J. DÖNITZ.

FIRE ALARM SYSTEM.

APPLICATION FILED DEC. 28, 1906.

Patented Mar. 23, 1909.

916,280.

2 SHEETS—SHEET 1.

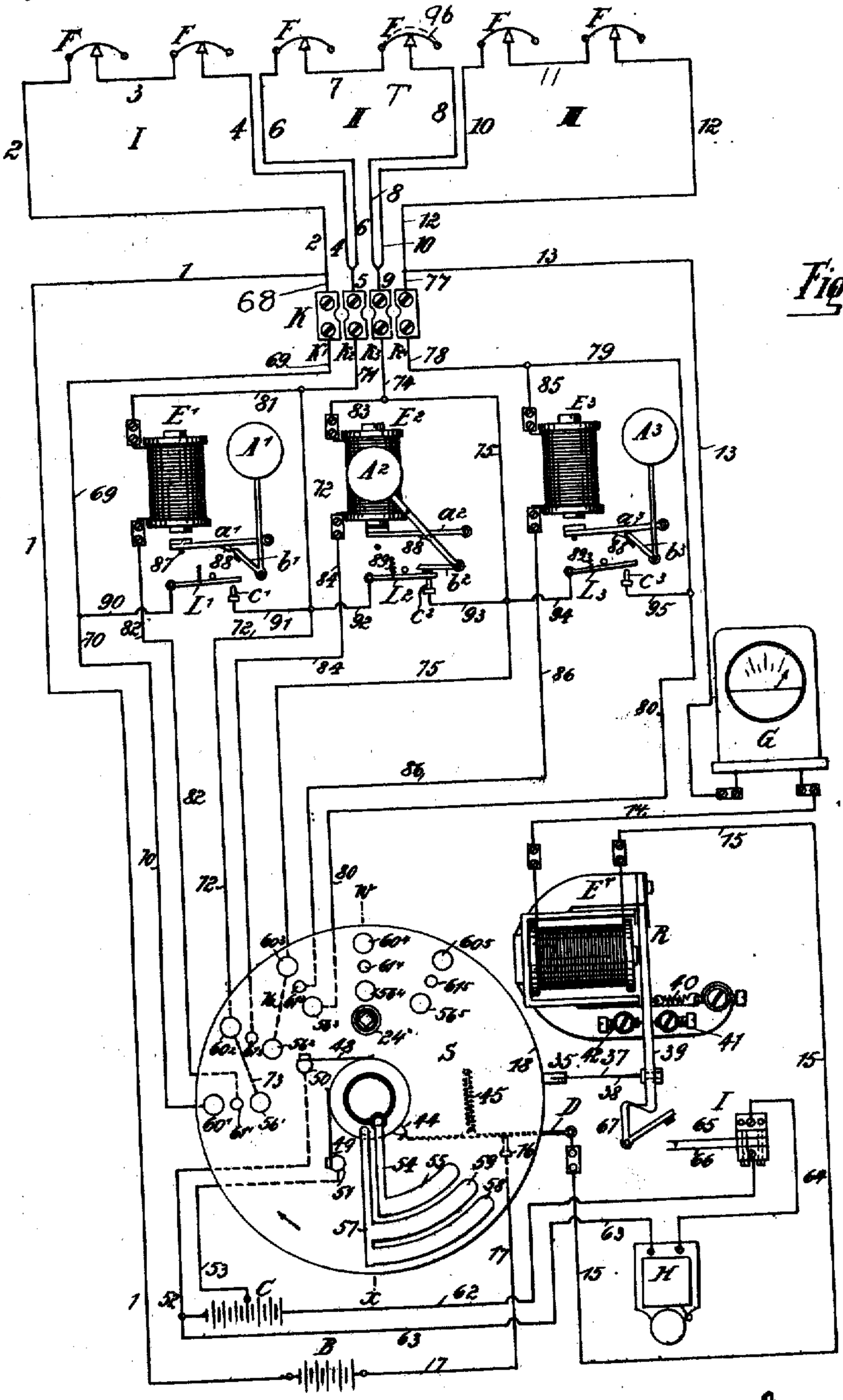

Fig. 1.

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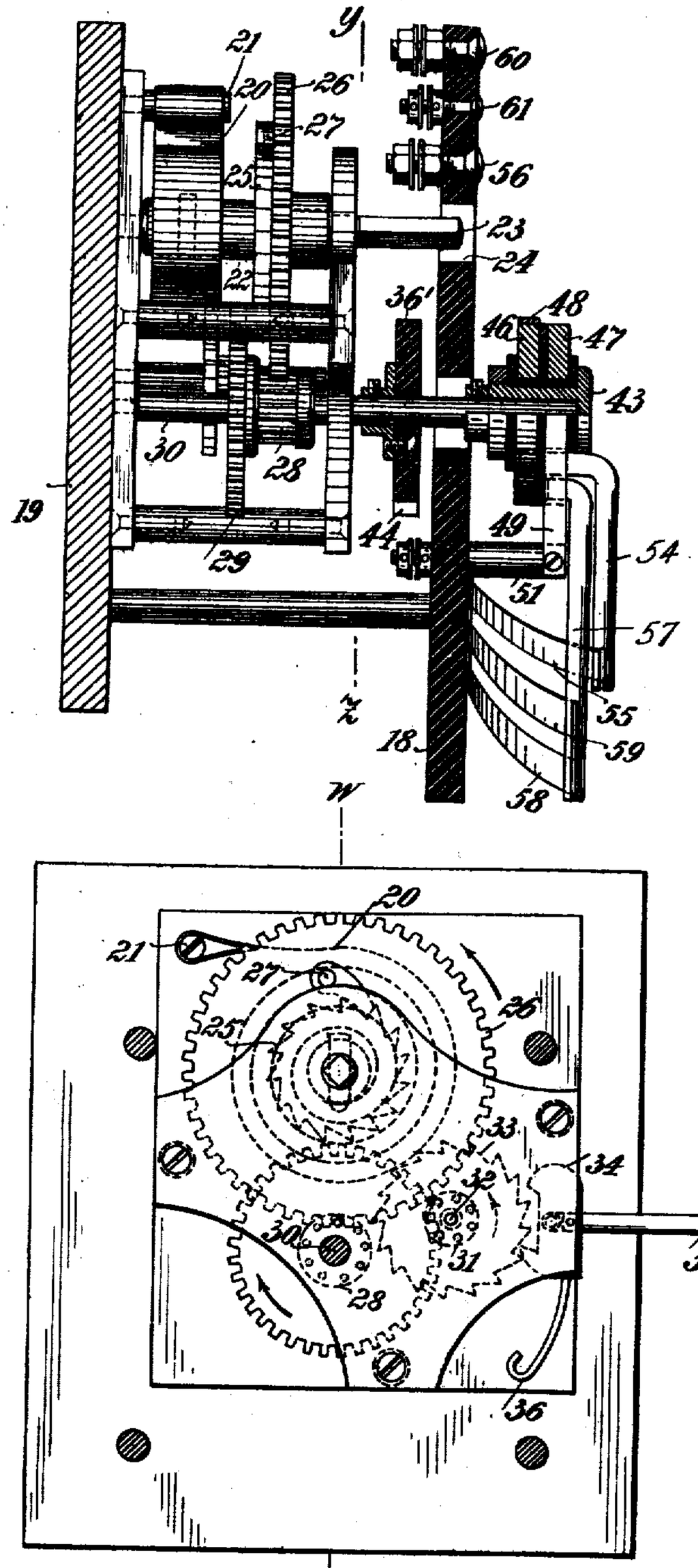

Fig. 2.

Fig. 3.

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UNITED STATES PATENT OFFICE.

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FIRE-ALARM SYSTEM.

No. 916,280. Specification of Letters Patent. Patented March 23, 1909.

Application filed December 28, 1906. Serial No. 349,865.

To all whom it may concern:

Be it known that I, JOHANNES DÖNITZ, a citizen of the Empire of Germany, residing at Leipzig, in the Empire of Germany, have invented a new and useful Fire-Alarm System, of which the following is a specification.

There are known fire alarm systems which are each divided into a number of sections, so that at the central station it may be possible to ascertain in which part of a building or the like a dangerous increase of the temperature occurs. Hitherto it was for instance customary to insert in each section with constant current an annunciator drop, which on the current being broken by some thermostat is caused to drop. In such systems, however, frequently the necessity of connecting in multiple several batteries could not be avoided. Other fire alarm systems with constant current, in which all the thermostats are connected in series with a battery and a subsidiary device such as a relay or the like, present the defect, that the switching device requires constant and special attention.

My invention relates to a fire alarm system, which combines the advantages of the above two known kinds of systems and avoids their defects. The new system is divided into several sections, which normally form together a single circuit and therefore can be worked with a single battery. The arrangement of the several sections is such, that not only any section in which a thermostat in consequence of a dangerous increase of the temperature breaks the current can be at once made known to the central station, but also several sections in which thermostats break the circuit can be simultaneously made known. Thus the defects of the said two known kinds of fire alarm systems, viz. voluminous batteries for continuous current on the one hand, and constant and special attention to the switching device or devices on the other hand are avoided.

I will now proceed to describe my invention with reference to the accompanying drawings, in which—

Figure 1 is a diagram of a fire alarm system, Fig. 2 is a vertical section, on an enlarged scale, through the line *w—x* in Fig. 1 and also through the same line in Fig. 3 and shows a switching device partly in section and partly in elevation, Fig. 3 is a vertical cross section through the line *y—z* in Fig. 2, Fig. 4 is a diagram of a fire alarm system divided into three groups, each of which is similar to the simple system in Fig. 1, and Fig. 5 is a modification of the same.

Similar characters of reference refer to similar parts throughout the several views.

In Fig. 1 the system is assumed to be divided into three sections I, II, III each of which comprises several thermostats F F of any known construction. In accordance therewith a gravity drop annunciator with three annunciator drops A^1, A^2 and A^3 and their electromagnets E^1, E^2 and E^3 is disposed at the central station. At the latter moreover two batteries B and C, a switching device S, a switch D, an electric bell H, a cut-out I, a relay R, a galvanometer G and a series of plug contacts K are disposed. The one pole of the battery B is connected with the first section I by means of lines 1 and 2 and the other pole of the battery B with the last section III by means of the lines 12 and 13, the galvanometer G, the line 14, the electromagnet E^r of the relay R, the line 15, the switch D, the contact piece 16 and the line 17. The thermostats F F in each of the sections I, II and III are connected in series by lines 3. . .7. . .11. . . and are each arranged to break the circuit on the temperature becoming dangerously high. The battery B is arranged to normally send a constant current through the circuit just described.

The switching device S comprises a clockwork shown at Figs. 2 and 3 and a supporting disk 18 of insulating material both of which may be secured on a suitable board 19 in any known manner. The clockwork comprises a spiral spring 20, which is fastened with its external end on a stud 21 and with its internal end on a winding shaft 22, that projects with its square end 23 into a hole 24 of the disk 18 and can be wound up in the direction of the arrow in Fig. 1 by means of a key as usual. The winding shaft 22 has fast on it a ratchet wheel 25 and loose a gear wheel 26, which latter carries a spring-pressed pawl 27 for engaging in the ratchet wheel 25. The gear wheel 26 is arranged to put into motion an escapement 34 by means of a pinion 28, its shaft 30, a gear wheel 29, a pinion 31, its shaft 32 and an escapement-wheel 33, these parts turning in the directions of the several arrows shown in Fig. 3. The escapement 34 is rigidly connected with two arms 35 and 36, of which the one 35 is provided with a straight

spring 37. The latter can engage with a stop 38 on the armature 39 of the relay R, see Fig. 1. A helical spring 40 tends to detach the armature 39 from the core of the electromagnet E^r and to press it on a stop 41. However, as the battery B circulates a constant current through the circuit mentioned above, it will be seen, that the armature 39 is normally attracted by the electromagnet E^r and is pressed against the other stop 42, so that its stop 38 checks the escapement 34. The shaft 30 of the clockwork extends through the central opening of the disk 18 and has fastened on it a circular disk 36^1 of insulating material and a supporting sleeve 43. The disk 36^1 is provided with a cam 44, which serves for normally pressing the elastic switch D on its contact piece 16 and thereby closing the circuit of the battery B. A helical spring 45 tends to detach the switch D from the contact piece 16 and thereby to break the said circuit. On the supporting sleeve 43 are fastened and insulated therefrom and from each other two annular contact disks 46 and 47, on which two contact springs 48 and 49 respectively constantly bear. These contact springs 48 and 49 are supported on the disk 18 by means of two binding posts 50 and 51, which are connected with the battery C by lines 52 and 53. The contact disk 46 is electrically connected with a bent arm 54, which passes through the other contact disk 47 and is insulated therefrom. It carries a contact spring 55, which is arranged to slide over the disk 18 and a series of contact pieces 56^1, 56^2, 56^3, 56^4, 56^5. . . disposed in a circle around the center of the disk 18. The other contact disk 47 is electrically connected with a bent arm 57, which carries two contact springs 58 and 59. The free ends of the latter are in the same radial line as the free end of the contact spring 55 and are arranged to slide over the disk 18 and two concentric series of contact pieces 60^1, 60^2, 60^3, 60^4, 60^5 . . . and 61^1, 61^2, 61^3, 61^4, 61^5 . . ., which are arranged in the same radial lines as the contact pieces 56^1, 56^2, 56^3, 56^4, 56^5 . . . . The intermediary contact pieces 61^1, 61^2, 61^3, 61^4, 61^5 . . . are made shorter than the contact pieces in the two other series and it will be understood that during the motion of the clockwork the two arms 54 and 57 are permitted to turn over the two binding posts 50 and 51 and that the two external contact springs 55 and 58 will come in contact with the corresponding contact pieces 56 and 60 in either radial line earlier than the middle contact spring 59 with the respective contact piece 61. The several contact pieces 56, 61, 60 are each electrically connected with a binding post on the rear side of the disk 18, as is shown in Fig. 2. The one pole of the battery C is connected with the cut-out I by a line 62 and the other pole with the electric bell H by a line 63, while a line 64 connects the cut-out I with the electric bell H. The cut-out I comprises two parallel contact springs 65 and 66, which can be brought into contact with each other by means of a bell-crank lever 67, that is normally held by the hooked end of the armature 39 of the relay R. Only on the electromagnet E^r becoming without current and on the armature 39 being detached by the helical spring 40 for releasing the clockwork will the bell-crank lever 67 be permitted to press the upper contact spring 65 on the lower one 66 for closing the circuit of the battery C, so that the electric bell H will ring. The arm 36 on the escapement 34 of the clockwork can be actuated by one's finger while overcoming the tension of the spring 37 for adjusting the two arms 54 and 57 with the three contact springs 55, 58 and 59 with regard to the disk 18.

The series of plug contacts K is shown as comprising four pieces k^1, k^2, k^3 and k^4, which can be at will electrically connected by means of plugs inserted in their recesses. The piece k^1 is connected on the one hand with the lines 1 and 2 by a line 68 and on the other hand with the binding post of the contact piece 60^1 on the disk 18 by lines 69 and 70. The piece k^2 is connected on the one hand with the two lines 4 and 6 by a line 5 and on the other hand with the binding posts of the two contact pieces 60^2 and 56^1 by lines 71, 72 and 73. The piece k^3 is connected on the one hand with the two lines 8 and 10 by a line 9 and on the other hand with the binding posts of the two contact pieces 60^3 and 56^2 by lines 74, 75 and 76. The last piece k^4 is connected on the one hand with the lines 12 and 13 by a line 77 and on the other hand with the binding post of the contact piece 56^3 by lines 78, 79 and 80.

The coil of the electromagnet E^1 is connected on the one hand with the line 71, 72 by a line 81 and on the other hand with the binding post of the intermediate contact piece 61^1 by a line 82. The coil of the second electromagnet E^2 is connected on the one hand with the line 74, 75 by a line 83 and on the other hand with the binding post of the second intermediary contact piece 61^2 by a line 84. The coil of the third electromagnet E^3 is connected on the one hand with the line 78, 79 by a line 85 and on the other hand with the binding post of the third intermediary contact piece 61^3 by a line 86. In the drawing only three sections I, II and III of the circuit are shown for want of space, but it will be understood, that the number of these sections may be increased and should be like the number of radial lines on the disk 18 in each of which three contact pieces 56, 60 and 61 are disposed. In this case it is obvious, that the contact piece 56 in the last radial line on the disk 18 requires to be connected with the last piece k of the series of plug contacts K and that the contact piece 60 in the

last radial line requires to be connected with the contact piece 56 in the preceding radial line as well as with the last but one piece k of the series of plug contacts K.

The armatures a^1, a^2 and a^3 of the three electromagnets E^1, E^2 and E^3 are arranged to normally rest on stops 87, 87 and are provided with noses 88, 88, on which the arms b^1, b^2 and b^3 of the annunciator drops A^1, A^2 and A^3 bear for holding the latter in their vertical positions. Three bridging switches L^1, L^2 and L^3 are disposed beneath the three electromagnets E^1, E^2 and E^3 and are normally detached from their contact pieces c^1, c^2 and c^3 by helical springs 89, 89. The first bridging switch L^1 is connected with the line 69, 70 by a line 90 and its contact piece c^1 is connected with the line 72 and the second bridging switch L^2 by lines 91 and 92. The second contact piece c^2 is connected with the line 75 and the third bridging switch L^3 by lines 93 and 94. The third contact piece c^3 is connected with the line 80 by a line 95. The arms b^1, b^2 and b^3 of the annunciator drops A^1, A^2 and A^3 are severally arranged on being released by the noses 88, 88 of the armatures a^1, a^2 and a^3 to press the bridging switches L^1, L^2 and L^3 on their contact pieces c^1, c^2 and c^3 respectively.

The fire alarm system operates as follows: Normally a constant current will be sent from the battery B through the lines 1 and 2, the thermostats F F and their connecting lines 3 . . . in section I, the lines 4 and 6, the thermostats F F and their connecting lines 7 . . . in section II, the lines 8 and 10, the thermostats F F and their connecting lines 11 . . . in section III, the lines 12 and 13, the galvanometer G, the line 14, the coil of the electromagnet E^r in the relay R, the line 15, the switch D, its contact piece 16 and the line 17 back to the battery B, so that the electromagnet E^r continues attracting its armature 39 to check the clockwork of the switching device S, while the galvanometer G will show that current of the proper amount is circulating. By means of a key the spiral spring 20 of the clockwork is wound up, so that the shaft 30 with the arms 54 and 57 and the contact springs 55, 58 and 59 can make several revolutions. All the annunciator drops A^1, A^2 and A^3 will occupy their vertical positions and thus remain invisible in their respective casings as usual. The bell-crank lever 67 of the cut-out I is held in its normal position shown by the hooked end of the armature 39. This state of the system will continue, as long as everything is all right. Should at some place in the building or the like, say at T in section II in Fig. 1, the temperature become dangerously high, the respective part 96 in the thermostat F will become distorted, as is indicated by the dotted line, and thus break the circuit of the battery B. Then the electromagnet E^r in the relay R will become without current and will release its armature 39 with its stop 38 and thereby the bell-crank lever 67 and the clockwork by means of its spring 37. The bell-crank lever 67 will drop and press the upper contact spring 65 on the lower one 66 of the cut-out I to close the circuit of the electric bell II, so that the latter will ring to call the attention of the official at the central station. The clockwork will be put in motion, so that the shaft 30 with the arms 54 and 57 and the contact springs 55, 58 and 59 will turn in the direction of the arrow in Fig. 1. The cam 44 on the disk 36^1 will release the switch D, so that the latter will be detached from its contact piece 16 by the helical spring 45 and no current can henceforth circulate in the circuit of the battery B. At the moment that the two external contact springs 55 and 58 come in contact with the first contact pieces 56^1 and 60^1 a current will pass from the battery C through the line 52, the binding post 50, the contact spring 48, the contact disk 46, the arm 54, the contact spring 55, the contact piece 56^1, the lines 73, 72 and 71, the plug contact piece k^2, the line 4, the thermostats F F and their connecting lines 3 . . . in section I, and the lines 2 and 68, the plug contact piece k^1, the lines 69 and 70, the contact piece 60^1, the contact spring 58, the arm 57, the contact disk 47, the contact spring 49, the binding post 51 and the line 33 back to the battery C. Thereby it is insured, that the current actually takes the prescribed path through the said circuit. Immediately afterward also the internal contact arm 59 will come in contact with the first contact piece 61^1, so that also a current will pass from the line 72 through the line 81, the coil of the electromagnet E^1, the line 82, the contact piece 61^1 and the contact spring 59 to the arm 57, so the electromagnet E^1 and the section I will be connected in multiple with the battery C. Now that the resistance of the coil of the electromagnet E^1 is made considerably larger than that of the section I, the consequence will be, that but a small part of the whole current will pass through the coil of the electromagnet E^1, so that the latter is unable to attract its armature a^1. Therefore the battery C will not produce any visible effect. The shaft 30 with the arms 54 and 57 continuing to turn, the three contact springs 55, 58 and 59 will leave the three first contact pieces 56^1, 60^1 and 61^1 and after a short while first the two external contact springs 55 and 58 will come in contact with the second contact pieces 56^2 and 60^2. Now that the section II is broken, of course no current can pass through the same. Directly afterward also the middle contact spring 59 will come in contact with the second contact piece 61^2. Then a current will pass from the battery C through the line 52, the binding post 50, the

contact spring 48, the contact disk 46, the arm 54, the contact spring 55, the contact piece 56^2, the lines 76, 75 and 83, the coil of the second electromagnet E^2, the line 84, the contact piece 61^2, the contact spring 59, the arm 57, the contact disk 47, the contact spring 49, the binding post 51, and the line 53 back to the battery C. The electromagnet E^2 being thus energized will attract its armature a^2 and thereby release the arm b^2 and the annunciator drop A^2, so that the latter will drop and appear in the respective window as usual and the arm b^2 will press the bridging switch L^2 on its contact piece c^2, so as to establish an electrical connection between the two lines 72 and 75, in other words to bridge over the section II. The official seeing the annunciator drop A^2 will know, that it is the section II, where danger is approaching or a fire may have broken out.

The shaft 30 with the arms 54 and 57 continuing to turn, the three contact springs 55, 58 and 59 will leave the three second contact pieces 56^2, 60^2 and 61^2 and afterward come in contact with the third contact pieces 56^3, 60^3 and 61^3, when the same series of occurrences will take place in the section III as described above with reference to the section I. At last before the completion of the revolution of the shaft 30 the cam 44 on the disk 36^2 will depress the switch D to close the circuit of the battery B, so that the current will now pass from the battery B through the lines 1 and 2, the thermostats F F and their connecting lines 3 . . . in section I, the lines 4 and 5, the plug contact piece k^2, the lines 71, 72 and 92, the bridging switch L^2, the contact piece c^2, the lines 93, 75 and 74, the plug contact piece k^3, the lines 9 and 10, the thermostats F F and their connecting lines 11 . . . in section III, the lines 12 and 13, the galvanometer G, the line 14, the coil of the electromagnet E^r in the relay R, the line 15, the switch D, the contact piece 16, and the line 17 back to the battery B. Thus the whole system with the exception of the section II will be again in working order without the switching device S requiring any special attention. The place T in section II can be meanwhile examined and the danger can be removed or the fire extinguished, after which the respective thermostat F will resume its normal position, so that at the central station the annunciator drop A^2 can be returned to its vertical position, whereby the bridging switch L^2 will be detached from its contact piece c^2, in other words the section II will be reinserted in the system. Of course the official is at liberty to break the circuit of the electric bell H by turning off the bell-crank lever 67, after his attention has been called.

From the above explanations it will be seen, that the several sections of the system are examined one after the other by means of the switching device S to ascertain the section, in which a danger or fire may be, and that the testing current from the battery C is sent first through any section and directly afterward through the electromagnet of the appertaining annunciator drop to make sure, that the respective section is actually broken. It is also evident, that in several sections danger may occur at the same time and that these sections can be ascertained in the manner described above during a single revolution of the shaft 30 with the arms 54 and 57 and the three contact springs 55, 58 and 59. It is likewise obvious, that afterward any other section, in which some thermostat F is actuated, can be made known at the central station in the same manner as described above, the clockwork being started and the shaft 30 caused to make one revolution.

If necessary a plug may be inserted between any two pieces of the series of plug contacts K for bridging over the respective section, so that repairs or the like may be made in the same without disturbing or rendering ineffective the whole system.

The fire alarm system described may be varied in many respects without departing from the spirit of my invention.

I claim:

1. In an alarm system, the combination with a normally closed circuit divided into a plurality of sections of which one is within the central station, of pluralities of thermostats in the several outer sections of said circuit and each thermostat being adapted to break the circuit, normally open primary inner circuits connected with the division points of said circuit and adapted on being closed to send currents through the corresponding outer sections of said circuit, normally open secondary inner circuits shunted to said primary inner circuits and adapted to severally receive the current on the respective outer section of the circuit being broken, announcing devices in said secondary inner circuits, means controlled by said announcing devices for bridging the several outer sections of said circuit, a relay in the inner section of said circuit, and means controlled by said relay for consecutively closing for a moment the several primary and secondary inner circuits on said circuits being opened.

2. In an alarm system, the combination with a normally closed circuit divided into a plurality of sections of which one is within the central station, of pluralities of thermostats in the several outer sections of said circuit and each thermostat being adapted to break the circuit, normally open primary inner circuits connected with the division points of said circuit and adapted on being closed to send currents through the corresponding outer sections of said circuit, normally open secondary inner circuits shunted to said primary inner circuits and adapted

to severally receive the current on the respective outer section of the circuit being broken, announcing devices in said secondary inner circuits, means controlled by said announcing devices for bridging the several outer sections of said circuit, a relay in the inner section of said circuit, means controlled by said relay for consecutively closing for a moment the several primary and secondary inner circuits on said circuit being opened, the closure of each primary inner circuit preceding that of the secondary inner circuit, and means for closing said circuit after the last primary and secondary inner circuits have been reopened.

3. In an alarm system, the combination with a normally closed circuit divided into a plurality of sections of which one is within the central station, of pluralities of thermostats in the several outer sections of said circuit and each thermostat being adapted to break the circuit, normally open primary inner circuits connected with the division points of said circuit and adapted on being closed to send currents through the corresponding outer sections of said circuit, normally open secondary inner circuits shunted to said primary inner circuits and including electromagnets which can be energized only if the corresponding outer sections of said circuit are severally broken, announcing devices controlled by said electromagnets, means controlled by said announcing devices for bridging the several outer sections of said circuit, a relay in the inner section of said circuit, a source of electricity, means controlled by said relay for consecutively closing for a moment the several primary and secondary inner circuits while connecting them with said source of electricity, the closure of each primary inner circuit preceding that of the secondary inner circuit, and means for closing said circuit after the last primary and secondary inner circuits have reopened.

4. In an alarm system, the combination with a normally closed circuit divided into a plurality of sections of which one is within the central station, of pluralities of thermostats in the several outer sections of said circuit and each thermostat being adapted to break the circuit, normally open primary inner circuits connected with the division points of said circuit and adapted on being closed to send currents through the corresponding outer sections of said circuit, normally open secondary inner circuits shunted to said primary inner circuits and inclosing electromagnets which can be energized only if the corresponding outer sections of said circuit are severally broken, announcing devices controlled by said electromagnets, means controlled by said announcing devices for bridging the several outer sections of said circuit, a relay in the inner section of said circuit, a source of electricity, a clockwork controlled by said relay to move on said circuit being broken, means driven by said clockwork for consecutively closing for a moment the several primary and secondary inner circuits while connecting them with said source of electricity, the closure of each primary inner circuit preceding that of the secondary inner circuit, and a switch controlled by said clockwork for closing said circuit after the last primary and secondary inner circuits have been reopened.

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