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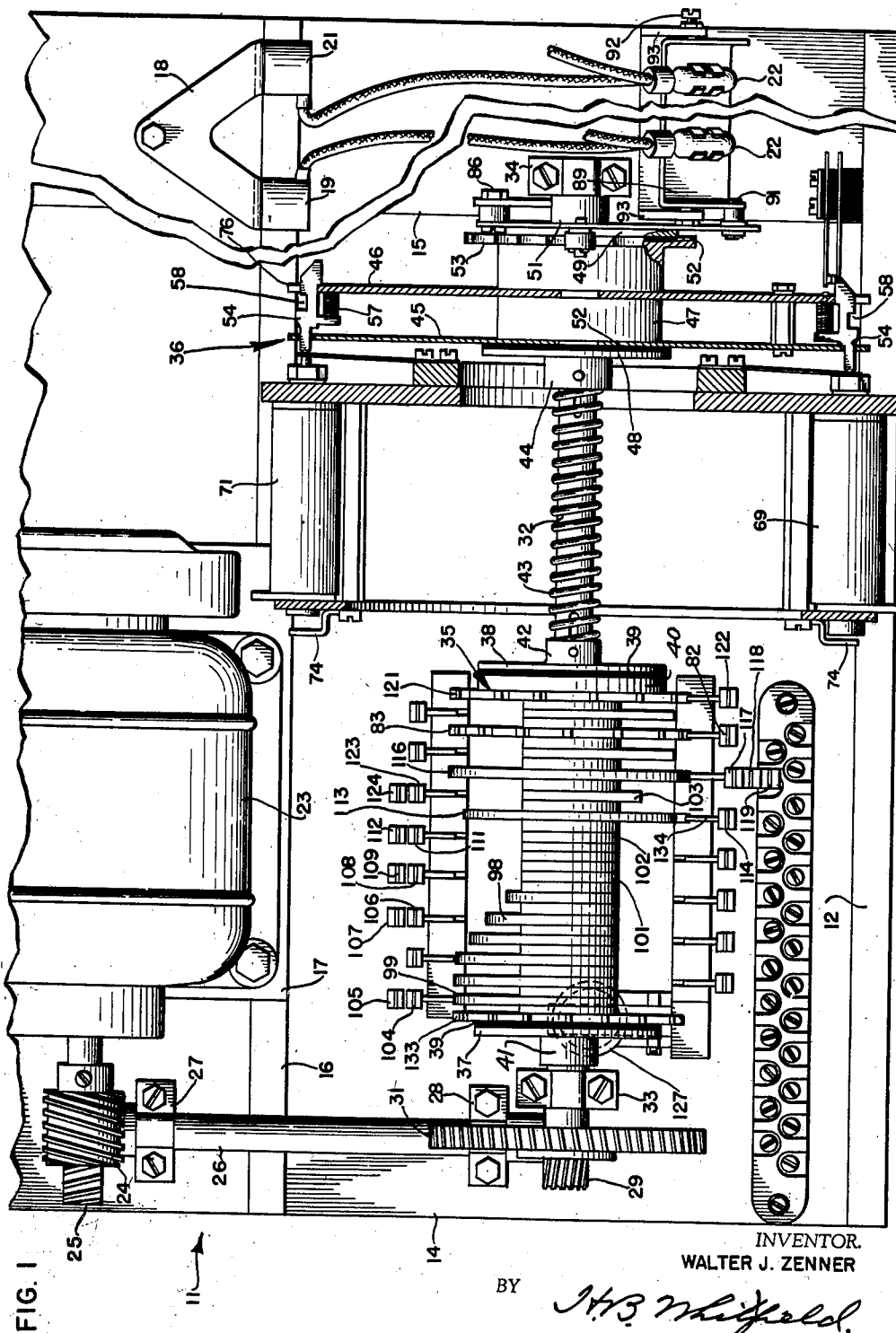
W. J. ZENNER

2,334,467

CODING APPARATUS

Filed Oct. 1, 1941

5 Sheets-Sheet 1



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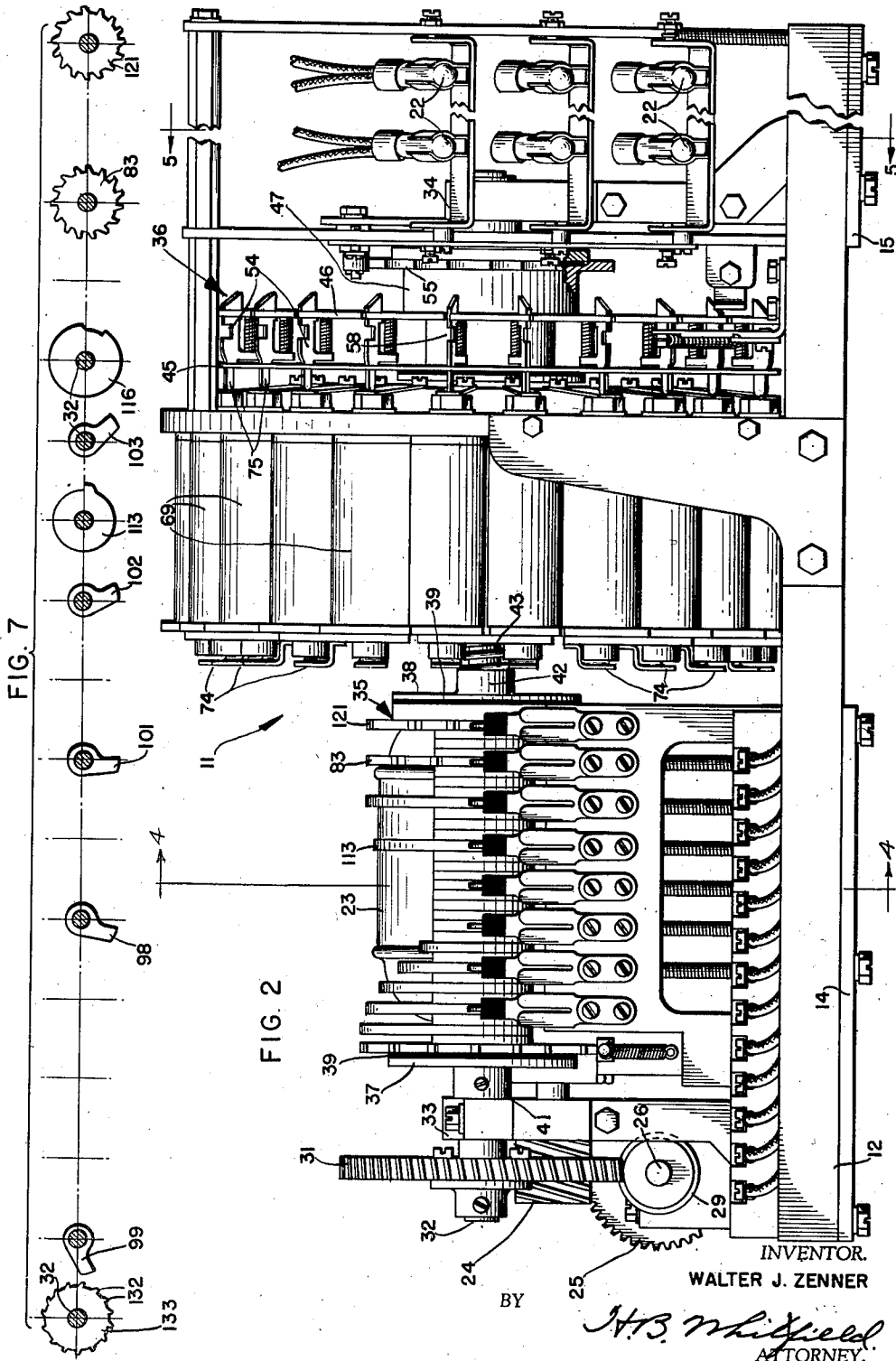
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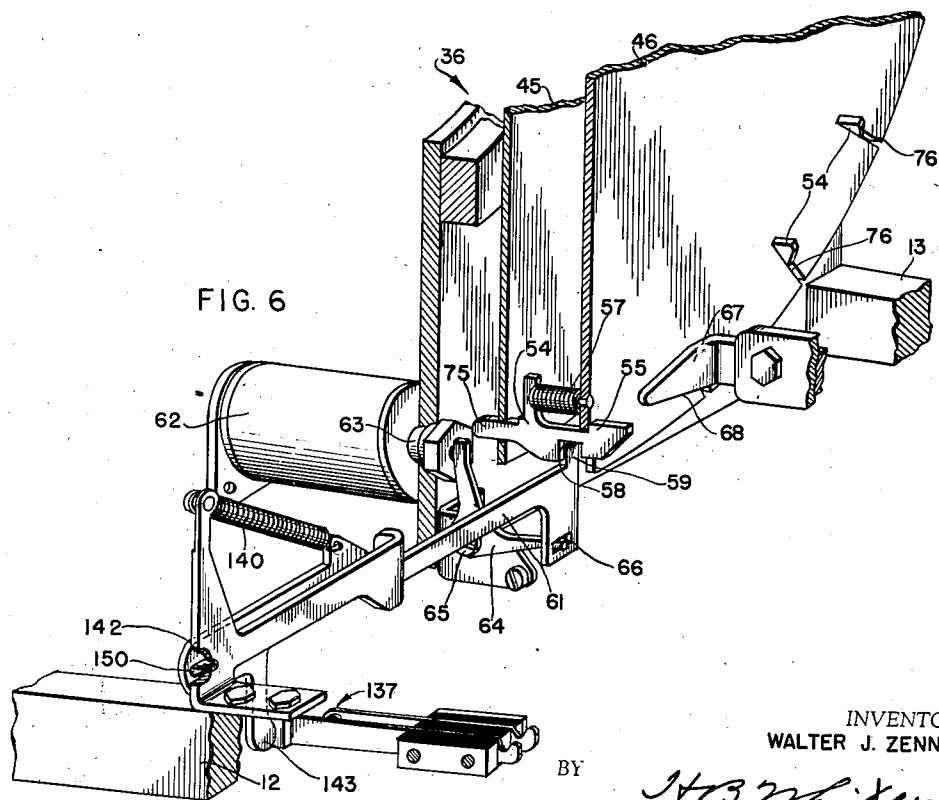
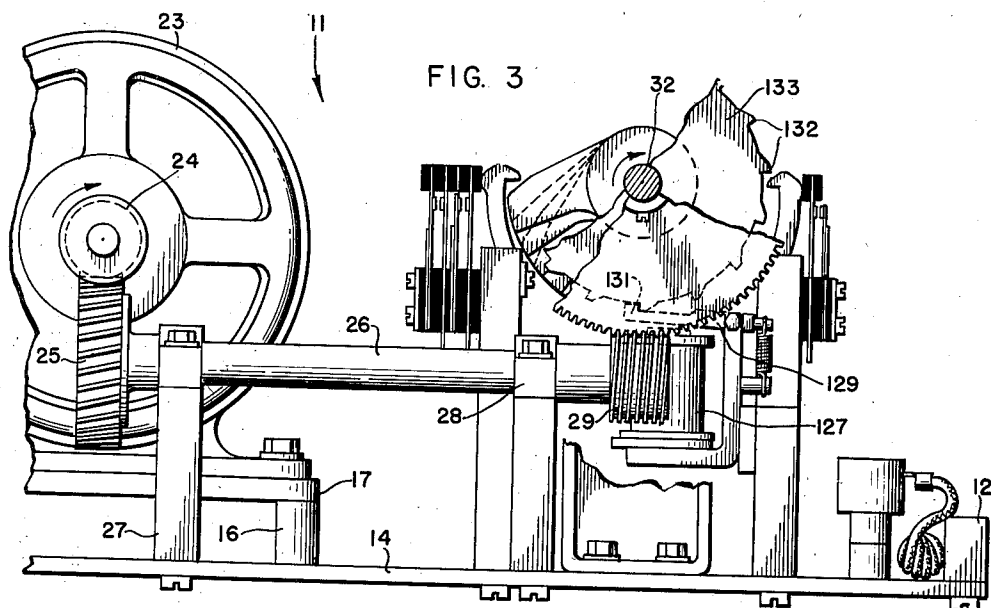
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CODING APPARATUS

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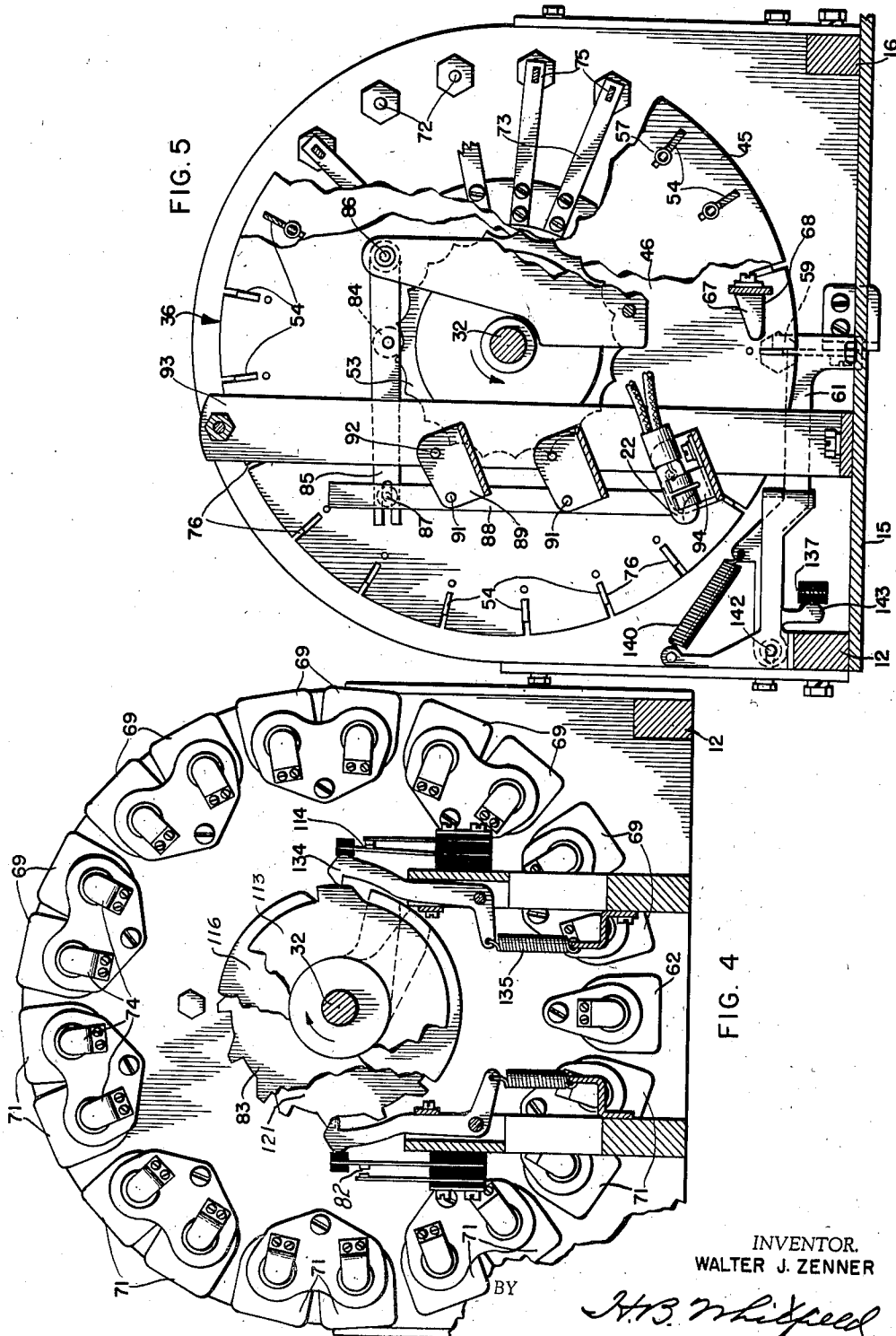
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CODING APPARATUS

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Nov. 16, 1943.

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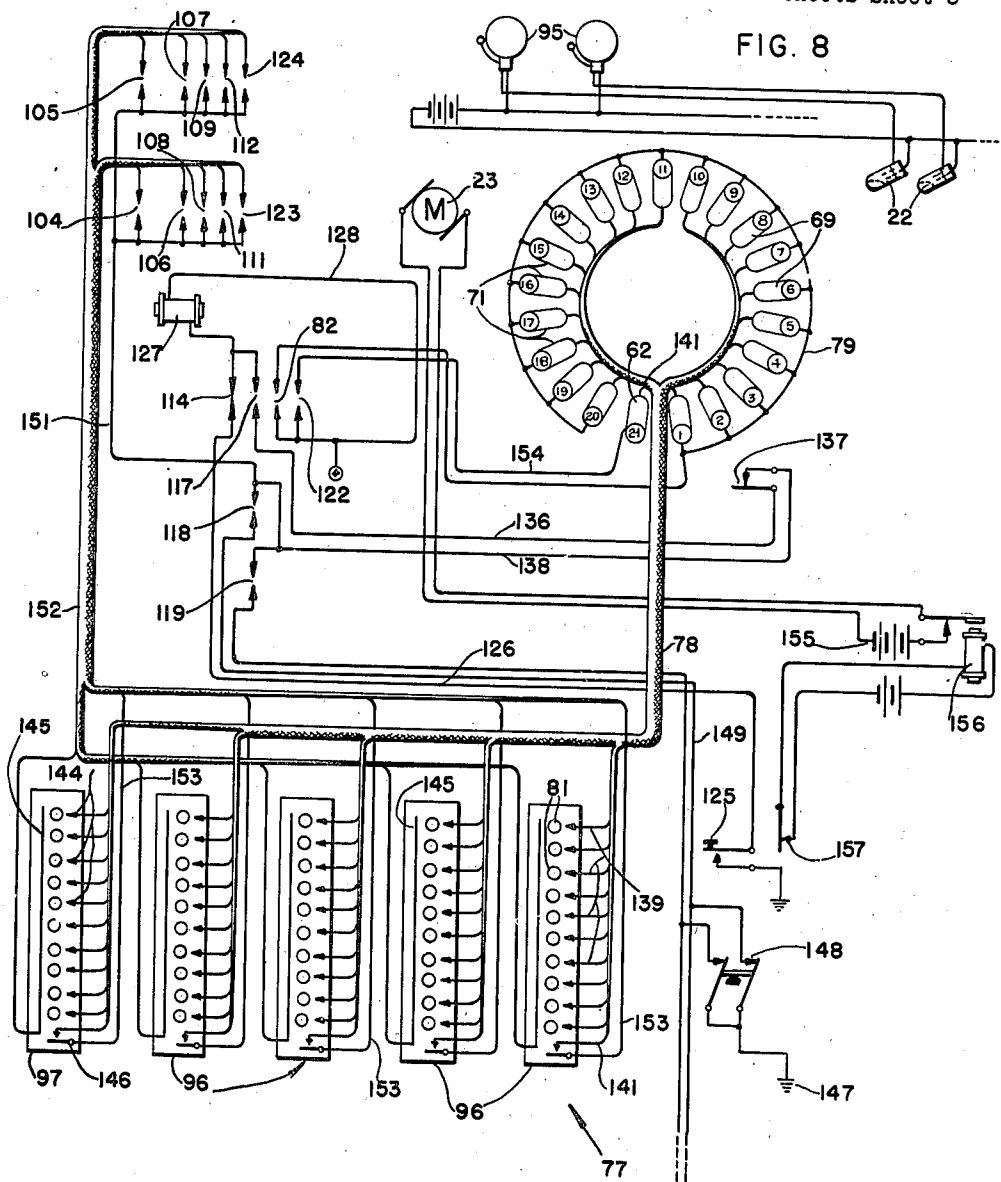
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CODING APPARATUS

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FIG. 8



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UNITED STATES PATENT OFFICE

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CODING APPARATUS

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tion of Delaware

Application October 1, 1941, Serial No. 413,079

17 Claims. (Cl. 177—380)

This invention relates to signal tolling apparatus and more specifically to variably settable tolling signal storage equipment.

The invention finds particular adaptability for use in conjunction with metropolitan systems of fire stations wherein a network of stations receive alarm signals and other information from a central distributing station with regard to the location and character of the fire to enable the prompt and proper dispatch of fire equipment. In a copending application by J. E. Wack et al., Serial No. 345,260, there is disclosed an arrangement of keyboard equipment, time recording apparatus, and telegraph printers whereby fire alarm information may be broadcast to a large number of outlying fire stations from a central distributing station to apprise each of said outlying stations of the fact that a fire alarm has been reported to the central station, that the location of the fire is in a particular district, that the fire is of certain proportions, and the number of the closest station thereto. In accordance with the disclosure in said copending application, this information is transmitted over telegraph lines and controls the production of a printed record. Accordingly, when the information is received at the various outlying stations, attendants, in order to learn at once of the facts communicated, read the information printed upon a tape.

The principal object of the present invention is, accordingly, the provision of apparatus to generate audible fire alarm signals over a plurality of individual circuits under the control of telegraphic signals originating at a central station.

In order that certain information concerning fire alarm broadcasts may be made available to station attendants within hearing range and so as not to require that each attendant personally examine the telegraphically printed record, it is proposed to operate, under the control of the telegraph signals, a secondary signaling apparatus to a telegraph printing system comprising a gong tolling network which may by combinations of gong sounds, relate certain essential information concerning alarm.

In obtaining these and other objects of invention, apparatus is herewith proposed which may respond to a central station keyboard operation by characteristically interrupting a plurality of individual circuits, each of which may be connected to one or more alarm tolling bells, so as to operate all alarm bells in all of said circuits simultaneously, thereby generating a number of gong signals in certain groupings which, by pre-

determined code arrangements, will relate certain information to all within hearing range provided, of course, that the signaling code is understood.

This audibly disseminated information which may be included also together with other information printed upon the telegraphically operated printer, will usually include such facts as the location of the fire in accordance with a predetermined arrangement of districting, the classification of the fire in terms of degree so as to apprise each station of the likelihood of apparatus demands that may be made upon neighboring stations, and the number of the call box from which the alarm originated.

In its specific contemplation, the apparatus may be briefly described as a frictionally driven rotary storage transmitter in which a number of peripherally placed shiftable stops are actuable by means of correspondingly placed stationary magnets so as to intercept a variable angle between the point of previous arrestment and the newly selected stop. Thus, no restoration to a zero position is required and as the transmitter moves from previous arrestment it carries with it a cam having apexes corresponding to the number of stops and with these acts upon a plurality of circuit interrupters comprised of mercury switch tubes which make and break on reciprocation. Release of the transmitter is effected by withdrawal of a block from the path of its shiftable stops whereupon a stationary cam releases the shifted stop so that it may resume unset condition.

For a more comprehensive understanding of the present invention, reference is made to the accompanying drawings and to the following detailed specification wherein like reference characters designate corresponding parts throughout and wherein;

Fig. 1 is a plan view partially in section of an apparatus that is capable of receiving and storing a number of signals and in accordance therewith of operating a number of individual circuit interrupters for generating audible alarm signals thereby;

Fig. 2 is a side elevation of the apparatus illustrated in Fig. 1;

Fig. 3 is an end elevation of the apparatus illustrated in Figs. 1 and 2, certain portions being broken away;

Fig. 4 is a transverse sectional view taken approximately on line 4—4 of Fig. 2;

Fig. 5 is a transverse sectional view taken approximately on line 5—5 of Fig. 2;

Fig. 6 is a detailed perspective view of a storage disc assembly release mechanism;

Fig. 7 is a dismantled group view illustrating the component cams of the unit assembly featured in Figs. 1 to 5; and

Fig. 8 is a schematic circuit illustration of a portion of the wiring hook-up of a fire alarm system as particularly related to the present invention.

In its essential embodiments, the present invention has been designed to operate as an auxiliary system to the one disclosed in the J. E. Wack et al. copending application for a fire alarm transmission system, Serial No. 345,260, wherein the propagation of fire alarm messages of a formal type is proposed to operate telegraph printing apparatus. As explained in said copending application, there is contemplated the provision of apparatus for transmitting time signals to accompany each message so that a record is thereby had of the precise time of day that each message is transmitted or received at the destination station. Also as explained in said application, provision is made for predetermining the length and the number of repetitions of each message under the control of a permanent setting of the instrumentalities, the individual message information being supplied at each operation in accordance with the manipulation of a keyboard.

In order to simplify the disclosure and understanding of the instant invention, the following detailed description and the accompanying drawings are inclusive only of that portion of the apparatus which concerns the present invention, reference being had to the drawings and specification of the copending application for such matter as is only functionally related thereto. To conform with the requirements of the instant apparatus, a keyboard unit resembling generally the keyboard disclosed in the copending application but having in addition thereto certain essential modifications to enable it to generate the signals required to operate the instant apparatus, have been developed and form the subject matter of a copending application of Raymond R. Smessaert bearing the Serial No. 413,081, filed on even date herewith.

In the accompanying drawings, the reference character 11 designates generally a signal coding apparatus unit which consists of a supporting structure comprise of two parallel side rails 12 and 13 which are traversed by the transversely connecting mount platforms 14 and 15. An intermediate supporting rail 16, Fig. 1, paralleling rails 12 and 13, and also connected to the mount platforms 14 and 15, affords support for a motor platform 17 as well as to a bracket 18 which carries a pair of junction blocks 19 and 21 to which the flexible leads from a plurality of mercury tube switches 22 are electrically connected.

An electric motor 23 which is bolted to platform 17 drives, by means of a worm gear 24, the worm wheel 25 of a power distributing shaft 26 journaled in the bearing brackets 27 and 28 and driving with its worm gear 29 a large worm wheel 31, the latter member being secured to a principal drive shaft 32 which is journaled in a pair of supporting brackets 33 and 34.

The armature of motor 23 and shaft 32 rotate in a clockwise direction as viewed in Fig. 3, and this is the direction of motion that shaft 32 tends to impart to its two frictionally driven assemblies 35 and 36.

Assembly 35 consists of a plurality of rotatable cam members integrally associated and driven by

means of a pair of driving discs 37 and 38 which impinge upon an endmost cam element 133 and a spacer 40 of the assembly through the intervening agency of fibrous or friction discs designated 39. Disc 37 is a flange integrally associated with a collar 41 that is secured to shaft 32 as by means of a set screw, but disc 38 is a flange integrally associated with the collar 42 splined to the shaft 32 but freely movable endwise or longitudinally thereof in which respect it is influenced by a helical compression spring 43 which is shouldered between another splined collar 44 and the described collar 42 of flange member 38.

The other driven assembly 36 is termed a storage disc assembly and it too is carried upon the described shaft 32. It consists of two spaced disc elements 45 and 46, see particularly Figs. 5 and 6, carried upon a sleeve or drum member 47. This assembly is driven, as in the case of the afore-described cam assembly 35, by means of a pair of cooperating flanges 48 and 49, the former being integrally associated with the spring urged longitudinally movable collar 44 and the latter member, 49, being an integral part of the collar 51 anchored to shaft 32. Accordingly, since flange and collar members 42 and 44 are both longitudinally shiftable upon shaft 32, the common compression spring 43 acts jointly between the two of them to maintain frictional driving engagement between shaft 32 and their respective assemblies 35 and 36. In the assembly 36 fibrous frictional driving discs 52 are provided which function in the same manner as do the friction discs 39 of assembly 35.

Integrally formed with the drum 47 is an endmost cam disc 53 having a scalloped periphery as indicated in Fig. 5. Assembly 36 is free to rotate in a counterclockwise direction as viewed in Figs. 5 and 6, under the influence of the drive shaft 32 when all of its transverse pawl members 54 are disposed in their respective release positions. Under the alternative of their conditions, namely, the set positions of said pawl members 54, which is the condition portrayed by the foremost pawl 54 of Fig. 6, its latching shoulder 55 engages that of disc 46 in a notch 76, since the pawl member has been shifted rightwardly as viewed in this illustration compressing the individual spring 57. When in this condition a notch 58 formed in each pawl 54, Figs. 1, 2, and 6, is disposed sidewardly with respect to its normal position, so that as the pawl 54 reaches its lowermost position of travel as that illustrated by the foremost pawl 54 in Fig. 6, the notch 58 is no longer in alignment with a stop lug 59 formed upon a trigger 61. On this account, the storage disc assembly is arrested when a so disposed pawl 54 encounters the stop lug 59 and remains dormant until by the actuation of a release solenoid 62 the latter member's armature plunger 63 is shifted rightwardly causing the rotation of a bell crank 64 in a clockwise direction about its pivot 65 and, since one arm 66 of said bell crank is articulated to the trigger 61, the latter member is rotated clockwise about pivot 142 as a center so that its stop projection 59 is drawn free from blocking engagement with the side of pawl 54. Trigger 61, in addition to being pivotally supported upon the pin 142 is also longitudinally shiftable with respect thereto since said pin 142 passes through a horizontal elongated pivot slot 150 and though trigger 61 is normally urged by a spring 140 backwardly and leftwardly as viewed in Fig. 6 so that integrally formed switch operating pro-

jection 143 is retracted permitting the contact pair 137 to stand ajar, this condition is reversed when storage disc assembly 36 through any one of its pawls 54, when in a set condition, bears against stop projection 59, for in so doing it also shifts trigger 61 forwardly and rightwardly. Accordingly, the arrestment of storage wheel 36 results in the closure of contact pair 137 for a purpose which will become clearer during the course of subsequent description.

Upon the de-energization of release solenoid 62 which remains energized for but a brief period as will appear later, its associated elements 64 and 61 are permitted to resume their original condition but meanwhile the assembly 36 is freed to resume its rotation, the particular blocking pawl 54 having been retracted from its set position in which it engages lug 59. As the particular stopping pawl 54 proceeds in its rotary path together with assembly 36, its protruding portion, Fig. 6, engages a cam projection 67 by riding up onto its lowermost edge 68. This moves the latching end of the pawl 54 so that shoulder 55 is cammed away from locking engagement with disc 46, spring 57 restoring said pawl to its normal position whereat notch 58 is again in the peripheral alignment to clear blocking projection 59 of trigger 61. In Fig. 4, the solenoid 62 may be noted to be disposed lowermost of a circular arrangement of solenoids, the general class of which have been designated 69 and 71, each half of the circle being constituted of ten solenoids disposed on one side and the other of the central shaft 32 with the release solenoid 62 being the twenty-first one and centrally disposed at the bottom.

Each of the classes of solenoids 69 and 71 comprises ten individual solenoid members having armatures 72, Fig. 5, and flat spring elements 73 against which the foremost ends of the armatures or plungers 72 engage, and which serve to restore the plungers 72 after any solenoid has been de-energized. At their opposite ends, the solenoid plungers are prevented from being removed from the assembly by the interposition of stop brackets 74. In the illustration, Fig. 8, the solenoids have been designated serially by numbers 1 to 21 as well as by the reference character designations employed in Figs. 1, 2, and 4. When any one of the solenoid armatures 72 responds to the energization of its solenoid 69 or 71, it is moved rightwardly, as viewed in Fig. 2, causing its reduced projection to flex restoration springs 73 and to engage the rounded extremity 75 of its associated latchable pawl 54 moving the latter member sidewardly, as best indicated in Fig. 6 and against the influence of compression spring 57 until its shoulder 55 becomes hooked over the end of its individual slot 76 in disc 46.

Thus it is to be understood that as assembly 36 is brought to rest when a particular one of its stop pawls 54 engages the shoulder 59 of trigger 61, the last operated one of said pawls 54 thus constitutes a new zero position. Following the arrestment of assembly 36, there may be obtained a number of angular positions between it and any one of the remaining pawls 54 that might become set by the energization of any of the solenoids 69 and 71 numerically designated from 1 to 20 in Fig. 8. The energization of any one of said solenoids is effected by the manipulation of a key bar in a keyboard unit designated by the general reference character 77 which prepares a circuit traceable over an individual line in cable 78 through the winding of one of the solenoids 69 or 71 to the com-

mon return circuit 79. While the closure of one of the key bars 81 of unit 77 prepares a circuit for energizing one of the solenoids 69 or 71 by placing ground on one of the lines in cable 78, the energization of said solenoid awaits the completion of the circuit when current is placed upon the common return wire 79 by the closure of contact pair 82 at a precise one of a plurality of regularly spaced intervals under the control of a multiple apex cam 83, Figs. 2, 4, and 7.

The number of solenoids 62, 69, and 71 which are assembled around the central shaft 32 corresponds to the number of scalloped apices in cam 53. As a result, when assembly 36 is permitted to rotate from a previously established zero position, where it has been arrested due to the blocking of one of its pawls 54 with shoulder 59, to a subsequent position which may be of any number of angular steps from 1 to 20 in terms of the angular distances between adjacent pawls 54, cam 53 will pass a corresponding number of its scalloped apices under the follower roller 84 reciprocating the lever arm 85 upon which said roller 84 is carried about its anchored pivot 86 so that its free end through the articulation pin 87 will induce a corresponding motion to the vertically disposed tandem bar 88.

As a result of the movement of tandem bar 88 vertically in a reciprocating motion, there is transmitted a corresponding rocking movement to each one of a plurality of cradles 89 which are pivoted as at 91 to said bar 88. Since each one of the cradles is also pivoted as at 92 to a pair of stationary upright members 93, the movement transmitted to the several cradles 89 will cause them to rock in clockwise and counterclockwise motion correspondingly rocking the mercury tube switches 22 which are held in clamp members 94 especially provided for this purpose in each one of said cradles 89. Accordingly, the number of reciprocations imparted to the several tubes 22 will in turn effect the opening and closure of individual circuits, Fig. 8, to the alarm tolling bells 95 generating audible signals comprised of a plurality of successive gong soundings to denote to fire station attendants certain information such as already explained above.

Each unit in the keyboard 77 consists of an alignment of key bars 81 representing a decimal position and individually supported in a removable unit section 96, certain structural features of which form the subject matter of the aforementioned copending application filed on even date herewith. Of the several keyboard sections, a particular one designated 97 resembling in mechanical details those of the four sections 96, is especially provided with circuit connections to the solenoids 71 while the keyboard units 96 wired in parallel over lines within cable 78 are connected to the solenoids 69. Accordingly, in the first decimal or numerical position, there being five such positions in accordance with the disclosure of Fig. 8, the number of tolling bell signals to be transmitted by means of the units 11 will comprise a number of gongs between 11 and 20, since the keyboard section 97, the first to be operated, is electrically connected to the solenoids 71 which correspond in the sequence to the eleventh to the twentieth solenoids of the series, inclusive. Subsequently, however, the operation of any of the remaining units 96 will cause to be energized the solenoids 69 so that accordingly the signals following the

first position will be comprised of a number of gongs from 1 to 10, inclusive.

In the illustration of Fig. 8, the keyboard unit 77 represents a device generally similar to the keyboard illustrated in copending application, Serial No. 345,260, discussed above, only such portions of the circuit being here indicated which concern the operation of the going tolling apparatus. Other portions of the keyboard apparatus, as well as of the remainder of the circuit illustrated in said copending application, are to be understood as being substantially of the type therein disclosed. Also, the requirement of providing a keyboard unit 97 and the solenoids 11 through 20 for the purpose of tolling a larger number of integer signals than the primary number of from 1 to 10, is by way of illustrating an arbitrary enlargement of the fundamental disclosure. If a larger number of decimal positions than the five illustrated in Fig. 8 and represented by the five keyboard sections 96 and 97 are desired, it is but necessary to provide such additional sections in the keyboard 77 and in the cam distributor 35 to provide additional distribution cams and thereby there may be obtained a system in which the number of call digits will be correspondingly increased.

In the illustration of a cam assembly 35, in Figs. 1, 2, and 7, space has been provided for accommodating a larger number of cams than there are integer sections in the keyboard unit 77. Some indication of the additional number of digits which may be accommodated can be learned from observing the number of unused spacings in Fig. 7 which are not filled in by timing cams such as the ones designated 98, 99, 101, 102, and 103. The relationship between the cams 98 to 103 and the contact pairs in Fig. 8 may be understood by comparing the arrangement of the cams with the schematic showing of the contact pairs in Fig. 1. Thus cam 99, the first of its class as shown in Fig. 7, controls the closing simultaneously of two contact pairs designated 104 and 105. Cam 98 controls the closure of two contact pairs designated 106 and 107; cam 101 controls the closure of two contact pairs 108 and 109; cam 102 closes the contact pairs 111 and 112, and cam 103 controls in the same manner closure of contact pairs 123 and 124. The brief apex cam 113 controls a single contact pair 114, the cam 116 whose apex is continuous but for a brief angle controls the closure simultaneously of three contact pairs designated 117, 118, and 119, and the multiple apex cams 83 and 121, disposed in staggered relation one from the other, each controls an individual contact pair designated 82 and 122.

Subsequently, in the description, the control circuits and the manner in which the several cams of assembly 35 operate their contact pairs, will be explained in detail with specific reference to their functional purpose. For the present it will suffice to note that during the normal or zero position of the assembly 35, which is an invariable position, all of the contact pairs remain open with the sole exception of contact pair 114 which is under the supervision of cam 113. The closure of this contact pair prepares a circuit which enables ground to be introduced upon the closure of a manual key lever 125 over line 126 through the cam held contact pair 114, winding of release magnet 127, line 128, to the positive current source. Release magnet 127, as may be observed from Figs. 1 and 3, is situated so that its pivoted armature 129 during the de-energized condition of magnet 127 will block by means of its shoulder

tooth 131 any of a number of peripheral teeth 132 of a stop disc 133 depending upon the possible number of contact sets which are to be operated thereby.

As soon as the assembly 35 starts to rotate under impetus of the driving discs 37 and 38 of shaft 32, the release being effected upon the energization of magnet 127, the apex of cam 113 rides off its follower lever 134, Fig. 1, and as a result the contact pair 114 is permitted to come ajar since each one of the follower levers such as 134 is provided with an individual spring 135 suited to this performance, as best indicated in Fig. 4. As soon as the contact pair 114 opens, the control over magnet 127 by the manual start key 125 is withdrawn and thereafter magnet 127 in order to remain energized obtains ground from a source supervised by cam 116 whose apex, Fig. 7, continues over a peripheral angle that is substantially the complement of 360° from the apex angle of cam 113.

Referring now to Fig. 8 it will be noted that contact pair 117, which is one of three contact pairs under the supervision of cam 116, becomes effective alternatively with contact pair 114, insofar as introducing ground to the winding of magnet 127 is concerned. Whereas contact pair 114 is connected over line 126 to the ground supplied upon the closure of button 125, contact pair 117 supplies ground from a source 147 over a line 136 through the closed contact pair 137, line 138, contact pair 118 which is closed during the same time that contact pair 117 is closed, over line 149, contact pair 143, to a ground source 147.

It is to be understood, of course, that in setting up the keyboard 77 for the purpose of transmitting a message, the key bars 81 of one or more of the integer sections 96 or 97 are actuated before the start key 125 is actuated, and in accordance therewith a contact point 144 of one of the ten integer lead wires 139 is brought into electrical contact with a common bus 145, and also the conductor 141 of each unit is closed with a conductor 153. As a consequence, ground is placed on line 141, and the twenty-first solenoid 62 is conditioned for energization which energization is completed when contact pair 122 is closed by the multiple apex cam 121. As a result of the energization of solenoid 62, see Fig. 6, its armature is projected rightwardly as in the case of the general class of armatures 72, bell crank 64 is rocked clockwise about pivot 65 and member 61 is pivoted clockwise causing it to be pivoted about its mounting screw 142. This movement releases trigger 61 to its retractile spring 140 and the downwardly extending arm 143, which had been holding closed the contact pair 137, is permitted to recede therefrom breaking the ground circuit to the magnet 127 and thereafter causing to be arrested the further rotation of cam assembly 35 because the armature 129 will at once engage an oncoming tooth 132 of the stop disc 133.

As a further result of the energization of magnet 62, and one which has already been mentioned above, blocking projection 59 will be withdrawn from a previously set one of the pawls 54 that had been holding the assembly 36 against rotation and in consequence, this assembly will be permitted to rotate in a counterclockwise direction, as viewed in Fig. 5, carrying with it the scalloped cam 53 and through it causing to be oscillated the entire cradle assembly including tandem bar 58 and the multiple switches 22. The number of oscillations which are permitted to be

made by assembly 36 will depend upon the angular distance between the previously set pawl 54 which had been holding the assembly through its engagement with blocking tooth 59 and the newly set pawl 54 which is dislodged by the operation of one of the integer keyboard sections 96 and 97 and which will again cause the arrestment of said assembly.

When the key bars 81 are depressed, there is effected in each case a closure of one of a contact pair 144, Fig. 8, which is electrically connected over one of the lead wires 139 of cable 78 with a particular solenoid 69 or 71, and a common bus bar 145 which ultimately obtains ground. Also as a result of the energization of any key bar 81 of an integer set, there is effected a closure of the common contact pair designated 146 individual to each integer set 96 or 97. The contact pair 146 consists of one contact which is connected to the twenty-first solenoid 62 and another contact which is connected to one of the lower rows of cam contact pairs 104, 106, 108, 111, or 123, Fig. 8.

As a result of the closure of any contact pair 146, ground is introduced from source 147, manual switch contact pair 148, line 149, through the contact pair 118 which remains closed during the long apex period of cam 116, line 151, the particular one of the above-mentioned pairs of contacts 104, 106, etc., relating to the associated integer section 96 or 97, through the particular wire in cable 152 which relates to said integer sections, thence over its individual line 153, contact pair 146 and the twenty-first magnet line wire 141 through the winding of solenoid 62, line 154, contact pair 122, which is closed twenty-one times during the cycle of rotation of cam assembly 35, to positive current source.

The tolling unit 11 is driven by the motor 23 as already explained receiving power from an alternating current source 155 when a supervisory control relay 156 is energized in response to the closure of a switch 157 located in the keyboard unit. In addition to the afore-described responses resulting from the operation of any one of the key bars 81 in the keyboard unit 77, it is to be understood that permutation code signals may simultaneously be generated under the control of permutation code closing contact pairs as explained in the foregoing described copending application. At each outlying station, therefore, in addition to the provision of the afore-described means for creating an audible signal indicative of destination station identification or/and any other information desired to be thus communicated, there is also provided means for making a printed record of this and other information such as time signals, etc., within the contemplation of the disclosure in said copending application.

There having been explained above a structural description of the toll bell operating unit as well as the circuit connections incident to the keyboard which supervise the performance of said unit, there will now be described in more particular detail, a typical cycle of operation under the supervision of the keyboard apparatus in order that the precise sequence of functional responses may be related in the order of their occurrence. Accordingly, let it be assumed that a station identifying signal together with such other information as is desired to be broadcast by means of the tolling gong, consists of the composite codal number 14-3-9-1-2.

It is incumbent upon the keyboard operator to make certain that the motor start contact pair 157 is closed at the start of transmission in order

that the motor 23 of the tolling apparatus 11 is in operation. In accordance with this arbitrary conception, the keyboard operator at the central office will depress the key tops 81 of integer sections 97 in the number 4 position which, as explained above, corresponds to the fourteen integer solenoid 71, thereby preparing the keyboard for transmission of 14 gong signals; the number 3 key bar 81 of the left-hand unit 96 which will prepare for the transmission of the number 3 integer; the number 9 key top 81 in the second unit 98; the number 1 key top 81 in the third unit 96, and finally, the number 2 key top 81 in the last unit 96, the foregoing order being readable from left to right as viewed in Fig. 8.

Following the setting up of the code number upon the keyboard 77, the operator will close the manual start key 125 and introduce ground upon line 126 through contact pair 114, which is closed during the rest position of the unit 11, winding of start magnet 127, line 128, to positive. As a result, magnet 127 will become energized and will attract its armature 129 withdrawing stop shoulder 131 from the tooth in wheel 133 which corresponds to the zero arrestment position.

Cam assembly 35 will then be initiated into rotation under the driving impetus of shaft 32 and its associated driving discs 37 and 38 which act through the frictional driving discs 39 upon said assembly 35. As soon as contact pair 114 is permitted to open in consequence of the riding off by apex of cam 113 of the contact pair 114, see Fig. 4, the long apex cam 116 will close the three contact pairs 117, 118, and 119 simultaneously. As a result of the closure of contact pair 117, ground will be supplied to the winding of magnet 127 from a circuit including line 136, contact pair 137, line 133, contact pair 118, line 149, contact pair 148, to ground at 147. The rotation of the cam assembly 35 will continue until the first one of the class of cams which close contact pairs 105-104, 106-107, etc., will become effective. In the order in which the arrangement of cams is laid out in accordance with Fig. 7, the first one of these to become effective is cam 99 acting upon contact pairs 104 and 105. As a result of the closure of these contact pairs, there will be energized the number 14 solenoid 71 and the twenty-first or storage disc release solenoid 62 over the following circuit.

Beginning at positive current source, the circuit continues through the contact pair 82, common wire 79, through the winding of the number 14 solenoid 71, its particular line 139 in cable 78 to the contact point 144, its particular common bus 145 in its associated bank 97, thence over an individual line in cable 152 through contact pair 105, line 151, contact pair 118, line 149, contact pair 148 to ground at 147. As a result, the number 14 solenoid 71 will become energized and will cause to be displaced the pawl 54 which happens to be fourteen angular positions distance from the previously arrested pawl 54. As a result of the closure of contact pair 82 which occurs substantially simultaneously with the closure of the several contacts on cam 116, a circuit is completed for the energization of the twenty-first or assembly 30 release magnet 62. This is traceable from positive current, through the contact pair 122, line 154, winding of solenoid 62, line 141 of cable 78, and its associated contact pair 143, line 153 thereof, and its related continuation in cable 152 through the contact pair 104, line 151, contact pair 118, over line 149 through contact pair 148, to ground at 147.

As a result of the energization of the storage disc release magnet 62, the disc 36 is started into rotation and the cam assembly 35 is arrested. In consequence of the energization of solenoid 62, its armature causes bell crank 64 to be rocked in a clockwise direction, as viewed in Fig. 6. This releases the wheel 36 for rotation but also on account of its articulation with bar 61 which is pivoted at 42, contact pair 137 is opened when said member 61, acting against its spring 140, withdraws projection 143 from said contact pair. In consequence of this, armature 129 is permitted to present its stop shoulder 131 into the path of oncoming tooth 132 in stop disc 133. Meanwhile, wheel 136 is permitted to rotate through an angular distance equivalent to fourteen of the consecutive angles represented by the pallets 54.

This rotation carrying with it scalloped cam 55 causes to be initiated fourteen tolling gong signals to the several circuits connecting to the goings 95. Because the projections on multiple apex cam 121 are of such short duration, contact pair 122 is opened before the assembly wheel 35 comes to rest and as a result solenoid 62 again becomes de-energized permitting its circuit at contact pair 137 to become closed. Meanwhile magnet 127 may not again become reenergized because its associated contact pair at one of the cams 99, 93, 101, etc., is no longer in position to hold closed its contact pair 104, 105, 106, 107, etc.

Assembly wheel 36 will then come to rest when the set pawl 54 encounters shoulder 59 of stop trigger 61. Upon the collision between pawl 54 and shoulder 59, member 61 is moved forwardly, as viewed in Fig. 6, in accordance with the provision made at pivot 142 where elongated hole 150 is provided in trigger 61. As a result of the forward motion of trigger 61, the bulbous extremity 143 again closes contact pair 137 and thereupon magnet 127 may become reenergized attracting its armature 129 and again freeing the cam assembly 35 to rotation.

Assembly 35 will continue to rotate until the next succeeding one of the contact pairs relating to the keyboard banks 96 is encountered. This contact pair is the one designated 106 and 107 which is closed by the cam 93, Fig. 7. As a result of the closure of contact pairs 106 and 107, circuits are established traceable from positive current source through contact pair 82 which is momentarily closed by one of the apices of multiple apex cam 83, line 79 through the winding of the number 3 solenoid 62, thence over individual line 139 relating to said solenoid in the cable 78 to contact point 144 and its associated common bus bar 145, thence through its individual line in cable 152, contact pair 107, line 151, contact pair 118, line 149, contact pair 148, to ground at 147. This energizes storage relay 3 while at the same time through the closure of contact pair 106 a circuit is completed traceable from positive through contact pair 122 which is momentarily closed by reason of the briex apex of multiple apex cam 121 which closes its contact pair 122 shortly after the contact pair 82 is closed, thence over line 154, through the winding of the solenoid 62, its individual line wire 141 of cable 78, through the particular pair of contacts 146 relating to the integer unit in which the next operated key lever 91 is depressed, thence out over line 153 of cable 152 through the contact pair 106, line 151, contact pair 118, line 149, contact pair 148, to ground at 147. As a result of the energization of solenoid 62 contact pair 137 is opened after the manner already described, thus de-energizing

start magnet 127 and permitting the cam assembly 35 again to be arrested upon armature shoulder 131 encountering an oncoming tooth 132 of stop disc 133. As a further result of the energization of solenoid 62, assembly 36 is released to rotation and in this case will continue to rotate through an angle equivalent to three intervening angles between the pallets 54 and will come to rest when the pallet which had been lined up with the number 3 solenoid and which had been displaced by the energization thereof encounters the stop lug 59 of trigger 61.

During the transit of the assembly 36, its scalloped cam 55 causes to be rocked the cradle assembly including lever 85, tandem bar 88, and the several cradles 89 whereupon all of the mercury switch tubes 22 open and close their respective circuits generating exciting impulses for the gongs 95 and sounding out a number of audible gong signals corresponding to the number of cam apices which pass follower roller 84, in the instant case three.

Thus the operation proceeds on to the third release of cam assembly 35 in response to which nine impulses are generated and a total of nine signals caused to be broadcast by the gongs 95 during the succeeding interval and followed thereafter by a similar period during which a single gong signal is broadcast and, in correspondence with the last integer, two gong signals are broadcast as the final cam 103 effects its function of closing the contact pairs 123 and 124.

When following the transmission of the final signal, storage assembly 36 for the last time encounters trigger 61 and causes the closure of contact pairs 137, a circuit is established for energizing release magnet 127 which remains energized until its circuit is broken at contact pairs 117, 118, and 119. Of these the contact pair 117 is effective to interrupt the flow of ground from source 147 and because the contact pair at 125 is not then manually energized, magnet 127 will thereat become de-energized and the cam assembly 35 will be arrested in its zero position; namely, with cam 113 disposed so that its apex closes the contact pair 114 in readiness for a subsequent message signal transmission.

While the present invention has been explained and described with reference to a particular embodiment as indicated in the foregoing detailed specification and in the accompanying drawings, it is contemplated, nevertheless, that numerous modifications and variations may be incorporated without departure from its essential spirit or scope. Accordingly, it is not intended to be limited by the specific language employed in the foregoing specification nor by the particular details in the accompanying illustrations except as indicated in the hereunto appended claims.

What is claimed is:

1. In a numerical tolling system, apparatus for generating interruptions comprising a continuously rotatable shaft, a cam assembly frictionally driven by said shaft, a storage device frictionally driven by said shaft, keyboard supervised means for transferring the control among successive cams of said cam assembly in accordance with decimal components of a code, means for storing a signal condition in said storage device representing a numerical integer of a decimal position, and a series of circuit breakers operated by said storage device in accordance with the numerical integer stored in said device.
2. In an alarm sounding system, a keyboard apparatus comprising a plurality of rows of keys

each having a number of circuit controlling contacts and a common contact, a rotary storage device, a mechanism for generating a number of alarm signals in accordance with the number of predetermined angles of rotation imparted to said storage device, and circuit means under the control of said controlling and common contacts of said rows of keys consecutively for controlling the rotation of said storage device according to angle.

3. In a signaling mechanism, a rotatable signal controlling apparatus having a plurality of settable storage members at equally spaced angular distances on the periphery thereof, a circular arrangement of stationary electromagnets in alignment with said settable members when said apparatus is at rest, mechanical transfer means associated with each one of said settable members and operated by any of said electromagnets when in alignment therewith for setting said members, and means for restoring said settable members to normal position after releasing said apparatus to rotation.

4. A signaling apparatus comprising in combination, a plurality of reciprocable cradles, a rotatable assembly including a cam having peripheral characteristics for reciprocating said cradles, a plurality of angularly spaced settable members carried by said rotatable assembly and electromagnetic means for displacing each one of said settable members and for releasing to rotation said rotatable assembly so as to impart a total angle of rotation to said cam corresponding to the number of settable members from a previous arrested position to the position of displacement of said settable member.

5. In a signal transmitting apparatus, the combination comprising, a rotating shaft, a storage assembly frictionally carried by said shaft and having a number of peripherally disposed longitudinally displaceable settable elements, a corresponding plurality of electromagnets stationarily supported in alignment each to each with said settable elements, a stop trigger, one of said electromagnets comprising a release for operating said trigger, and the rest of said electromagnets effective to displace said elements from their unset to their set positions.

6. In a tolling system, apparatus for generating signals over a plurality of circuits simultaneously comprising a continuously rotatable shaft, an integer selecting cam assembly comprising a series of cams driven by said shaft, a signal impulse storage device rotated by said shaft, and keyboard supervised means for transferring the control from one cam to another of said series in accordance with successive decimal positions of a code message and for storing a signal condition in said storage device corresponding to the integer of a decimal position.

7. In a fire alarm system, a keyboard apparatus comprising a plurality of rows of integer keys, each row having a number of circuit controlling elements corresponding to a decimal position and a release contact set, a signal transmission unit comprising a rotary integer storage device and a cam assembly including one cam for each decimal position, a mechanism having reciprocal motion in accordance with the number of predetermined angles of rotation imparted to said storage device, and circuit means under the control of said key rows sequentially and to said contact set for transferring the supervision from one cam to another of said cam assembly and for thereby rotating said storage device and reciprocal mo-

tion mechanism through a number of degrees of rotation a number of times corresponding to the integer of an operated key.

8. In a signal storage mechanism, a rotary device having peripherally and at equally spaced angular distances from each other a plurality of settable storage members, a plurality of electromagnets corresponding in angular placement with said settable members for setting any of said members in accordance with its ordinal position from a previous setting of a member of said rotary device, and means for restoring a settable member to its unset position.

9. A signaling apparatus comprising in combination a plurality of cradles, a rotatable assembly including a cam for reciprocating said cradles, circuit breakers carried by said cradles, a plurality of members carried by said assembly, means for positioning said members and for releasing to rotation said assembly to describe an angle of rotation corresponding to the distance from its previous arrested position to the one of said positioned settable member.

10. Means for generating interruptions in a plurality of circuits simultaneously comprising in combination, a plurality of mercury switch elements supported in reciprocable cradle members, a leverage system for reciprocating said cradle members, a cam having a number of peripheral apices corresponding to the number of reciprocations to be imparted to said lever system during a cycle of rotation, and a device frictionally driven in integral relation with said cam including a series of peripheral elements corresponding in number to that of the apices of said cam and operative to be displaced to intercept a characteristic number of cam apices following a preceding arrestment of said device.

11. In a signal impulse generating unit, the combination including a continuously rotatable shaft, a plurality of cams driven through frictional coupling by said shaft and corresponding to successive decimal components of signals, a frictionally driven rotatable member having a plurality of peripheral storage elements each corresponding to an integer of said decimal positions, keyboard supervised means for releasing to rotation said cam assembly to select a decimal, and circuit means under the supervision of said plurality of cams for releasing said storage device to rotation to select an integer.

12. In a system of signal transmission, a keyboard apparatus having a plurality of sets of integer keys, means for storing a signal upon the manual depression of any key lever of a set, a rotary signal generating device comprising a plurality of storage members each corresponding to an integer, trigger means for arresting said rotatable device by the blocking of a displaced storage member, and a cam distributor comprising a plurality of cams each for associating successive integer key sets of said keyboard with said storage device.

13. In a signal transmission system, a keyboard device, a continuously rotatable shaft, a storage device frictionally driven by said shaft, a cam device frictionally driven by said shaft, a plurality of sets of key bars in said keyboard device each set relating to a decimal position and each key bar of a set relating to an integer of a decimal position, a plurality of cams in said cam device each related to a decimal position of said keyboard device, a plurality of storage elements in said storage device each related to an integer of a decimal position, and means comprising circuit

connections between said keyboard and said storage device under the supervision of said cam device for successively associating decimal positions in a predetermined sequence of said keyboard with said storage device.

14. In combination, a rotatable coding apparatus comprising an interrupter cam having a series of interruption characteristics, a corresponding series of settable stops carried by said apparatus, a corresponding series of actuators disposed to align with said series of stops during arrestment of said apparatus, one of said series of actuators operative to release a set one of said stops when the latter is disposed in effective position, and the remainder of said actuators disposed to set said stop in effective condition.

15. In combination, a keyboard apparatus having a plurality of sets of integer keys, a rotary signal generating device comprising a plurality of storage members each corresponding to an integer, means for storing a signal in said device upon the manual depression of any key lever of a set, means for arresting said rotatable device by the blocking of a displaced storage element, and a cam distributor comprising a plurality of cams each for associating successive integer sets of said keyboard with said storage device.

16. In combination with a keyboard device, a continuously rotatable shaft, a storage device and a cam device each frictionally driven by said shaft, a plurality of sets of key bars in said keyboard device each set relating to a decimal position and each key bar of a set relating to an integer of the decimal system, a plurality of cams in said cam device each related to a key bar set of said keyboard device, a plurality of storage elements in said storage device each related to an integer, and means under the supervision of said cam device for associating key bar sets of said keyboard with said storage device in a predetermined sequence.

17. In a fire alarm system, a plurality of keyboards for storing decimal integers, a constantly rotating shaft, a cam assembly frictionally driven by said shaft, a cam on said cam assembly corresponding to each of said keyboards, a single integer storage assembly frictionally driven by said shaft, and means under the control of said cams to set successively said single integer storage assembly corresponding to the integers stored in said keyboards to generate tolling impulses.

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