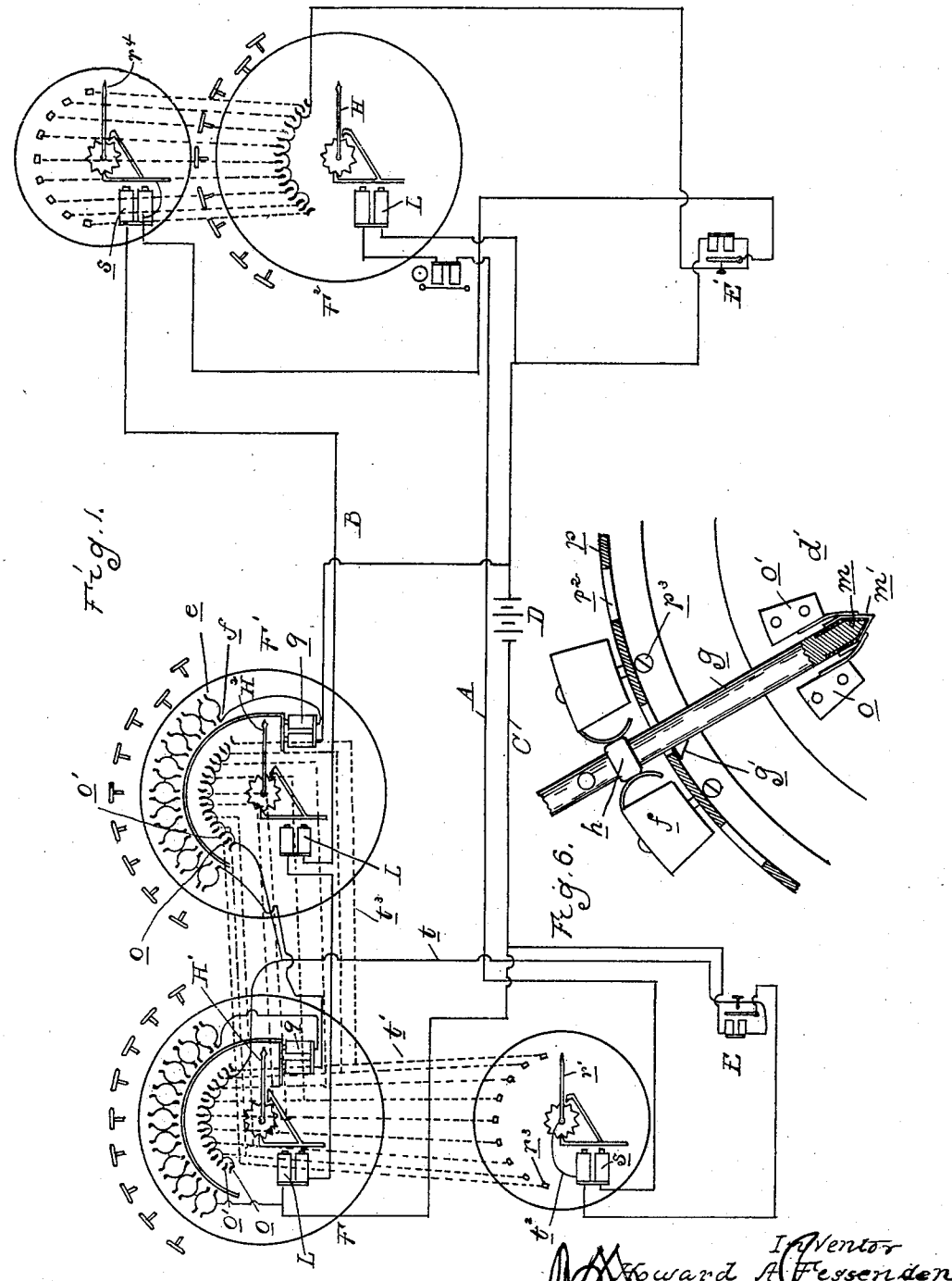
No. 740,261. PATENTED SEPT. 29, 1903.

H. A. FESSENDEN.

ELECTRIC SIGNAL.

APPLICATION FILED MAY 6, 1901. RENEWED AUG. 8, 1902.

NO MODEL. 2 SHEETS—SHEET 1.



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NO MODEL. 2 SHEETS—SHEET 2.

Fig. 2.

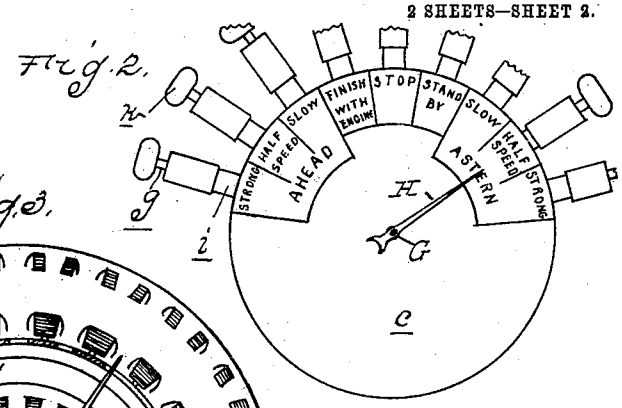


Fig. 3.

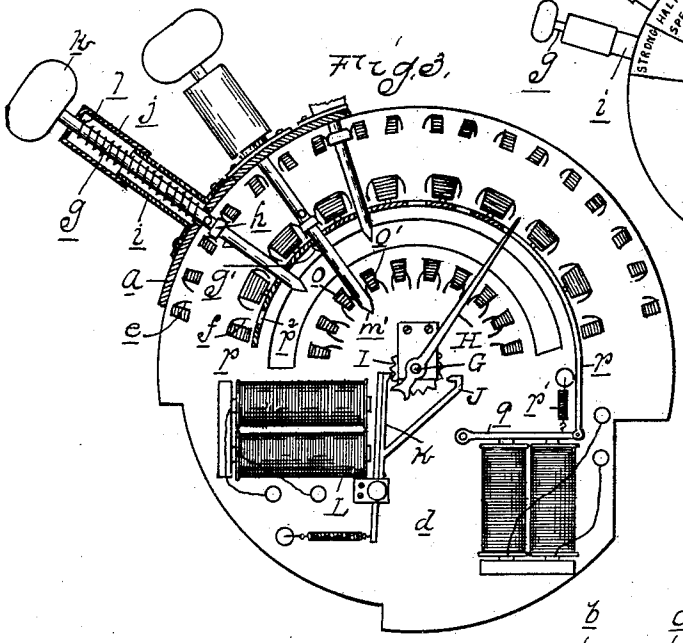


Fig. 4.

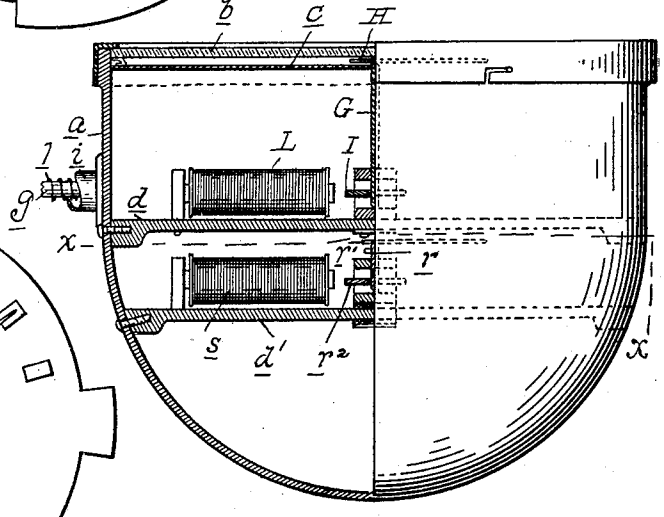
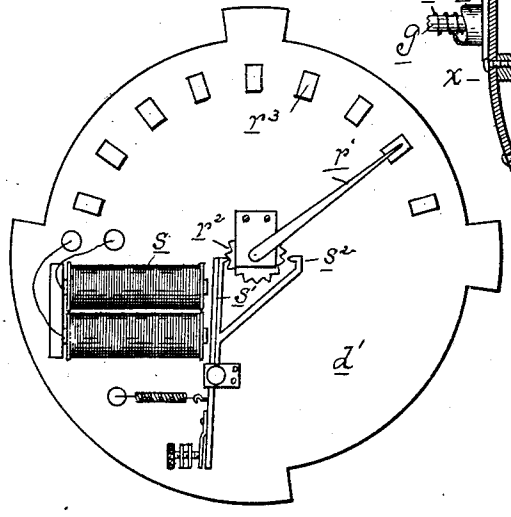


Fig. 5.



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No. 740,261. Patented September 29, 1903.

UNITED STATES PATENT OFFICE.

HOWARD A. FESSENDEN, OF DETROIT, MICHIGAN, ASSIGNOR TO DETROIT ELECTRIC SIGNAL COMPANY, OF DETROIT, MICHIGAN.

ELECTRIC SIGNAL.

SPECIFICATION forming part of Letters Patent No. 740,261, dated September 29, 1903.

Application filed May 6, 1901. Renewed August 8, 1902. Serial No. 118,908. (No model.)

To all whom it may concern:

Be it known that I, HOWARD A. FESSENDEN, a citizen of the United States, residing at Detroit, in the county of Wayne and State of Michigan, have invented certain new and useful Improvements in Electric Signals, of which the following is a specification, reference being had therein to the accompanying drawings.

The invention relates to electric-signal systems of that type in which a plurality of distinct signals may be sent from one station and received at the opposite station, the system being especially designed for use on boats and other like purposes.

It is one of the objects of the invention to obtain a construction in which each signal sent is indicated in the sending instrument and that this indication cannot be changed without sending a different signal.

It is a further object to provide means by which signals may be sent from a number of different points and received by the same receiving instrument, each of the several sending instruments being adapted to indicate the signal sent thereby, as above set forth, and also to restore any previous indication, whether on the same or a different sending instrument.

It is a further object to obtain a mechanical construction in which both sending and receiving instruments for one end of the line may be compactly arranged in a single casing.

The invention therefore consists in the peculiar construction, arrangement, and combination of parts, as hereinafter described and claimed.

In the drawings, Figure 1 is a diagram of the signal system. Fig. 2 is a front elevation showing the dial and index. Fig. 3 is an elevation with the dial removed. Fig. 4 is a longitudinal section, partly in elevation, through the casing. Fig. 5 is a section on line $x\,x$, Fig. 4; and Fig. 6 is an enlarged view of a portion of Fig. 3.

Generally described, the system comprises an electric circuit and transmitting and receiving instruments, each provided with electromagnetically-operated synchronous mechanisms. The receiving instrument constitutes the progressive signal which is operated by the actuating mechanism thereof, while the transmitting instrument is provided with a plurality of keys, each of which is adapted when operated to cause the actuation of said synchronous mechanisms, which continue in operation until that signal is reached corresponding to the key actuated, whereupon further movement is arrested.

The system further comprises the arrangement of combined transmitting and receiving instruments at each station which are so constructed that the operation of the key at one station will indicate the signal adjacent to the corresponding key at any station, while the operation of the latter key will indicate the return-signal adjacent to the first operated key.

Still further, the system comprises the arrangement of a plurality of interconnected transmitting instruments, as more fully hereinafter described.

As shown in Fig. 1, A is the main-signal line, B the return-signal line, and C a common return-line, including an electric generator D.

E is an electromagnetic pulsator of any desired construction adapted to automatically make and break the current in the main line A, and E′ is a similar pulsator included in the return-line B.

F is a transmitting instrument for the main line A, which is of the following construction:

a is a casing, which, as shown, is dome-shaped and is provided with a transparent cover b, beneath which is arranged a dial c. Within the casing is arranged a plate or diaphragm d, to which is secured two series of insulated electric contacts e and f. The contacts e are arranged in a segment of a circle near the wall of the casing and are grouped in pairs which are oppositely arranged and uniformly spaced from each other. The contacts f are arranged in the segment of a concentric circle and are also grouped in oppositely-arranged pairs which are in radial alinement with the contacts e. Between each pair of contacts is arranged and slidingly secured in bearings a push-rod g, which carries a contact h, adapted in one position of the rod to bridge between the oppositely-arranged contact e and in another position to similarly

bridge between the contacts f. The rod g extends radially outward through an aperture in the casing and is preferably inclosed in a telescopic housing comprising a stationary portion i and a movable part j, the former being secured to the casing. The outer end of the rod is provided with a suitable operating handle or knob k, and within the housing sleeved upon the rod g is a spring l. The inner end of the rod is provided with an insulating-block m, carrying a wedge-shaped contact m', which is adapted to bridge between a pair of oppositely-arranged contacts o and o'. These contacts o and o' are also arranged in the segment of a circle concentric with the contacts e and f.

The transmitting instrument is provided with as many of the rods g as it is desired to have distinct signals, and each rod, together with the contacts e, f, o, and o', constitutes a circuit-closer or operating-key which in its normal position bridges between the contacts e and in its operated position separately bridges between the contacts f and contacts o and o'.

p is a segmental band provided with a series of apertures through which the rods g pass. One end of this band is connected to an armature q of an electric magnet q', while a spring p' serves to normally retract the armature and band. The band p is arranged to slide in suitable bearings p^3, which hold it from lateral movement, and the apertures p^2 in the band are of sufficient size not only to receive the rod g, but also in one position of the band to permit of the passage of the detent g' on the rod g. This detent is so arranged that when the rod g is pushed inward it will engage with the band p and lock the rod from outward movement. The detent will, however, be released upon the longitudinal movement of the band sufficiently to disengage from the shoulder of the detent.

Within the casing a and parallel to the plate d therein is arranged a second plate d'. Centrally of this plate is journaled in suitable bearings a rotary spindle r, carrying a traveling contact-arm r' and having secured thereto an operating ratchet-wheel r^2.

s is an electromagnet, and s' the armature thereof, which is provided with a pallet or actuating-pawl s^2, adapted in the reciprocating movement of the armature to engage with a ratchet-wheel r^2 and impart a step-by-step rotary movement thereto.

r^3 represents insulated electric contacts arranged in circular series upon the plate d' in the path of the free end of the traveling contact r'. These contacts r^3 correspond in number to the pairs of contacts o o upon the plate d and are respectively electrically connected to the contacts o of each of said pairs. The other contacts o' are connected in common to the conductor t, which constitutes a portion of a branch circuit passing around the make-and-break contact device of the pulsator E, but including the electromagnet of said pulsator. The other portion of this branch circuit comprises the multiple connections t', extending between the contacts o and the contacts r^3, respectively, together with the contact-arm r' and the connection t^2 between said arm and the main circuit A.

The arrangement of electric connections just described is such that when one of the rods g has been thrust inward, so as to cause the contact m' to bridge between the corresponding pair of contacts o o', and when the traveling contact r', which in its movement successively closes therewith, is closed with that one of the contacts r^3 corresponding to and electrically connected with the contact o, above referred to, the electric circuit will be completed through the main line, including the magnet of the pulsator corresponding to the instrument operated and the magnet s, but excluding the make-and-break contacting device of the pulsator. This will prevent the operation of said pulsator and will cause a continuous current to flow through the main circuit. On the other hand, whenever the particular contact r^3 with which the contact r' is closed does not correspond to the particular contacts o and o' bridged by the contact m the current in the main circuit is compelled to pass through the make-and-break of the pulsator. This will cause the alternate closing and opening of said main circuit, which will operate the armature S' and the magnet S and the pawl S^2 carried thereby, so as to cause a step-by-step movement of the contact r' until it reaches that contact corresponding to the particular contacts o and o' which are operated.

The series of contacts e and f are included in a local electric circuit which also includes the electromagnet q. The corresponding contacts e and f are electrically connected to each other, and the adjacent contacts of adjacent pairs are also electrically connected. The contacts of each pair are electrically disconnected excepting when bridged between by the contacts h on the rods g. Thus in the initial position of parts before any one of the rods g has been operated a complete electrical connection will be established through the series of contacts e, which will close the circuit through the magnet q, causing it to attract its armature q' and hold the band p in its locking position. If, however, one of the rods g is pushed inward, so as to withdraw its contact h from between the corresponding contact e, this electric circuit will be temporarily broken, but will be completed again as soon as the contact h bridges between the corresponding pair of contacts f. When the rod g is pushed inward, the detent g', which is provided with an inclined inner face, will act as a latch to move the band longitudinally against the pull of the magnet q and then will engage beneath said band so as to hold the rod from being drawn outward. As soon, however, as another rod is pressed inward the breaking

of the electric circuit by the movement of the contact h from between the contacts e will deënergize the magnet q, permitting the spring p' to draw the band p in the opposite direction from the pull of the magnet, thereby loosening the detent of the previously-operated rod and permitting its spring l to force it outward.

From the description as above given it will be understood that the transmitting instrument comprises, essentially, a series of keys and means operated thereby for causing a traveling contact to move into different positions, respectively corresponding to said keys, by a step-by-step movement and that this step-by-step movement is accomplished by a pulsating current in the main line. The receiving instrument or register consists of mechanism adapted to move synchronously with the movement of said traveling contact, which mechanism is actuated by a pulsating current in the main line and operates an index. As each station or end of the lines is provided with both transmitting and receiving instruments, I preferably arrange these two instruments in a single casing—viz., the casing a. The mechanism for the receiving instrument is located between the dial and the plate or diaphragm d and is of the following construction:

G is an arbor journaled in bearings upon the plate d and arranged axially within the casing a. The outer end of this arbor extends centrally through an aperture in the dial and has secured thereto an index-hand H.

I is a ratchet-wheel secured upon the arbor, and J is a pallet or actuating-pawl secured to the pivotal armature K, which is arranged in proximity to the electric magnet L. The magnet L being included in the main circuit it will be understood that the pulsating current therein will cause a vibratory movement of the armature K and by means of the pawl or pallet J will cause a step-by-step movement of the ratchet-wheel I, thereby causing the index to travel synchronously with the movement of the traveling contact in the transmitting instrument.

Transmitting and receiving instruments constructed as above described may, if desired, be employed at both ends of the lines, the main signaling instrument being included in circuit with the line A and the return signaling instruments in circuit with the line B. For certain uses of my signal system, however, it may be desirable to employ a number of signaling instruments arranged at different stations, all adapted to register a signal in one receiving instrument at the opposite end of the line and also adapted to mutually control each other. Such a system is illustrated in Fig. 1, in which F indicates one signal instrument, F′ another instrument at a different point from the instrument F, but arranged to be controlled thereby, while F^2 indicates the instruments at the opposite end of the line constituting the receiver and transmitter for both instruments F and F′. The instruments F and F′ are identical in construction, so far as the parts comprising the receiving instrument are concerned, and also the parts of the transmitting instrument, with the exception of the traveling contact r' and its actuating mechanism. The instrument F′ is unprovided with said traveling contact, but is electrically connected to control the movement of the traveling contact in the instrument F. This electrical connection comprises a series of electrical conductors t^3, respectively connecting the contacts o of the instrument F′ with the contacts r^3 or to the conductor t', leading to said contacts. The contacts o' of the instrument F′ are also connected in series to the electrical conductor t, the arrangement being such that when any one of the contacts m bridges between a pair of contacts o and o' in the instrument F′ and the traveling contact r' in the instrument F closes with a corresponding contact r the pulsator E in the main line A will be locked. The contacts e and f of the instrument F′, as well as the electromagnet q thereof, are connected in series with the corresponding parts in the instrument F in the same local electric circuit. Thus the operation of any of the keys of the instrument F′ will cause the actuation of the traveling contact r' in precisely the same manner as if a corresponding key of the instrument F were operated. Furthermore, the actuation of the key in either of the instruments F or F′ will cause the unlocking and restoring of any previously-operated key in either instrument.

It is obvious that the system may be provided with as many different instruments connected in a similar way to the instruments F and F′ as it is desired to employ. For use in a signal system on boats it is frequently desirable to have one instrument in the pilot-house, another at the bridge, and others at different points, all adapted to register a signal in the receiving instrument in the engine-room. The instrument in the engine-room (represented by the reference-letter F^2 in Fig. 1) may be the same in construction as the instruments F and F′; but inasmuch as but one instrument is employed at that point the electric lock for the keys may, if desired, be dispensed with and a mechanical lock substituted therefor.

The instruments and circuits being constructed and arranged as above set forth, the general operation of the system is as follows: One operator, such as the captain or pilot of the boat, is in a position to control one or both of the instruments F and F′, the other instrument, F^2, being arranged for inspection and control by the other operator, such as the engineer. Supposing one of the keys of the instrument F to have been previously operated, this key alone will remain locked in its operated position, all of the other keys of said instrument, as well as all of the keys of the instrument F′, being in normal position.

If the operator now depressed another key in the instrument F, the temporarily breaking the local electric circuit deënergizes the magnets Q in both instruments F and F′ and releases the previously-operated key. As soon as the key is fully depressed this local circuit will be again restored, thereby locking the key from return movement. The releasing of the previously-operated key will cause it to withdraw its contact *m* from between the corresponding pair of contacts *o* and *o*′. This will break the branch of the main circuit, including the conductor *t*′ and traveling contact *r*′, thereby deënergizing the magnet of the pulsator E and the magnet *s*′ for actuating the traveling contact. As soon as the magnet of the pulsator is deënergized the armature thereof will move to again close the circuit through the make-and-break mechanism in the well-known manner of operation of the instruments of this kind. Thus the main circuit will be alternately closed and opened by the pulsator, which will cause a step-by-step movement of the contact *r*′ and a synchronous movement of the index H in the instrument F^2. The traveling contact *r*′ will continue its movement until it finds that one of the contacts, r^3, which is connected to the contact *o*, corresponding to the key last operated. As soon as this contact is reached the branch of the main circuit around the make-and-break device of the pulsator will again be closed, which will lock the magnet of the pulsator and prevent further movement thereof. This locking of the pulsator will of course terminate the movement of the traveling contact *r*′ and also that of the index H in the instrument F^2. Supposing the captain to have operated that key opposite the marking "Half speed astern" on the instrument F, the index G when its movement is arrested will point to a corresponding signal on the instrument F^2. The operator at that station then presses in the key corresponding to the signal recorded, which will set into operation the instruments included in the return-signal circuit-line B. The operation is precisely the same as that previously described, with the exception that the pulsator E′ is set into operation, causing the movement of the traveling contact r^4 of the instrument F^2 and a synchronous movement of the indices H′ and H^2 of the instruments F and F′. At the completion of their movement these indices will stand at the marking "Half speed astern," showing that the engineer has understood the signal.

It will be noticed that the operation of either of the instruments F and F′ does not restore the previously-operated key of the instrument F^2, and, on the other hand, the operation of the instrument F^2 has no effect upon the keys of either instrument F or F′. Thus by an inspection of the instrument the key last operated is always indicated by being locked in its depressed position. This feature is of special value in determining which operator is to blame in case of a mistake, as the recorded signal cannot be changed by the operator at that end of the line, nor can he change the position of the keys upon his instrument without recording a new signal at the opposite end of the line.

It is to be understood that the step-by-step mechanisms always turn in one direction. Thus if the traveling contact *r* passes the last of the segmental series of stationary contacts r^3 without closing the locking-circuit it will continue its step-by-step movement around to the opposite end of said segmental series and will then pass through said series until it finds the proper contact and the locking-circuit is established. It is to be also understood that although, as shown and described, the closing of any one of the branch circuits effects the locking of the pulsator, this is not necessary, as the pulsator may operate continuously to make and break its branch of the main circuit, and at the same time the closing of one of the other branches would cause a continuous current to pass through the main line, which current would lock the step-by-step mechanisms from movement.

What I claim as my invention is—

1. A signal system comprising instruments at different stations each comprising an indicator for a series of signals and a corresponding series of actuating-keys arranged in adjacence thereto, the two instruments being provided with electrical connections whereby the actuation of any one of the keys at one station will effect the corresponding indication at the opposite station, and the operation of the adjacent key at the latter point will effect a return-signal indication at the first station, adjacent to the key first operated.

2. A signal system comprising instruments at different stations each comprising an indicator for a series of signals and a series of keys corresponding to but independent of said indicator, each key being adapted upon operation to automatically lock itself and to unlock the previously-operated key, and electrical connections between said stations whereby the operation of any key at one station will effect a corresponding indication at the opposite station.

3. A signal system comprising instruments at different stations each comprising an indicator for a series of signals, and a series of keys corresponding to but independent of said indicator, and electrical connections whereby an indicator may be effected in the indicator at one station by the actuation of any one of the keys at a plurality of different stations, and whereby the actuation of said key will automatically lock itself and unlock the previously-operated key whether at its own or a different station.

4. A signal system comprising a normally closed electric circuit, transmitting and receiving instruments each comprising a step-by-step mechanism and an actuating-electromagnet therefor, the latter being included in said electric circuit, an automatic break-and-make

pulsator for said circuit, a plurality of branch circuits around the break and make of said pulsator, each having two breaks therein, a series of keys in the transmitting instrument for respectively closing one of the breaks in each of said branch circuits, each key when operated being adapted to open the circuit closed by the previously-operated key and means operated by the step-by-step mechanism of the transmitting instrument for successively closing the second breaks in said branch circuits in endless series for the purpose described.

In testimony whereof I affix my signature in presence of two witnesses.

HOWARD A. FESSENDEN.

Witnesses:
L. J. WHITTEMORE,
H. C. SMITH.