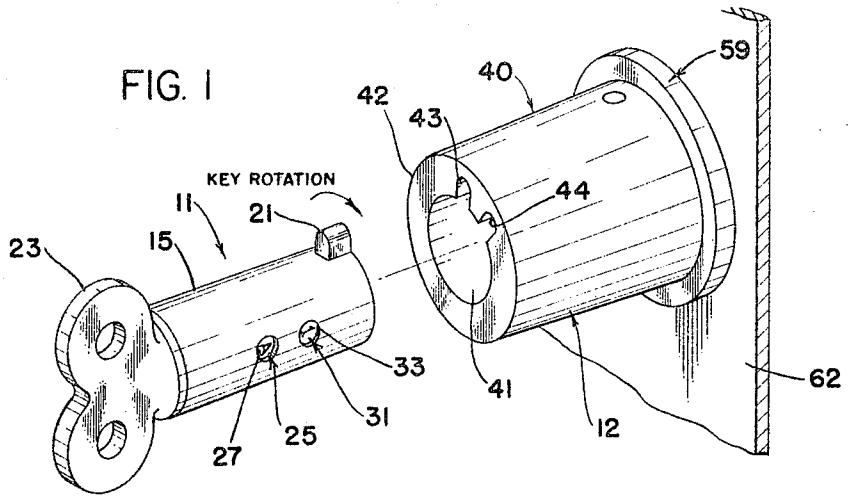
Aug. 2, 1966 L. A. WARD 3,264,632

COMPULSORY TOUR SIGNALLING SYSTEM FOR WATCHMEN

Original Filed April 26, 1960 5 Sheets-Sheet 1

FIG. 1



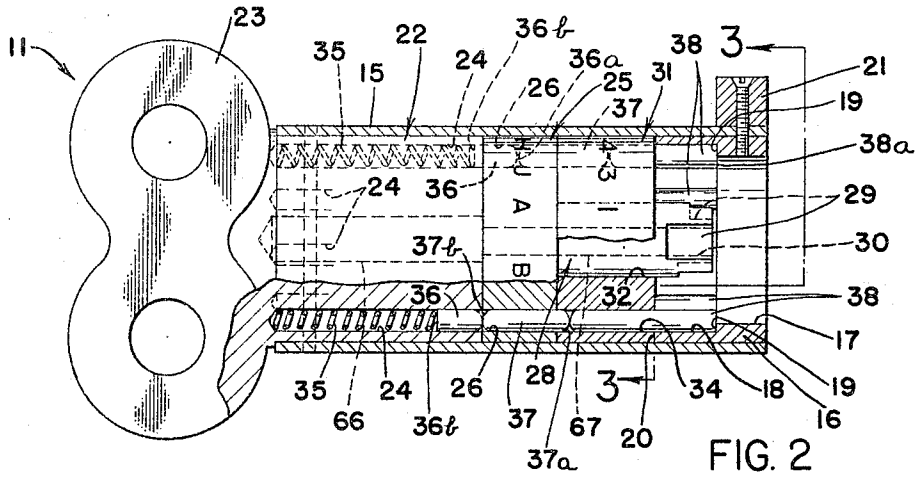


FIG. 2

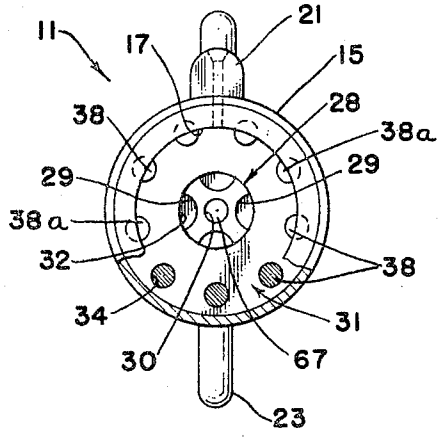


FIG. 3

INVENTOR.
LESLIE A. WARD

BY

ATTORNEY

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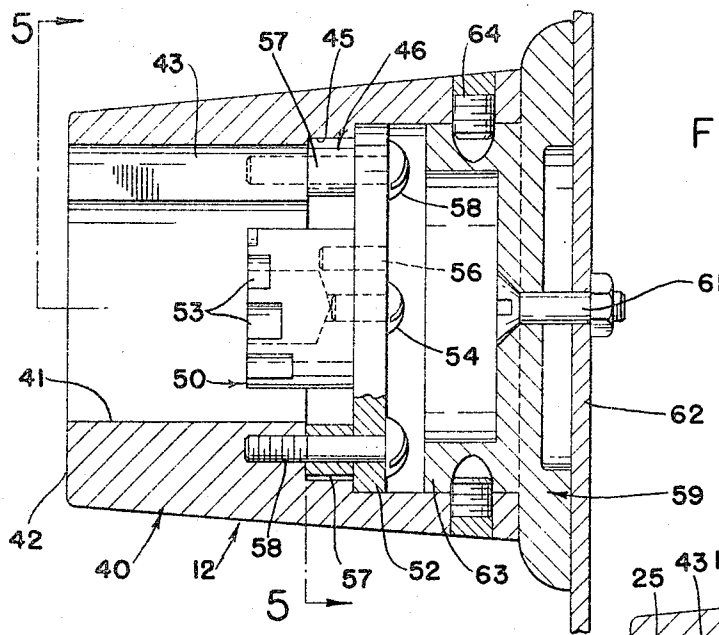

FIG. 4

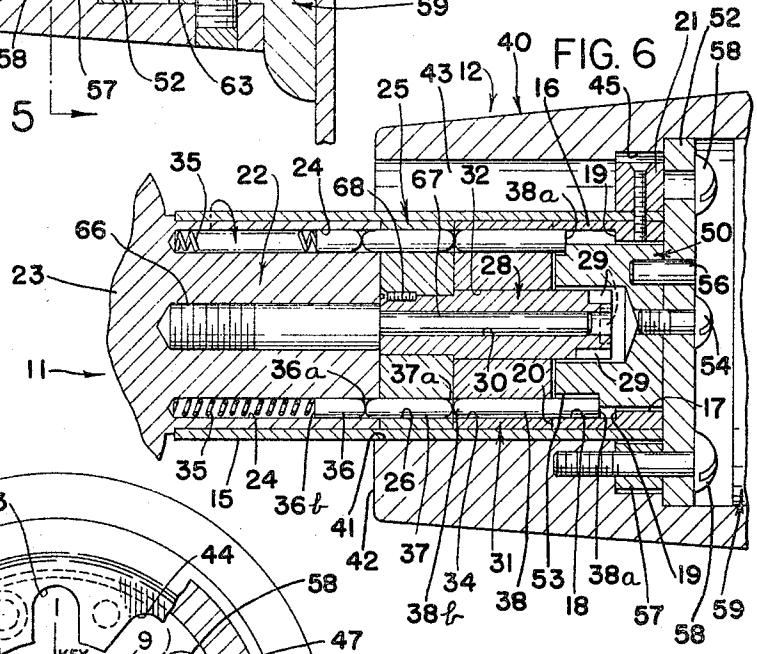

FIG. 6

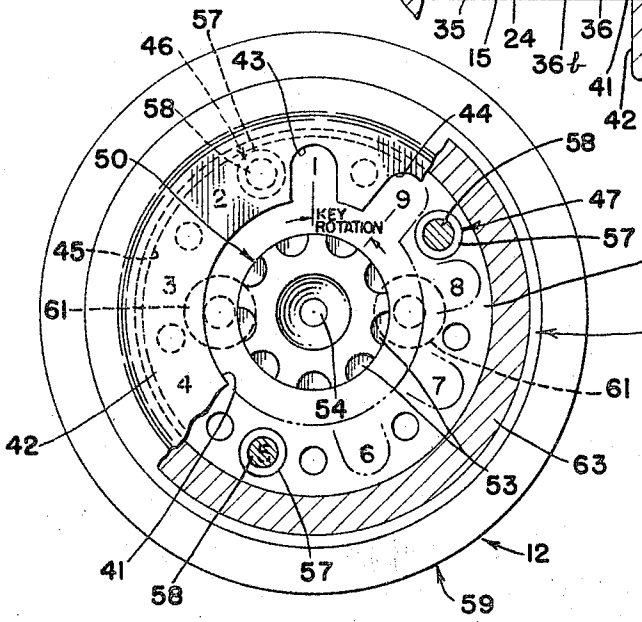

FIG. 5

INVENTOR.
LESLIE A. WARD
BY
ATTORNEY

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COMPULSORY TOUR SIGNALLING SYSTEM FOR WATCHMEN

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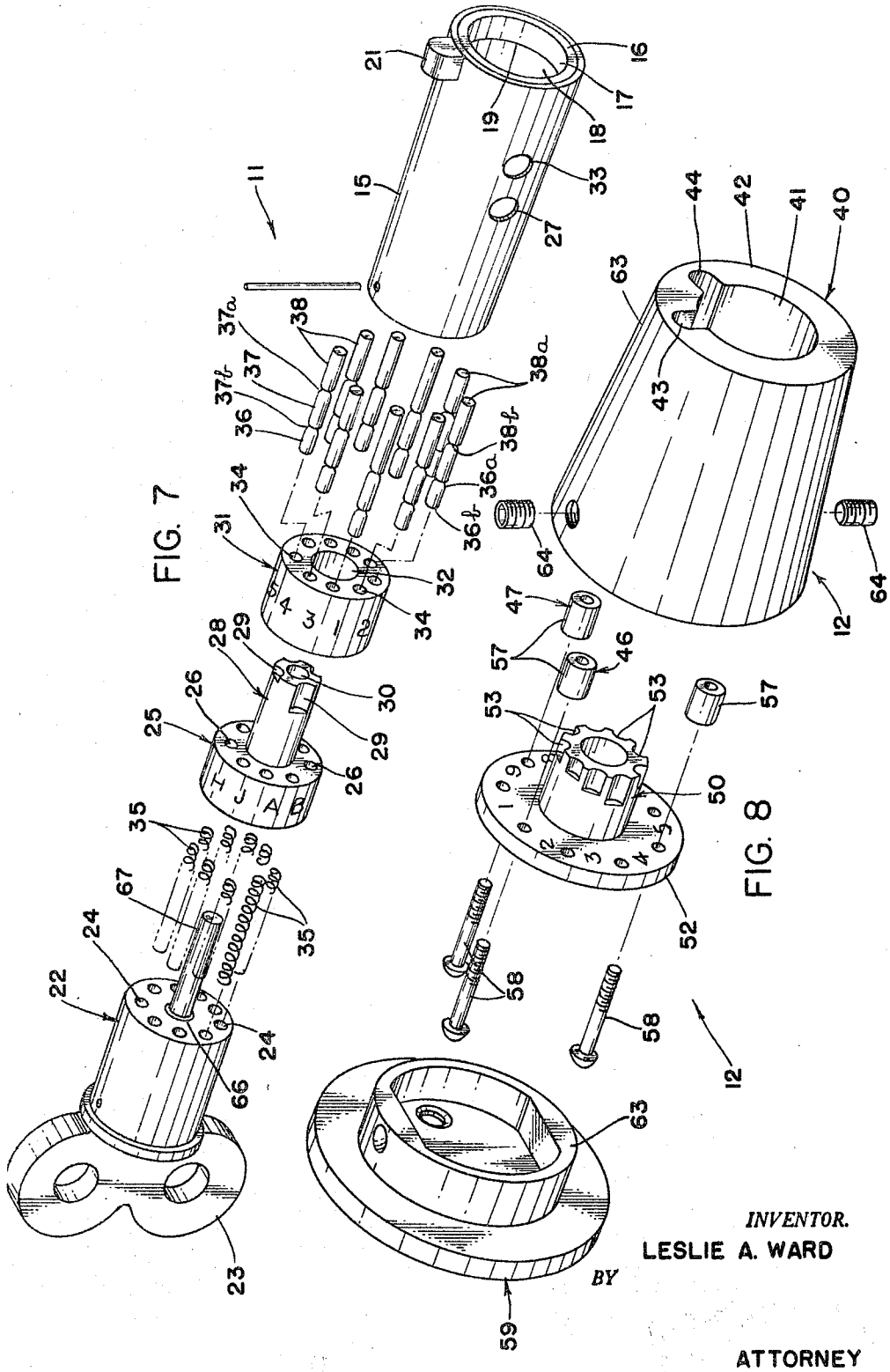

INVENTOR.
LESLIE A. WARD
BY

ATTORNEY

COMPULSORY TOUR SIGNALLING SYSTEM FOR WATCHMEN

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FIG. 9

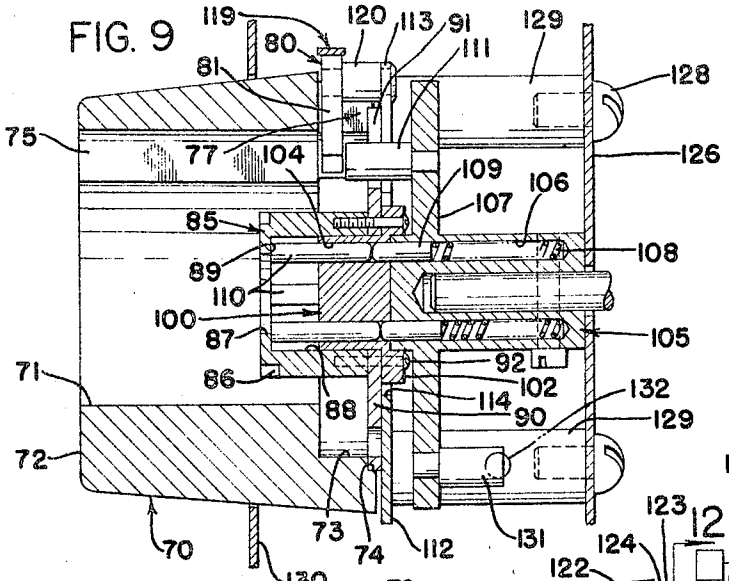

FIG. 10

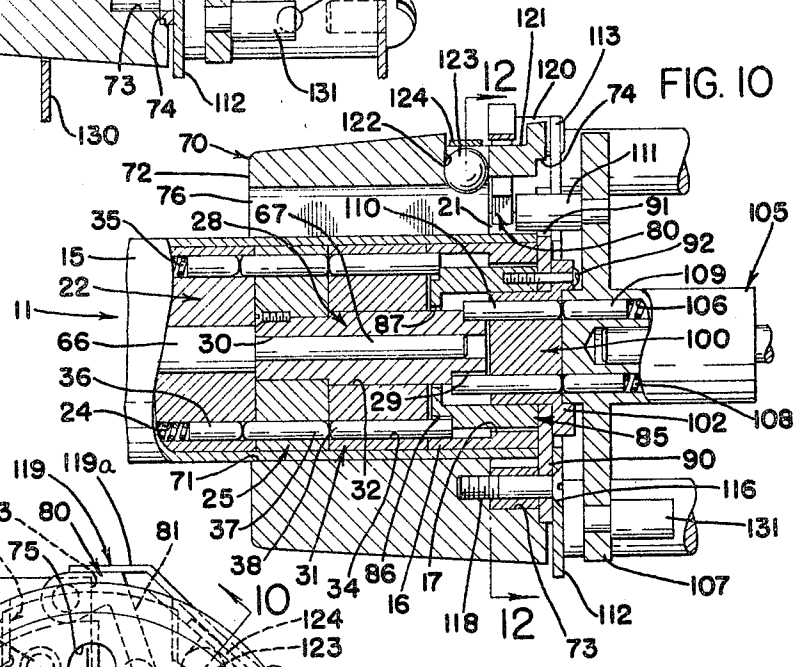

FIG. 11

INVENTOR.
LESLIE A. WARD
BY
ATTORNEY

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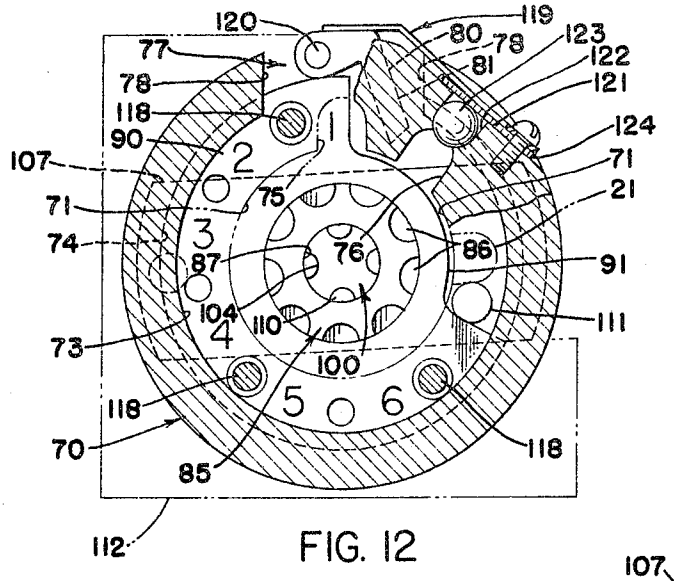

FIG. 12

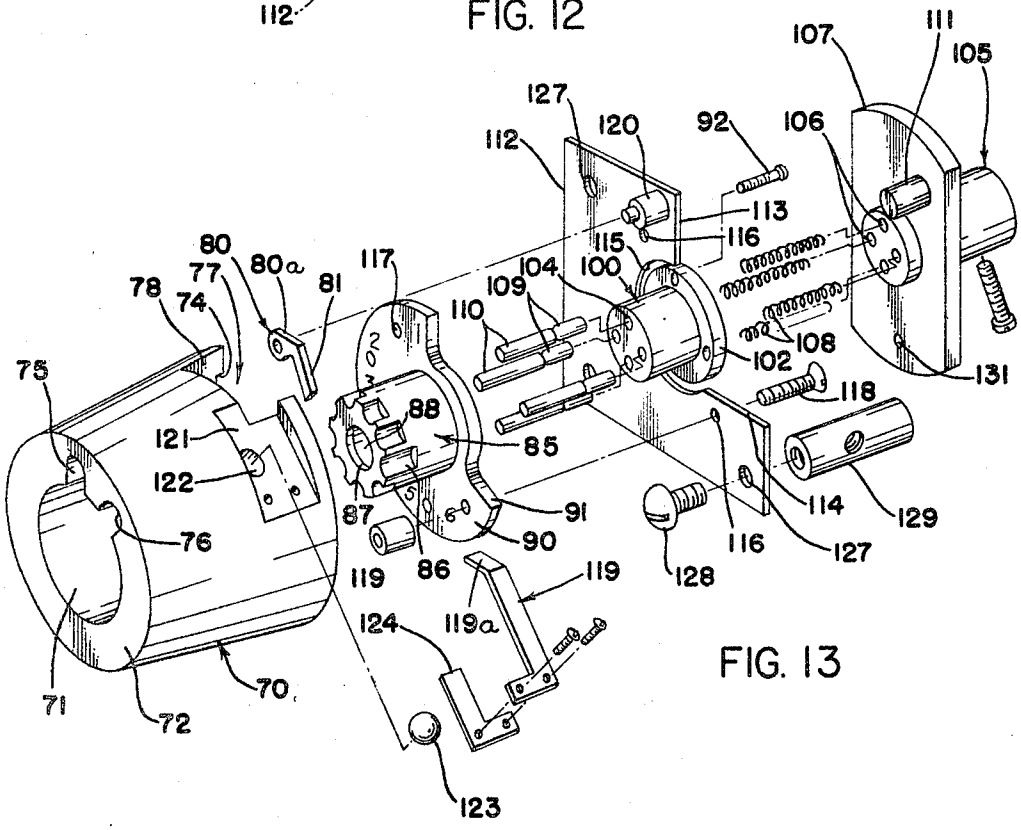

FIG. 13

INVENTOR.
LESLIE A. WARD

BY

ATTORNEY

United States Patent Office 3,264,632 Patented August 2, 1966

3,264,632

COMPULSORY TOUR SIGNALLING SYSTEM FOR WATCHMEN

Leslie A. Ward, Cleveland, Ohio, assignor to Morse Signal Devices, Inc., Cleveland, Ohio, a corporation of Ohio

Original application Apr. 26, 1960, Ser. No. 24,727, now Patent No. 3,149,321, dated Sept. 15, 1964. Divided and this application Apr. 8, 1964, Ser. No. 363,041
5 Claims. (Cl. 340—306)

This application is a division of application Serial No. 24,727, filed April 26, 1960, and now U.S. Patent 3,149,-321.

This invention relates to compulsory tour signalling systems for watchmen wherein it is desired to have the watchmen visit a plurality of stations in accordance with a predetermined route pattern, and more particularly, to a relatively simple and tamperproof system of this type.

It has heretofore been suggested in signalling systems of this type to provide a plurality of non-wired or dummy stations and one or more signal transmitter stations, all located at selected spaced locations throughout the area to be protected. The watchman carried a combination key and lock (hereinafter called a key-lock) which, if he inserted in the various stations in a predetermined order ultimately actuated the signal transmitter to send an OK signal back to a central manned control station. Thus each dummy station contained a key which reset the lock so that it could be reset only by the key in the next predetermined station and so forth until the tour was completed. If the tour was completed in the proper order, the key-lock then could serve as a key to actuate the signal transmitter. However, the key-locks used heretofore had radially movable tumblers, and unless very bulky, were limited to use with a relatively small number of stations and the means at each non-wired station adapted to actuate the key-lock was relatively complicated and expensive. In some cases, the system was not fool-proof or tamper-proof and it was possible to bypass a station or visit the stations in undesired sequence while rendering the key-lock effective to transmit a signal at the transmitter station.

I have devised improved and relatively simple means obviating the aforementioned disadvantages.

In accordance with the present invention, a somewhat similar arrangement is provided but the key-lock includes a body and a member relatively rotatable thereto which carry a plurality of sets of aligned longitudinally movable tumblers so arranged that when engaged with an appropriate key, the member and body may be rotated relative to each other through a predetermined arc to reset the lock for operation by a different key.

Also in accordance with the invention, the key-lock may include a body and two or more members relatively rotatable to each other and to the body. Such members and body each carry a plurality of longitudinally movable tumblers, arranged so that when engaged with one plug-key, one of the members may be relatively rotated to the other member and the body or when engaged with a different plug-key, both of the members may be relatively rotated relative to the body in either case to preset the lock to be actuated by a different key. The number of stations which a given key-lock may serve is thus equal to the number of sets of tumblers raised to the power of the number of members, e.g., two members and nine sets of tumblers can service 9^2 or 81 stations.

Further in accordance with the invention, the key-lock includes a key engageable with a lock at each transmitter station to actuate the signal transmitter. The number of stations which such a key-lock may serve is thus increased by the number of sets of tumblers in the transmitter station lock.

It is a primary object of the invention to provide in a compulsory route-type signalling system for watchmen comprising a plurality of non-wired stations and at least one wired transmitter station, improved means for insuring a visit to each non-wired station in accordance with a predetermined route pattern prior to actuating mechanism at the transmitter station to send a signal indicaing completion of the route.

Another object of the invention is to provide improved means as set forth in the preceding object comprising a key-lock carried by the watchman and operable successively to a large number of different positions by differently formed keys, whereby with a key disposed at each station, a large number of stations can be visited by a watchman carrying a single key-lock without duplication of the keys.

Another object of the invention is to provide improved means as set forth in the primary object and wherein the improved means is also adapted to effect a signal from an emergency transmitter station disposed along the said route without disturbing the normal sequential operation of said means.

Another object of the invention is to provide improved means as set forth in the preceding objects which are relatively simple and inexpensive to manufacture.

The invention takes physical form in certain parts and arrangement of parts, the preferred embodiment of which will be described in this specification and illustrated in accompanying drawings which forms a part hereof and wherein:

FIGURE 1 is an exploded perspective view showing the key-lock I preferably employ in position to engage a typical non-wired or dummy station;

FIGURE 2 is an enlarged, fragmentary longitudinal, section showing the interior mechanism of the key-lock illustrated in FIGURE 1;

FIGURE 3 is a view, partially in transverse section, taken along the line 3—3 of FIGURE 2;

FIGURE 4 is a longitudinal sectional view of the non-wired station illustrated in FIGURE 1;

FIGURE 5 is a view, partially in transverse section, taken along the line 5—5 of FIGURE 4;

FIGURE 6 is a fragmentary longitudinal sectional view showing the key-lock partially telescoped within a non-wired station and engaging a plug type key;

FIGURE 7 is an exploded view showing the various parts of the key-lock;

FIGURE 8 is an exploded view showing the various parts of the non-wired or dummy station, including the plug-type key;

FIGURE 9 is a longitudinal sectional view showing the various parts of the transmitter station.

FIGURE 10 is a longitudinal sectional view showing the key-lock engaged with the plug key at the transmitter station taken on the line 10—10 of FIGURE 11;

FIGURE 11 is a front or left end elevational view of the transmitter station shown in FIGURE 9;

FIGURE 12 is a transverse section taken along the line 12—12 of FIGURE 10 shown in an alternative position with the key-lock removed for purposes of clarity; and

FIGURE 13 is an exploded view showing the parts of the transmitter station.

Referring now to the drawings wherein the showings are for the purposes of illustrating preferred embodiments of the invention only, and not for the purpose of limiting same, FIGURE 1 shows a key-lock generally indicated at 11 which is adapted to be inserted in a non-wired or dummy station generally indicated at 12 or into

a transmitter station generally shown in FIGURES 9–13 to engage a key **50**. If the key and lock match, the key-lock may be rotated in a clockwise direction and the lock reset to match a different key **50** at the next station. The dummy station **12** shown in FIGURE 1 is typical of a plurality of such stations which may be located at various selected points throughout the area to be protected.

Key-lock

The key-lock **11** may take a number of different forms but in accordance with the embodiments shown, it includes an elongated cylindrical tube **15** having a generally cylindrical fitting or insert **16** brazed to the front end thereof. This fitting **16** is formed with a cylindrical bore **17** extending from its front end and a cylindrical counterbore **18** extending from the back end. At the juncture between the bore **17** and the counterbore **18** the fitting **16** presents an internal annular shoulder or lip **19**. At its back end the fitting **16** presents an annular shoulder **20** disposed within the bore of the tube **15**. A nose **21** is brazed to the front end of the tube **15** at the top thereof.

At the back end of the tube **15** there is provided a body member having a cylindrical portion **22** disposed inside the tube **15** and a transversely extending handle **23** disposed outside of the tube **15**. The portion **22** is fixedly secured to the tube **15** in any suitable manner. In the particular embodiment illustrated in the accompanying drawing, the portion **22** is formed with nine elongated cylindrical passages **24**. Obviously, more or less passages could be provided. Each of these passages is closed at the outer or back end of the member and is open at the inner or front end thereof. The passages **24** are spaced apart circumferentially at 40 degree intervals about the axis of the member and extend lengthwise parallel to that axis.

Abutting the front end of the member portion **22** is a cylindrical letter wheel **25** which is rotatably mounted in the tube **15**. This letter wheel is formed with lengthwise passages **26** of the same number spacing and location as the passages **24**. At 40 degree intervals on its periphery, the letter wheel is provided with letters from "A" to "H" inclusive and "J." At one side the tube **15** is formed with an opening **27** which serves as a window through which one of these nine letters on the letter wheel is visible, depending upon the angular position of the letter wheel inside the tube.

The letter wheel **25** is provided with a key **28** in the form of an integral reduced diameter hub which projects forwardly from the cylindrical portion of the letter wheel. At its front end this key **28** has a plurality, in this case four, grooves **29** which are open at the front end of the hub and which extend to different depths rearwardly from the front end of the hub. These grooves **29** are disposed at 90 degree intervals circumferentially around the hub **28**. An axial passage **30** extends lengthwise through the key **28** and the letter wheel **25**. The key **28** serves to actuate the transmitter stations as will appear hereinafter.

An annular number wheel **31** is rotatably mounted within tube **15** on the key **28** just forward of the main cylindrical portion **25** of the letter wheel. The number wheel has a central bore **32** which receives the letter wheel key **28**. The number wheel has a cylindrical periphery marked with the numbers "1" to "9" inclusive, at 40 degree intervals around its circumference. The tube **15** is provided with a second opening **33** aligned with the previously mentioned opening **27** and serving as a window through which one of these numbers is visible, depending upon the angular position of the number wheel. The number wheel in this case is formed with nine lengthwise passages **34** which register with the respective passages **26** in the letter wheel. The front face of the number wheel is disposed just behind the annular shoulder **20** presented by the back end of the fitting **16** in the tube **15**. The key **28** on the letter wheel projects forwardly beyond the number wheel to a location substantially even with the internal shoulder **19** in the tube fitting **16**.

At each of the registering sets of passages **24**, **26** and **34** formed in the portion **22**, letter wheel **25** and number wheel **31**, there is provided a spring and tumbler set. Each set includes a spring, a back tumber, a middle tumbler and a front tumbler. In each set the compression coil spring **35** has the same normal length, the back tumbler **36** has the same length, and the middle tumbler **37** has the same length. The front tumblers **38** in the respective sets are of different lengths.

Each of the springs **35** is received in a corresponding one of the passages **24** in the portion **22**, with the back end of the spring engaging the closed back end of this passage. In its normal uncompressed condition, each spring **35** has a length equal to the length of the passage **24** in which it is received.

Each of the back tumblers **36** is generally cylindrical, presenting a rounded front end face **36***a*, and a flat back end face **36***b*. Each back tumbler **36** is freely slidable with respect to its body passage **24** and a letter wheel passage **26**. The length of each back tumbler **36** is less than the axial length of each passage **26** in the letter wheel.

Each middle tumbler **37** is generally cylindrical and is dimensioned to be freely slidable with respect to the corresponding passage **26** in the letter wheel and an aligned passage **34** in the number wheel. Each middle tumbler **37** is provided with a rounded front end face **37***a* and a rounded back end face **37***b*. Each of the middle tumblers **37** has a length which is somewhat greater than the axial length of the corresponding passage **26** in the letter wheel.

Each of the front tumblers **38** is clyindrical and is dimensioned to be freely slidable in the corresponding passage **34** in the number wheel. Each front tumbler **38** presents a rounded back end face **38***b* and a flat front end face **38***a*. As best shown in FIGURES 6 and 7, the front tumblers **38** are of four different lengths and each has a length greater than the axial length of the number wheel **31**. Also, each of these front tumblers **38** has a length greater than the spacing between the front end of the number wheel **31** and the internal shoulder or lip **19** provided by the fitting **16** inside the tube **15** at the front end thereof.

In the normal position of the parts, the respective springs **35** bias the tumblers to positions in which the front end face of each front tumbler **38** engages, or is close to, the shoulder **19**. Each of the front tumblers **38** at this time projects partly into the number wheel **31**. Each of the middle tumblers **37** is disposed partly in the number wheel **31** and partly in the letter wheel **25**. Each of the back tumblers **36** is disposed partly in the letter wheel and partly in the member portion **22**. In this position of the parts the tumblers hold the letter wheel and the number wheel against rotation with respect to portion **22** and the tube **15**, as well as holding these wheels against rotation with respect to each other.

It is obvious that more wheels can be used as desired, provided the tumblers are dimensioned and arranged so that when all the tumblers are depressed or forced inwardly the proper amount, all the wheels are free to rotate relative to body portion **22** and tube **15**. Further, the tumblers would be arranged so that depressing the tumblers a lesser amount would selectively lock one or more wheels to body portion **22** while the remaining wheels would be free to rotate relative to portion **22** and to each other.

Dummy station

Each dummy station **12** includes a key in the form of a plug for cooperation with the aforementioned key-lock in such a manner that, by inserting the key-lock in the

dummy station and turning it, the number wheel on the key-lock, or both the number wheel and the letter wheel on the key-lock advance a predetermined amount so as to present a different number or letter and number at the window or windows of the key-lock. This new letter and number combination designates the next station which must be visited by the watchman in making his rounds.

Referring to FIGURES 1, 4, 5, 6 and 8, each dummy station comprises a body **40** having a cylindrical bore **41** which is open at the front end **42** of the body. This bore **41** is dimensioned to slidably receive the tube **15** of the key-lock **11**.

At the periphery of the bore **41** there are provided a pair of angularly spaced slots **43** and **44**, each of which is dimensioned to slidably pass the nose **21** on tube **15**. The slot **43** is located in vertical position at the upper portion of the dummy station body **40**. In the particular embodiment shown, the other slot **44** is located 40 degrees clockwise from the slot **43**. However, it is to be understood that the second slot **44** may be at any desired multiple of 40 degrees away from the slot **43**.

At the back end of the bore **41**, the body is formed with an enlarged cylindrical counterbore **45**. The back ends of the respective slots **43** and **44** communicate with this counterbore **45**. As best shown in FIGURE 5, a stop in the form of a pin **46** is located in the counterbore **45** at the side of the slot **43** remote from the second slot **44**. Also, a stop in the form of a similar pin **47** is located in the counterbore **45** at the side of the second slot **44** which is remote from the first slot **43**.

With this arrangement, the key-lock may be slidably inserted into dummy station **12** or the body **40** thereof with the nose **21** on the key being slidably inserted along the slot **3**. When the nose **21** on the key reaches the counterbore **45**, the key may be turned clockwise until the key nose **21** registers with the second slot **44**. The key cannot be turned in the opposite direction due to the stop pin **46**, and it cannot be turned angularly more than the spacing between the station body slot **43** and **44** due to the presence of the stop pin **47**. As already indicated, depending upon the operation desired, the second slot may be either 40 degrees, or 80 degrees, or 120 degrees, or 160 degrees, or any suitable angular position away from the slot **43** into which the nose of the key is first inserted.

In order to effect operation of the number wheel, or both the letter and number wheels, in the key-lock **11** when turned as described, the dummy station is provided with a code plug key designated generally by the reference numeral **50**. This plug key is rigidly secured to a plate **52** which is fixedly mounted in the station body at the back end of the counterbore **45**. The plug key **50** extends forwardly from this plate into the bore **41** in the station body. The plug key is generally cylindrical in outline and is substantially smaller in cross section than the bore **41**. The spacing between the periphery of the plug key **50** and the wall of the bore **41** in the station body is such that the front end of the key-lock **11**, which includes the tube **15** and the fitting **16**, is freely slidable between them. At its front end the plug key is formed at its periphery with nine grooves **53** which are of varying lengths in a direction from front to back. These grooves **53** are spaced apart angularly at 40 degree intervals. Each of these grooves **53** is approximately semi-circular in cross-section, closed at the rear, and open at the periphery of the plug key **50**. These grooves **53** are dimensioned and located to receive the respective front tumblers **38** in the key-lock **11**.

In operation, when the key-lock is inserted into the station body previously described, the front ends of the front tumblers **38** in the key-lock engage the back walls of the respective grooves **53** in the station plug key. This causes the respective tumbler sets to be forced within the respective key-lock passages to an extent determined by the lengths of the respective grooves **53** in the station key plug.

The station code plug key may be either of two types. In one, the code plug key is intended to coact with the key-lock in such a manner that only the number wheel is held stationary while the key-lock is turned. In the other, the station code plug key is constructed so that both the number and letter wheels are held stationary while the key-lock is turned. Where number wheel operation only is involved, the grooves **53** in the code plug key have a lesser depth than the corresponding recesses in a code plug key designed for both number and letter wheel operation.

For operation of the number wheel only, and referring to FIGURE 6, the sets of tumblers are moved axially or forced inwardly to such an extent that each of the middle tumblers **37** is substantially flush with the front face of the letter wheel **25** and projects partially into an aligned passage **24** in body portion **22** to hold the letter wheel locked thereto. The front tumblers **38** are received partly in the grooves **53** in the code plug key and partly in the number wheel **31**, so that the number wheel is held by these tumblers against turning with respect to the station plug key as the remainder of the key-lock is turned. Since the middle set of tumblers **37** are longer than the letter wheel passages **26** and are held flush with the forward face of the letter wheel **25** by the front set of tumblers **38** they project partially into passages **24** of portion **22** against the compression of springs **35** and thereby lock the letter wheel with tube **15**. The letter wheel **31** turns in unison with the rest of the key-lock, with the rounded front ends **37***a* of the middle tumblers **37** carried by the letter wheel riding over the rounded back ends **38***b* of the front tumblers **38** and the rear face of the number wheel. Accordingly, with the entire key-lock except the number wheel **31** and the front tumblers **38** having been turned, a new number appears at the window **33**.

When the code plug key is arranged to operate both the number and letter wheels, the front tumblers **38** are axially moved or forced inwardly relative to the key-lock to a slightly less extent than for number wheel operation only. Accordingly, the middle tumblers **37** have their front ends partly received in the corresponding passages **34** in the number wheel **31**, with the remainder of each middle tumbler being disposed in the corresponding passage in the letter wheel **25**. The rounded front ends of the back tumblers **36** are substantially flush with the rear face of the letter wheel **25**. When the key-lock is turned, the front tumblers **38** engaged by the plug key **50** hold the number wheel **31** against turning with respect to key **50**, and the middle tumblers **37**, which are partly received in the number wheel, hold the letter wheel stationary also. The body portion **22** and tube **15** turn with respect to the letter wheel **25**, with the rounded front ends **36***a* of the back tumblers **36** riding over the rear face of the letter wheel to permit such relative movement to take place.

It will be apparent that with the foregoing arrangement, wherein the number wheel has nine positions and each position can have nine combinations with the letter wheel, there are 81 possible combinations of the number and letter wheels for which the individual plug keys at the dummy stations may be designed without any one station duplicating another.

Referring now particularly to FIGURES 4, 5, 6 and 8, the manner of mounting the plug key **50** in the station body **40** and the manner of mounting the key unit at a dummy station will now be described. The plug key **50** at the rear portion thereof has an axial threaded opening adapted to receive a screw **54** and an eccentric recess adapted to receive a pin **56** projecting from the forward face of plate **52** whereby the key is rigidly secured to the plate in a desired position. The stop pins **46** and **47**, previously referred to, comprise spacing collars **57** and screws **58** threadedly engaging body **40** and these screws

together with a third screw and spacing collar positioned between pins 46 and 47, hold plate 52 rigidly fixed to the keyway body. As best indicated in FIGURE 5, the front face of the plate 52 has spaced numbers stamped therein, the numbers running from 1–9 inclusive and being spaced at 40° intervals. Numbers 1 and 9 are visible through slots 43 and 44 and these numbers aid in properly positioning the plate. An end closure plate 59 is formed with two spaced holes adapted to receive screws 61 whereby it may be secured to an upright panel 62 located at each dummy station. Plate 59 is formed with a forwarding extending circular flange 63 adapted to telescope within an enlarged bore formed at the rear portion of body 40 and engage set screws 64 to rigidly mount the keyway body 40 on panel 62. After the set screws 64 are properly engaged with plate flange 63, they are each sealed by a lead slug which is placed over the set screw and swedged into place with a special sealing tool which leaves a distinctive symbol of mark on the seal. The seal cannot be removed except by drilling or digging out, which will mutilate the seal, thereby showing evidence of tampering.

Referring to FIGURE 6, it will be noted that cylindrical portion 22 is formed with a threaded central opening which receives the large end of a shaft 66, the reduced forward end of the shaft indicated at 67 projects into key passage 30 and forms a bearing for key 28. The letter wheel 25 is fixed to key 28 in any suitable manner as by a screw 68 whereby the key will rotate with the letter wheel to change the angular position of key grooves 29 relative to tube 15. In a manner to be later described, when the grooves 29 disposed at the forward end of key 28 are moved or rotated to a predetermined position, the key acts on a wired transmitter station to actuate mechanism and cause transmission of a signal to a remote central station.

Thus, letter wheel 25 is rotatable relative to tube 15 about shaft portion 67 and number wheel 31 is rotatable relative to tube 15 about key 28 and independently of the letter wheel. However, it will be noted that any rotation of letter wheel 25 relative to tube 15 must be effected through number wheel 31 since only the forward set of tumblers 38 carried by the number wheel engage the grooves 53 formed in the plug key 50. It will be apparent that if the letter wheel 25 occupies or is moved to B position, as evidenced through window 27 of tube 15, it can have nine different combinations with the number wheel as the number wheel is rotated through 360° by successive engagement with plug keys 50 at different dummy stations. Since this is true for each letter on the letter wheel 25, a large number of dummy stations can be visited without duplication of plug keys 50 or without the same pattern for the key grooves 53. For example, in the embodiment shown wherein both the letter wheel and number wheel have nine different positions, 81 dummy stations can be accommodated. Of course, several wired signal transmitter stations can be disposed at points along the dummy station route since it is merely necessary to rotate the key 28 to a new position for each transmitter station.

The transmitter station will now be described with reference to FIGURES 9–13 inclusive.

Transmitter station

At each transmitter station along the route which the watchman is required to follow, there is provided a conventional signal transmitter which is operated by the insertion and turning of the aforementioned key-lock, provided this station is visited in the proper sequence with respect to the other stations along the route.

At each transmitter station there is provided a keyway body 70 which is generally similar to the keyway body at each of the dummy stations. This keyway body is provided with a cylindrical bore 71 which is open at the front end face 72 of the keyway body. At its back end the bore 71 communicates with a first enlarged cylindrical counterbore 73. At the back end of the keyway body there is provided a second larger counterbore 74 which communicates with the first counterbore 73. The second counterbore 74 is open at the back end of the keyway body.

A pair of slots 75 and 76 are formed in the keyway body at the periphery of the bore 71 therein. These slots extend lengthwise along the keyway body from the front end thereof back to the first counterbore 73. In the embodiment shown, the second slot 76 is located 40 degrees clockwise from the first slot 75, viewed from the front end of the keyway body. The first slot 75 is located in vertical position at the top portion of the keyway body.

At its back end the keyway body is formed with a transverse recess 77 at its periphery which intersects the two counterbores 73 and 74 in the keyway body. The recess 77 is defined by generally vertically extending wall 78 located about 20° beyond the slot 75 on each side of center.

With this arrangement, the key-lock 12 may be inserted into the body 70 with the nose 21 of the key-lock being received in the vertical slot 75. The key-lock is forced lengthwise into the keyway body 70 until the nose 21 of the key-lock reaches the counter bore 73. Then the key-lock may be turned a limited amount in a clockwise direction beyond slot 76 and subsequently in a countercolckwise direction until it is aligned with slot 76. This operation winds and then releases the transmitter mechanism, which causes a one-round "finish" signal to be transmitted. At the start of the next tour the key-lock is removed, which again releases the transmitter mechanism and causes a one-round "start" signal to be transmitted. The key-lock is set for the first dummy station on the tour when removed from the transmitter.

A stop latch 80 is pivotally mounted in the body recess 77 so as to present a depending finger 81 positioned in the path of movement of the nose 21 of the key-lock as the key-lock is turned after having been inserted in the keyway body. The arrangement is such that the stop latch 80 is pivoted out of the way when the key-lock is turned clockwise from the initially inserted position where its nose 21 is in registration with the slot 75 in the keyway body. However, after the nose of the key-lock has passed beyond the stop latch, the latter drops down and the key-lock cannot be turned in the opposite direction to bring its nose 21 in registration with the keyway slot 75 after it has passed the stop latch. With this arrangement, the only way the mechanism can be operated is to insert the nose of the key-lock into the slot 75 and then turn the key clockwise, as described. It is impossible to insert the key-lock first into the keyway slot 76 and then remove it from the keyway slot 75.

A code plug key 85 is fixedly positioned in the bore 71 in the keyway body. This plug key 85 is cylindrical in outline and is of substantially smaller diameter than the bore 71 in the keyway body, so that the front end of the key-lock may be inserted fully into the bore 71 around the plug key. At its front end face, the plug key 85 is formed with 9 evenly spaced recesses 86 at its periphery which are of different depths. These recesses 86 are positioned to receive the front tumblers 38 on the key-lock in the same manner as the code plug key 50 at the dummy station, already described.

The plug key 85 is formed with an axial bore 87 which is open at its front end and extends to an enlarged counterbore 88 which is open at the back end of the plug key. At the intersection between the bore 87 and the counterbore 88 the plug key presents an internal annular shoulder or lip 89.

The plug key 85 is fixedly mounted on a plate 90 which is located at the second counterbore 74 in the keyway body. The plate 90 is generally cylindrical in outline, and is formed with a cutaway peripheral portion 91 hav-

ing a circumferential extent of approximately 120 degrees. Also, the plate **90** is formed with a central opening receiving the cylindrical portion of a flanged body member **100** which is secured to plate **90** and the plug key **85** by screws **92**.

The cylindrical portion of member **100** projects into the counterbore **88** in the code plug. The enlarged rear flange **102** on the member **100** abuts the rear face of plate **90**. The front end of the member **100** is spaced rearwardly from the annular lip **89** on the plug key **85**.

At its flanged back end the member **100** is formed with a cylindrical recess. Four evenly spaced passages **104** extend lengthwise through the body member **100** from its front end to the recess, each of these passages **104** being open at each end.

Rearwardly of the body member **100** there is a barrel and cam assembly including a barrel member **105** of cylindrical shape whose front end extends into the cylindrical recess in the flange **102** on the body member. The barrel member is formed with four evenly spaced, lengthwise cylindrical passages **106** adapted to register with the passages **104** in the body member **100** and form continuations thereof. Each of the passages **106** is open at the front end of the barrel and is closed at the back end thereof.

An elongated cam member **107** is secured to the barrel member **105**, extending perpendicular thereto. This cam member is arranged to initiate the operation of the transmitter in response to turning of the cam member. The cam member **107** carries a forwardly projecting pin **111** which is positioned to be engaged by the nose **21** when the key-lock is turned after having been inserted in the keyway body **70**.

Four sets of spring and tumblers are provided for the respective passages **104** and **106** in the body and barrel members. Each of the barrel passages **106** receives a compression coil spring **108** seated at the closed back end of its passage. Each set also includes a back tumbler **109** shaped and dimensioned to be freely slidable in the respective passages **104** and **106**. The back tumblers **109** in the respective sets are all the same length. Each set also includes a front tumbler **110** which is slidably received in the corresponding passage **104** in the body member **100**. The several front tumblers **110** are of different lengths. Each of the back tumblers **109** is formed with a rounded front end face and each of the front tumblers **110** is formed with a rounded back end face. Each of the front tumblers **110** is longer than the passages **104** in the body member **100**.

Normally, and as shown in FIGURE 9, in the absence of a key-lock inserted in the keyway body, the springs **108** cause the front tumblers **110** to project forwardly beyond the front end of the body member **100** and into engagement with the annular lip **89** on the key **85**. The back tumblers **109** are disposed partily in the body member **100** and partly in the barrel member **105**.

When the key-lock is inserted into the keyway body, the respective front tumblers **110** seat in the grooves **29** formed in the front end of the key **28** on the letter wheel in the key-lock. The respective front tumblers **110** are forced rearwardly to an extent determined by the depth of these recesses **29**. The arrangement is such that when the key-lock is inserted at the transmitter station or into the keyway body **70** in proper sequence, the respective sets of tumblers will be moved longitudinally to such an extent that the back tumbler **109** in each set is completely disposed within the barrel member **105**, as shown in FIGURE 10. This movement unlocks the barrel member from body member **100** and enables the barrel member **105** and the cam member **107** to turn with respect to the body member **100**. As the key-lock is turned, the nose **21** on the key-lock engages the pin **111** on the cam member **107** causing the cam member and barrel member **105** to turn in unison with the key-lock. During such turning movement of the barrel and cam unit, the rounded front ends of the back tumblers **109** ride over the rounded back end faces of the front tumblers **110** and over the rear face of the body member **100**. Such turning movement of the cam **107** causes it to initiate the operation of the transmitter at that station.

It will be apparent that the operation of this mechanism depends upon the coaction between the key **28** on the letter wheel in the key-lock and the respective sets of tumblers associated with the body member **100** and the barrel and cam unit **105** and **107**. Thus, if the angular position of the key **28** does not correspond to the particular arrangement of the tumblers at that transmitter station, which would occur if the watchman were to visit this station out of order, the sets of tumblers would hold the barrel and cam unit locked to member **100** so that the barrel and cam unit could not turn and the key-lock itself could not be turned.

The manner of pivotally mounting the stop latch **80** and supporting the key body **70** and associated parts will now be described. As best illustrated in FIGURE 13, a mounting plate **112** is generally rectangular with the exception of a cutaway peripheral portion including a vertically extending edge **113**, a horizontally extending edge **114**, and a connecting arcuate edge **115** slightly spaced radially from flange **102** of member **100**. Plate **112** abuts the rear face of plate **90** and both plates are formed with a plurality, preferably three, aligned holes indicated at **116** and **117** respectively adapted to receive screws **118**. These screws are projected through the plates and threaded into the wall of the keyway body **70**. The screw heads are preferably counter-sunk to be flush with the rear face of plate **112**. Plate **112** has a forwardly extending and preferably step shouldered pin **120** fixed thereto which forms a bearing for the stop latch **80**.

The stop latch is thus free to pivot about pin **120** in the space provided by recess **77** of body **70**. To normally hold latch **80** in a downward position, as shown in FIGURE 12, and to limit downward movement thereof, a spring finger **119** is mounted at a flattened area **121** of body **70**. The finger has its outer end **119***a* bent to resiliently engage the flat top surface **80***a* of latch **80**, whereby the latch will normally be held in a downward position but can be elevated by nose **21** as the key-lock **11** is rotated clockwise.

Also provided at the body area **121** is a cylindrical opening **122** having a partly spherical base which supports a ball **123**. The ball normally projects partly into slot **76** forwardly of the circular path of nose **21** of key-lock **11** whereby if the nose is in registry with slot **76**, the key-lock cannot be withdrawn without elevating the ball. To insure a firm seat for the ball, a spring finger **124** is mounted at body area **121** to resiliently engage the top surface of the ball. The ball detent prevents accidental withdrawal of the key-lock when it is disposed at the transmitter station or in the body **70** between tours of the watchman. For reasons hereinafter pointed out, a detent for the key-lock is not provided at intermittent transmitter stations.

The plate **112** is adapted to be secured to a mounting member **126**, preferably generally U-shaped in horizontal section, which in turn is adapted to be mounted on the back or interior panel (not shown) of a cabinet at the transmitter station. Accordingly, plate **112** is formed with a plurality of holes **127**, preferably three, through which screws **128** are projected to threadedly engage one end of mounting and spacing studs **129**. The opposite ends of the studs are engaged by similar screws projected through holes in the wall of the mounting member whereby when the mounting member is secured to the cabinet panel the key body **70** and associated parts described are firmly supported. The studs **129** are of a length to permit the barrel member **105** to turn freely with slight clearance relative to mounting member **125**. The barrel member is usually provided with a rearwardly extending shaft which projects through mounting member **126** for

actuating the signal transmitting mechaism in a conventional manner as the barrel member and shaft are rotated.

The manner of using key-lock **11** at a transmitter station as described and which is adapted to send a "start" signal to a remote central station at the beginning of a watchman's tour and to send a "finish" signal to the central station at the completion of the tour will now be explained. Between tours the key-lock remains inserted in the transmitter station with the nose **21** thereof disposed in recess **73** of body **70** and with the nose held in registry with slot **76** of the body by stop latch **80**. With the nose in this position, it abuts pin **111** of cam member **107** and holds the pin to the right of the nose as viewed from the front of the transmitter station. At the completion of the previous tour, the signal transmission mechanism, which includes spring means, has been wound by key-lock rotation whereby the cam member **107** is urged to rotate in a counterclockwise direction. Upon the watchman withdrawing the key-lock with the nose thereof passing along slot **76**, pin **111** is free to move and the cam member **107** is moved to upright position as shown in FIGURE 11. This movement causes counterclockwise rotation of the barrel member **105** and its shaft and in a conventional manner, causes the transmission mechanism to send a coded signal to the remote central station indicating "start" of the tour. As previously mentioned, the key-lock is withdrawn against the resistance of the detent ball **123**.

For limiting counter-clockwise movement of the cam member **107** and adjusting it to proper upright position, a rearwardly extending pin **131** is fixed to the lower portion thereof. This pin is in the path of a transversely extending adjusting screw **132** threadedly supported by one of the lower spacing studs **129**.

When the cam member moves to upright position the tumblers **109** in barrel member **105** are brought into registry with tumblers **110** in member **100** and under the influence of springs **108**, the tumblers **109** are forced partly into the passages **104** of member **100**. The front end of tumblers **110** engage lip **89** of plug key **85** and limit forward movement of the tumblers. The cam member **107** is thereby locked to the plug key **85** through member **100** until it is actuated by the key-lock **11**. At this time the key-lock is properly set to be actuated by the first dummy station **12** if this station is visited in accordance with the predetermined tour pattern. As previously explained, if each dummy station is visited in predetermined sequence, the front tumblers **38** of the key-lock **11** will engage the grooves **53** formed in the plug key **50** and as the key-lock is rotated at each dummy station, the number wheel **31** or both the number wheel and the letter wheel **25** will be rotated relative to the key-lock tube **15**. Since the key **28** of the key-lock is fixed to letter wheel **25**, the key **28** will be moved a new angular position as the letter wheel is rotated. Assuming all the dummy stations **12** are visited according to the route pattern, upon withdrawal of the key-lock from the last dummy station visited, the key **28** and the tumblers **38** of the key-lock will be set to be accepted at the transmitter station. The key-lock is then inserted in the transmitter station or body **70** thereof with the key-lock nose **21** sliding along slot **75** until the nose enters bore **73** in body **70**. It will be noted by reference to FIGURE 11 that if the key-lock is inserted with the nose passing along slot **76** rather than along **75** as intended, the key-lock cannot be rotated counter-clockwise for withdrawal through passage of the nose through slot **75**. This is because the cam member pin **111** prevents rotary movement of the key-lock nose **21** in a counter-clockwise direction. Upon proper insertion of the key-lock, as shown in FIGURE 10, the tumblers **110** are seated in grooves **29** of key **28** and will have been forced inwardly to an extent whereby the rear tumblers **109** are entirely disposed in barrel member **105** thereby unlocking the cam member **107** and permitting rotation thereof relative to body **70**. The key-lock nose **21** will then be disposed in body bore **73** and under stop latch **80**. It will be noted by reference to FIGURES 10 and 11 that pin **111** of cam member **107** is in the path of clockwise movement of key-lock nose **21**. The key-lock is then rotated clockwise until further movement of pin **111** is prevented by the lower shoulder of the cutaway portion **91** of plate **90**. After the nose **21** passes beyond stop latch **80**, the latch drops to a position preventing the nose from moving in a counter-clockwise direction beyond registry with slot **76**. After the key-lock has been rotated clockwise as far as possible, it is rotated counter-clockwise to bring nose **21** whereof into registry with body slot **76**. This rotation of the key-lock and resultant rotation of cam member **107** and barrel member **105** winds the transmitter mechanism and at the same time causes a coded signal to be transmitted to the remote central station indicating "finish" of the watchman's tour. The key-lock **11** then remains inserted in the transmitter station until the start of another tour.

As previously mentioned, the transmitter station unit described is preferably mounted on the interior panel of a cabinet. The cabinet preferably has a hinged door, as indicated at **130** in FIGURE 9, and the forward or nose portion of the keyway body **70** projects through the cabinet door. The door is locked to the cabinet in a manner to guard against tampering.

If the tour is relatively long, it may be desirable to send a signal from one or more intermediate points on the tour route to the remote central station. For this purpose an intermediate transmitter station is provided which is adapted to transmit a single signal as distinguished from the transmitter station already described which is adapted to send both a "start" and "finish" signal. The unit provided at an intermediate transmitter station is essentially the same as the unit described except that the ball stop or detent for the key-lock nose **21** is omitted and the unit is arranged to transmit only one distinctive coded signal designated as "intermediate" signal. In operation, the key-lock **11** is inserted with the nose **21** thereof passing through vertical slot **75** and it is turned clockwise as far as possible and then turned counter-clockwise until engaged by the stop latch **80**. This operation winds and releases the transmitter mechanism, causing a one-round "intermediate" signal to be transmitted.

At either type transmitter station engagement of the key-lock **11** with the plug key **85** and rotation thereof sets the key-lock for actuation at the next station designated on the route pattern.

As an added safeguard, a special police call transmitter which is identical in appearance to the transmitters customarily visited may be provided at some point on the tour route. In an emergency, this transmitter may be visited and operated with the key-lock **11** to transmit a distinctive coded signal to the central station operator indicating that police assistance is required. For such an emergency transmitter station, the key body is designed so that it is only necessary to insert the key-lock **11** with the nose **21** thereof passing through a vertically disposed slot and then rotate the key-lock and withdraw the same through an angularly disposed slot. This operates the transmission mechanism to send the coded signal. It is not necessary that the key-lock numbers engage grooves on a plug key so that the setting of the key-lock is not altered. Accordingly, the key-lock can be actuated at the next designated station without regard to its use at an emergency signal station.

Obviously, modifications of the embodiments of the invention differing radically from those described would occur to others upon a reading and understanding of this specification, and it is my intention to include all such modifications and alterations insofar as they come within the scope of the appended claims.

I claim:

1. A compulsory tour signalling system for watchmen comprising

a plurality of nonwired stations,

a wired transmitter station,

each nonwired station arranged to be visited by a watchman in accordance with a predetermined route pattern before a signal can be effected at the transmitter station,

key-lock means carried by the watchmen connectable at each station to set a key element therein only if the next preceding station has been visited as prescribed by said predetermined route pattern, said key element comprising

a front rotatable member and a rear nonrotatable member each having a radial array of axially alignable passages therein,

a set of tumblers received in the passages of each member and certain tumblers in one set being of unequal length and both sets being mutually biased forwardly so that at least one tumbler in one member partially extends into the adjoining aligned passage of the other member thereby locking the members against relative rotation when the key-lock means is not being set at one of said stations,

said key lock means including means to restrain forward travel of the sets of tumblers and to permit access thereto at the front end of the rotatable member and plug key means at each station for depressing the tumblers in a prescribed fashion so that the rotatable member is free to rotate relative to the nonrotatable member in setting the key element.

2. A compulsory tour signalling system as set forth in claim 1 wherein a plurality of rotatable members and sets of tumblers are provided in said key element whereby the number of stations which can be visited is a function of the number of passages per member and the number of rotatable members.

3. A compulsory tour signalling system as set forth in claim 2 wherein the plug key means at each station comprises

a set of axially extending grooves registrable with the sets of tumblers of said key element,

the plug key means depressing the tumblers of unequal length so as to release one or more of the rotatable members when setting the key element.

4. A compulsory tour signalling system as set forth in claim 2 wherein a supplemental transmitter station is disposed in proximity to the predetermined route pattern adapted to send a predetermined signal to a central station, and said key-lock means is adapted to effect a signal from said station without regard to the previous operation of said key-lock means at a previous station.

5. A compulsory tour signalling system as set forth in claim 4 wherein said transmitter station comprises

a key body adapted to effect a signal when actuated by said key-lock means after said key element has been set to a predetermined position, said key body comprising

a generally tubular body adapted to receive said key-lock means,

a fixed plug key centrally disposed within the body,

a cam member rotatable by the key-lock means to actuate a conventional transmitter mechanism, and

axially movable tumbler means adapted to normally lock said cam member to a said key body in a non-actuating position, said plug key adapted to engage said key-lock means and permit rotation thereof in the key body and said engagement moving the tumbler means to a position unlocking said cam member whereby it may be rotated by the key-lock means to effect transmission of a signal.

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NEIL C. READ, *Primary Examiner.*

R. M. GOLDMAN, *Assistant Examiner.*