Oct. 9, 1934. J. M. JOHNSON 1,976,347

FIRE ALARM SYSTEM

Filed July 21, 1928 8 Sheets-Sheet 1

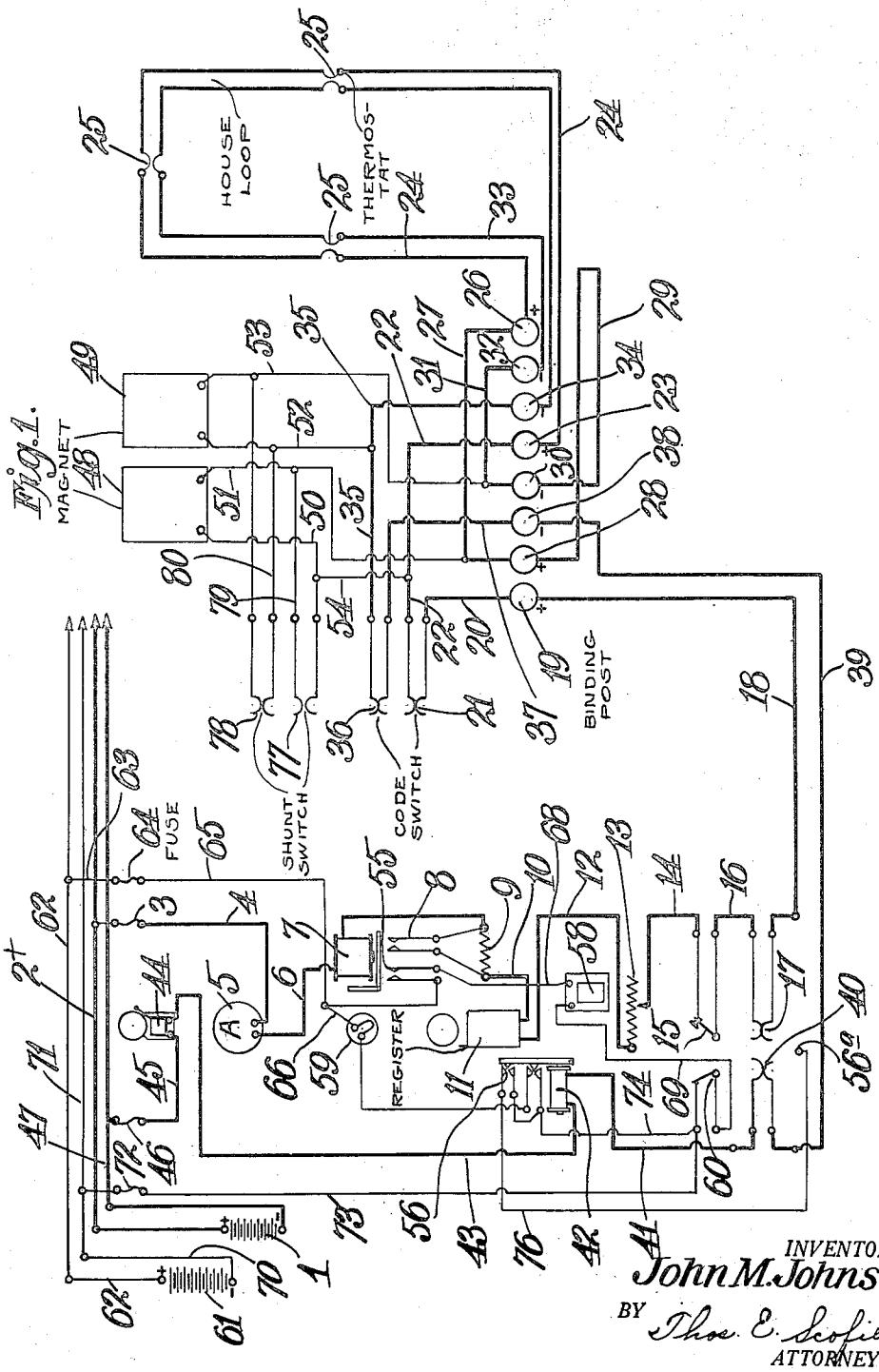


Fig. 1.

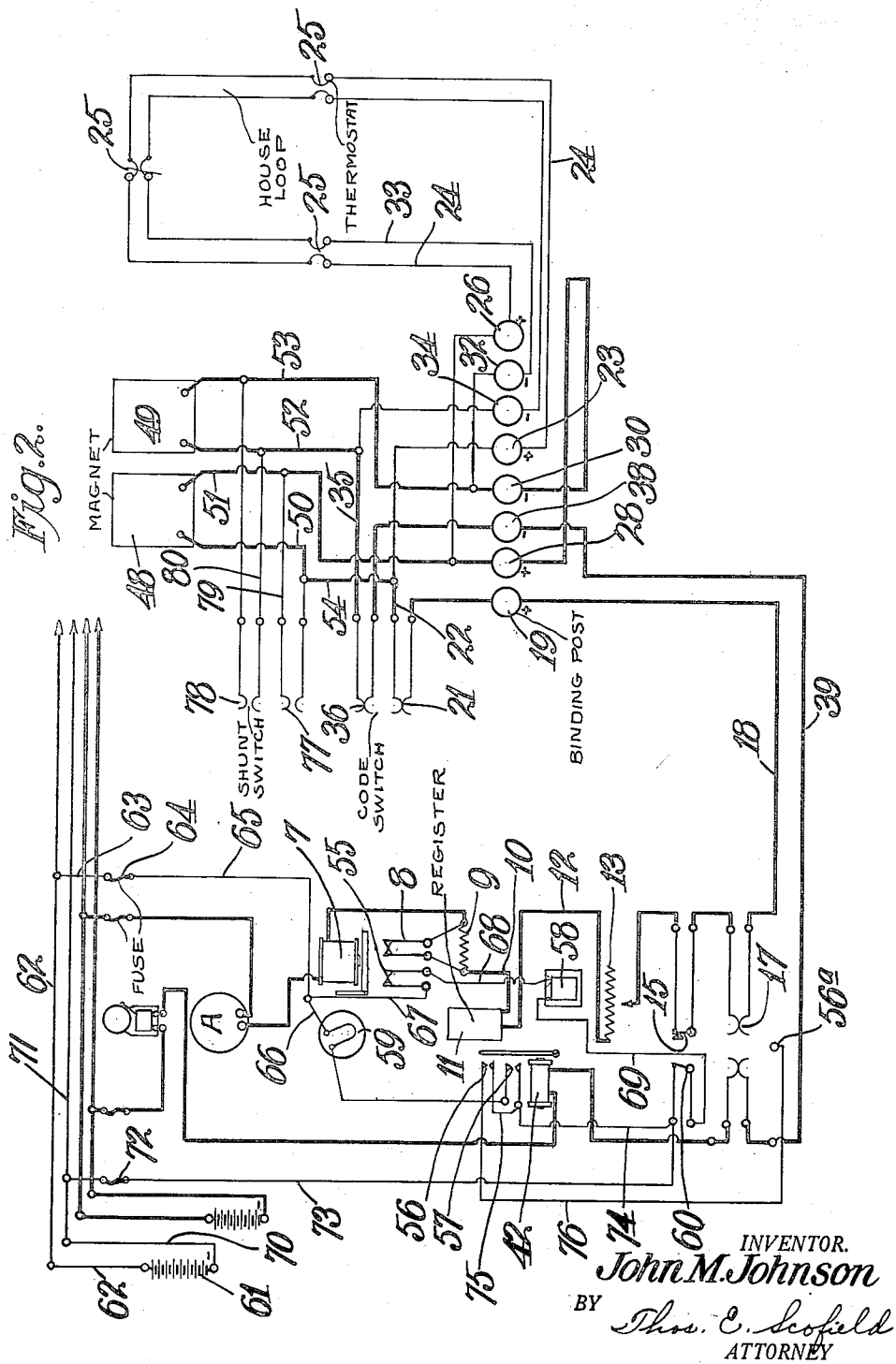
INVENTOR.
John M. Johnson.
BY Thos. E. Scofield
ATTORNEY.

Oct. 9, 1934. J. M. JOHNSON 1,976,347

FIRE ALARM SYSTEM

Filed July 21, 1928 8 Sheets-Sheet 2

Fig. 2.



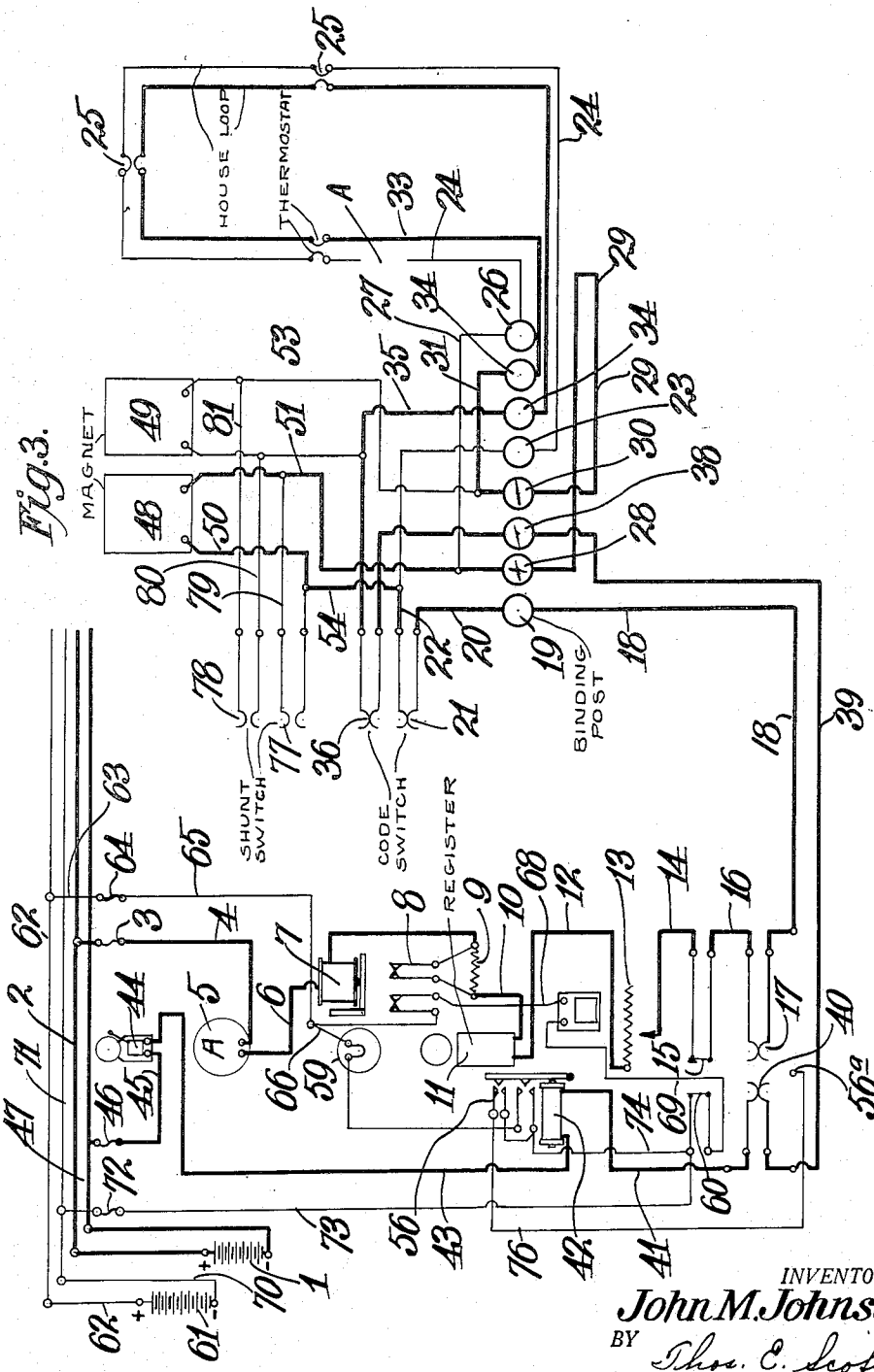
INVENTOR.
John M. Johnson
BY Thos. E. Scofield
ATTORNEY

Oct. 9, 1934. J. M. JOHNSON 1,976,347

FIRE ALARM SYSTEM

Filed July 21, 1928 8 Sheets-Sheet 3

Fig. 3.



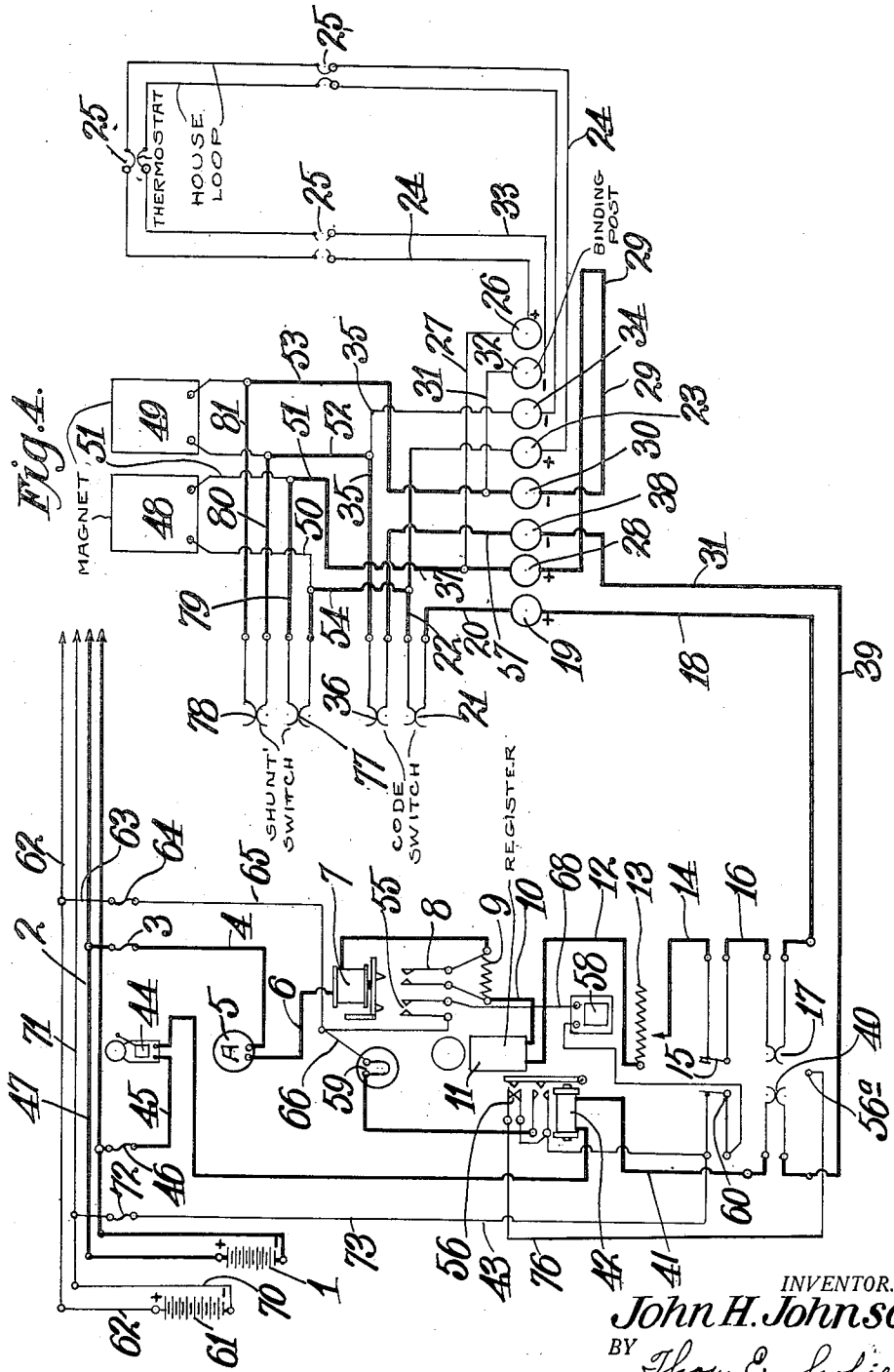
INVENTOR.
John M. Johnson
BY Thos. E. Scofield
ATTORNEY

Oct. 9, 1934. J. M. JOHNSON 1,976,347

FIRE ALARM SYSTEM

Filed July 21, 1928 8 Sheets-Sheet 4

Fig. 4.



INVENTOR.
John H. Johnson
BY Thos. E. Scofield
ATTORNEY

Oct. 9, 1934. J. M. JOHNSON 1,976,347

FIRE ALARM SYSTEM

Filed July 21, 1928 8 Sheets-Sheet 5

Fig.6.

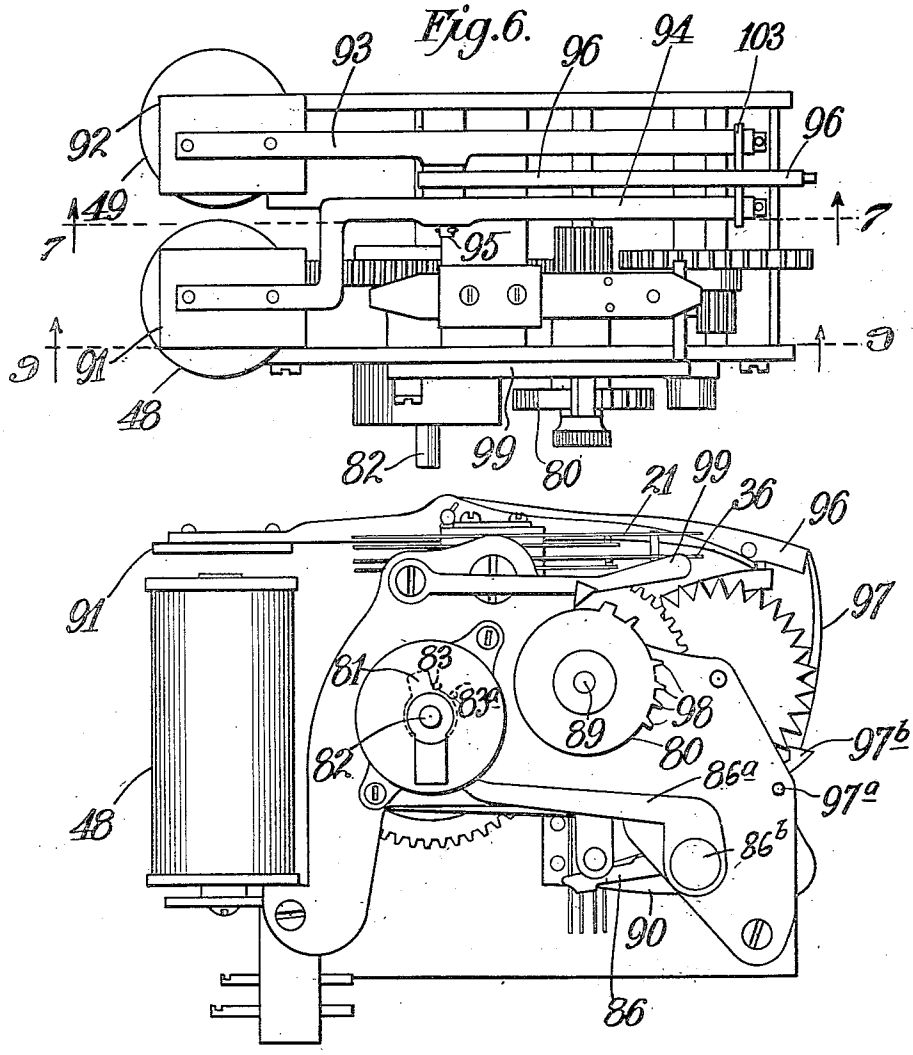


Fig.5.

INVENTOR.
John M. Johnson
BY Thos. E. Scofield
ATTORNEY

Oct. 9, 1934. J. M. JOHNSON 1,976,347

FIRE ALARM SYSTEM

Filed July 21, 1928 8 Sheets-Sheet 6

Fig.7.

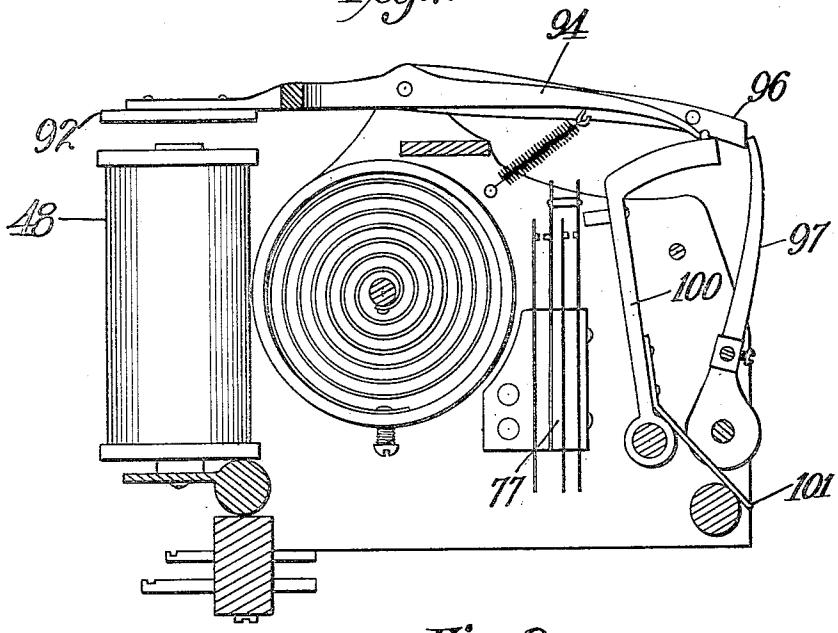
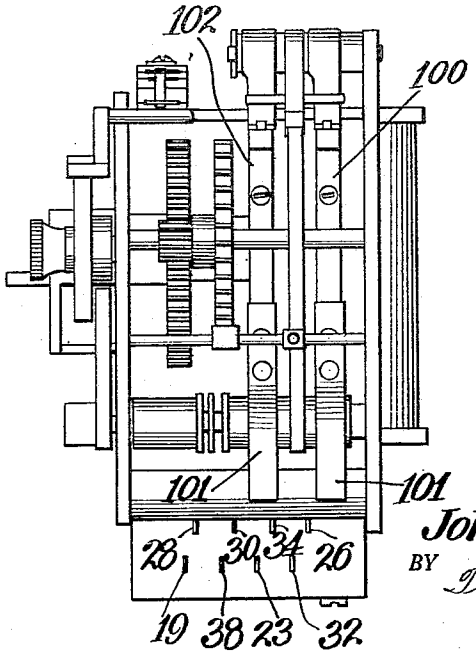


Fig.8.



INVENTOR.
John M. Johnson.
BY Thos. C. Scofield
ATTORNEY

Oct. 9, 1934. J. M. JOHNSON 1,976,347

FIRE ALARM SYSTEM

Filed July 21, 1928 8 Sheets-Sheet 7

Fig.9.

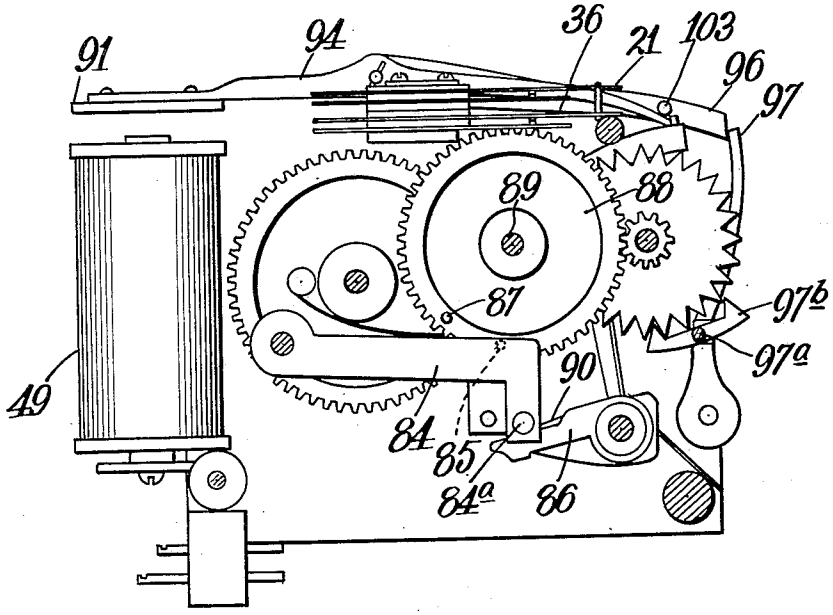
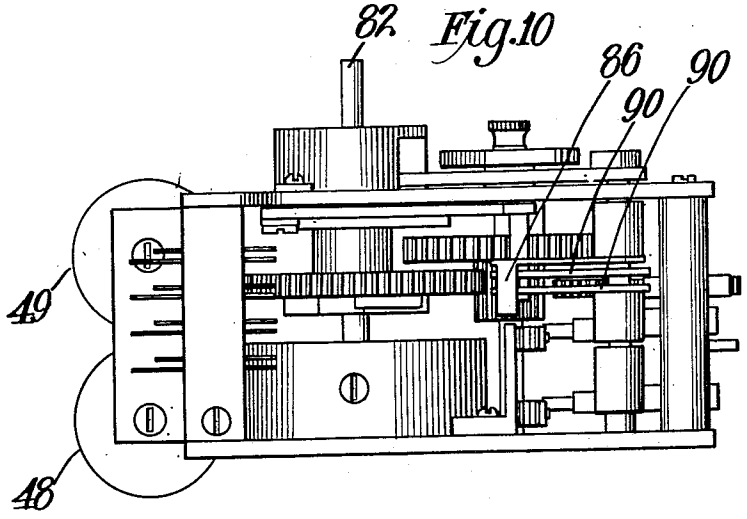


Fig.10



INVENTOR.
John M. Johnson
BY Thos. E. Scofield
ATTORNEY

Oct. 9, 1934. J. M. JOHNSON 1,976,347

FIRE ALARM SYSTEM

Filed July 21, 1928 8 Sheets-Sheet 8

Fig.11.

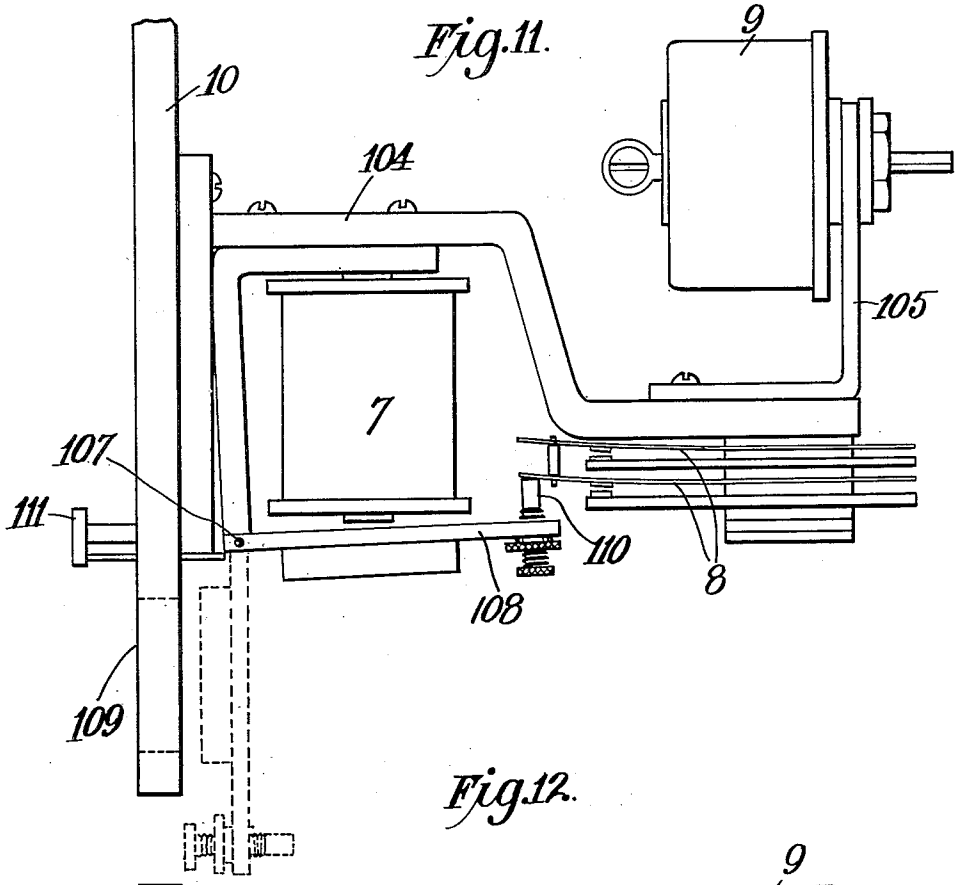


Fig.12.

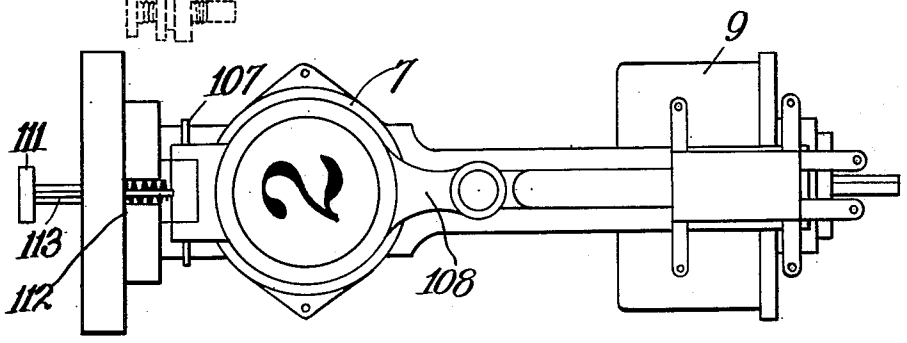
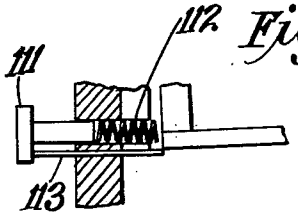


Fig.13.



INVENTOR.
John M. Johnson
BY Thos. E. Scofield
ATTORNEY.

Patented Oct. 9, 1934 1,976,347

UNITED STATES PATENT OFFICE

1,976,347

FIRE ALARM SYSTEM

John M. Johnson, Kansas City, Mo.

Application July 21, 1928, Serial No. 294,346

8 Claims. (Cl. 177—358)

This invention relates to improvements in an automatic fire alarm system, and refers more particularly to a system which is positive in action and which operates on a closed circuit from a central battery, no local batteries being used. The system provides transmission of a fire alarm signal from a protected building or residence in the event of fire, to the central office, recording by code signal the location of the fire.

The system also provides for trouble alarm, that in the event that the house or building line is broken or one side of the thermostat accidentally released, that this rupture will be recorded by a special code signal transmitted to the central office. The system further provides for an emergency fire alarm so that in the event one of the house lines is broken, the system is still operative for an emergency fire alarm, as the house lines are duplicated and therefore afford double protection.

A signal is also provided in the event the current in the lines is diminished below a normal operating value, under which circumstances a signal is recorded in the central office.

Further novelty lies in the transmitter and the automatic drop, controlling the minimum circuit requirement for the closed circuit system.

One of the principal features of the system lies in the fact that it is operated on the principle of opening the circuit rather than making a contact, which assures operation and eliminates the possibility of bad or ineffective contact where an open circuit is used.

In order to describe the details of the system and its operation there are offered four wiring diagrams, and in order that the circuits may be readily traced, the path of the circuit is indicated in heavy lines.

Fig. 1 is a diagram of the wiring, showing the normal position of the system and the flow of the current at this time.

Fig. 2 is a wiring diagram of the fire alarm position after the thermostatic connections have been broken.

Fig. 3 is a trouble alarm position after the disruption of the positive or negative wire.

Fig. 4 is a wiring diagram of position after alarm has been transmitted.

Fig. 5 is a side elevational view of the transmitter.

Fig. 6 is a top view of the transmitter.

Fig. 7 is a view of the transmitter, taken along the line 7—7 in Fig. 6.

Fig. 8 is an end view of the transmitter.

Fig. 9 is a view taken along the line 9—9 in Fig. 6.

Fig. 10 is a bottom view of the transmitter.

Fig. 11 is a side view of the main circuit control drop.

Fig. 12 is a bottom view of the drop shown in Fig. 11 .

Fig. 13 is a detail of the restoring button which swings the drop back into operable position.

Referring to the drawings:

The system operates through a central office and employs two sets of batteries, one main battery and one local battery. The main battery operates the main line instruments and the local battery operates the signal light and buzzer which are positioned on the central office panels hereinafter described. The main line battery may be common or a battery for each circuit. The main signal line may connect as many as four transmitters, one transmitter for each floor of the building, each with a different code.

From the transmitter house wires will be connected in looped circuits with thermostats which are placed on the ceiling, preferably one thermostat to each 144 square feet.

In the event of fire the heat rising to the ceiling causes the thermostat to break the circuit which functions the transmitter to release, thereby recording the alarm signal at the central office.

The system may be divided into three main parts, first the panel positioned in the main office upon which is mounted the mechanism, visual and auditory and record instruments by means of which the alarms are registered and through which the operator is informed of trouble as well as the location of the trouble and fire. Second, the transmitter which constitutes a mechanism which through energized coils functions code and shunt switches which in turn manipulate the proper signal or signals on the recording panels in the central office. Third, the thermostat loops which are positioned in the dwellings or office buildings, or thermostats, may be affixed to any type of mechanical mechanism such as bearings or the like where it is desired to determine when excessive temperatures exist. The latter purpose, namely, the use on bearings or machinery, offers a large field for a system of this character in order that a central office control may be maintained upon large plants or large machine installations.

Referring now to the diagram of wiring shown in Fig. 1, which represents the system in normal position, the current will be followed from the

battery to the operating board through the transmitter and house line.

The current from the battery 1 passes through the positive feed wire 2 and fuse 3, wire 4, milliampere meter 5, wire 6, to a drop which consists of a coil 7, drop contact 8, resistance 9, thence through wire 10 to the punch register 11, shown diagrammatically inasmuch as the construction is known to the art, wire 12 to the variable resistance 13, wire 14, to the telegraph key 15, wire 16 to the line jack 17, main line wire 18 to the positive binding post 19, thence through transmitter wire 20 to the code switch 21, wire 22 to the transmitter binding post 23, house wire 24 to the thermostats 25, which may be of any suitable construction returning to the transmitter binding post 26, wire 27, to the binding post 28, wire 29 to the negative binding post 30, wire 31 to the binding post 32, thence through the house wire 33 to thermostats 25, returning to transmitter binding post 34, wire 35 to code switch 36, wires 37 to binding post 38 and by the main line wire 39 to the line jack 40, thence by wire 41 to the relay 42 and by wire 43 to tap bell 44, finally returning to the main battery 1 through wire 45, fuse 46 and wire 47. It will be seen that the magnets 48 and 49 are shunted in the manner described above.

Referring now to Fig. 2, which shows a system in fire alarm position.

Assuming that one of the thermostats 25 has released both sides of the house wire 24 and 33 which are opened by the functioning of the thermostat. The path of the current will now be through the magnetic coil 48, code switch 21, wire 22, wire 54, wire 50, magnetic coil 48, wire 51, to the binding post 28 of the transmitter. In other words, current is now flowing through the coil 48 from the positive side of the main battery. Current is also flowing through the magnetic or energizing coil 49 from the negative side of the battery through code switch 36. The connections between the code switch and the coil 49 are through wire 35, wire 52, magnetic coil 49, wire 53 to the negative binding post 30 and thence to the negative side of the battery through the main line wire 39. It is evident that both of the coils 48 and 49 are energized, which causes armatures hereinafter described, in Fig. 5, to release a spring driven motor shown in Fig. 7, which rotates the code wheel and functions by opening, as will be hereinafter explained, the code switches 21 and 36, in accordance with the digits of the code wheel. The digits of the code wheel identify the exact location from which the fire alarm comes. This functioning of the code wheel causes the recording instruments at the registering panel to operate to correspond with the opening and closing of the circuit. The tap bell 44 will tap the signal. When the circuit opens, the drop 7 will be released, causing the double contact 8 and 55 to close. The punch register 11 will perforate holes in a paper tape in accordance with the opening and closing of the circuit.

The relay 42, being provided with double contacts 56 and 57, will operate the master register 56^a through the contact 56, while contact 57 operates the light signal 59. The relay contacts 56 and 57 are normally open. The drop contacts 55 close the circuit to the buzzer 58 so that the buzzer which is an audible signal, will function with the signal lamp and master register according to the code signal produced at the transmitter.

The current from the local battery 61 is now flowing through the feed wire 62, wire 63, fuse 64, wire 65, wire 66, to light the signal lamp 59. Current also passes through wire 67, drop contact 55, wire 68 to the buzzer 58, thence through wire 69 to the silencing switch 60.

The negative side of the local battery is connected to the circuit through the wire 70 and wire 71, fuse 72, wire 73, to the binding post of the silencing switch 60 to which there is also connected wire 74 which connects to one of the contact members of the relay contact 57. A separate wire 75 communicates between one of the contacting members of the relay contact 57 and a contacting member of the adjoining relay contact 56. From the opposite contacting member of the relay contact 56 is a wire 76 communicating with the master register 56^a.

It will now be evident that when the drop 7 is released and the contact 55 completes the circuit, the buzzer will operate continuously, calling the operator's attention to fire or trouble alarms. The relay will also be functioned by the code wheel of the transmitter to register by the signal lamp, tap bell and punch recorder the location of the fire.

Referring now to the wiring diagram shown in Fig. 4, which discloses the system at a position after an alarm, the path of the current from the positive wire 18 is through the code switch and shunt switch 77 thence through wire 79, wire 51 to the positive binding post 28, thence through wire 29 to the negative binding post 30. The negative side is connected up from the line 39 through binding post 38, wire 37 through code switch 36, wire 35, wire 52 and wire 80 with shunt switch 78 connecting with the binding post 30 of the transmitter through wires 81 and 53. Thus it will be seen that in this after alarm position the transmitter automatically closes the shunt switches and the main line is again in normal position with the house line, so that all that is necessary to put the house lines again in the system is to reset the thermostat and the transmitter to open the shunt switches and eliminate the energizing coils 48 and 49 from the system.

Referring to the wiring diagram shown in Fig. 3, which represents the system in what is known as trouble alarm position, and assuming that the house wire 24 is broken at A in Fig. 3, which has caused the magnetic coil 48 to energize, permitting the code wheel to make a revolution, which is automatically functioned as hereinafter explained in connection with the description of the transmitter. This one round of the code wheel gives notice to the operator that one side of one of the house loops is open. In this position it will be noted that the house wire which constitutes the automatic loop, still remains closed with current passing therethrough. Now in the event that fire should occur before repairs are made, the system is operative for emergency fire alarms the same as in normal operating position. The current in this position passes through the wire 18 and code switch 21 thence through wires 54 and 50 to the coil 48, out of the coil through wire 51 to the binding post 28, wire 29 to binding post 30, through wire 31 to binding post 34, thence through the operative house loop 33 back to binding post 34 and thence through wire 35 and code switch 36 to binding post 38 which is connected to the main line wire 39. In this position is shown a positive line broken, but functioning of the system would be identical in so far as results are concerned were the negative line 33 broken, ex-

cept that the other coil 49 would be energized. In the trouble alarm position the code wheel of the transmitter has made only one revolution and should a fire occur at this time, the rupture of the remaining operative line 33 would release the transmitter, permitting the code wheel to make the remaining revolutions to register proper fire alarm signals upon the panel in the central office.

It will be noted in Fig. 2, which is fire alarm position, that both drop contacts are in a closed position so that current passes through the drop instead of through the permanent resistance 9. When the drop is in the ready position the current passes through the permanent resistance which reduces the current to a very low point, but immediately upon the drop operating, the contact 8 is closed, which cuts out the resistance, shunting the current through the drop contact. In other words, under normal position it is only desired to allow enough current to pass through the circuit to keep the system under test, which is not a sufficient current to operate the system in transmitting signals. Therefore, when the drop contact closes, the circuit is increased sufficiently to operate the various registering instruments on the panel, which are interposed in the line of the circuit. The use of the drop in this manner is of considerable importance, as it affords a great saving of electrical energy.

In order that the mechanical operation of the transmitter may be understood it has been detailed in Figs. 5, 6, 7, 8, 9 and 10. In explaining the operation thereof, reference will be made also to Figures 1, 2, 3 and 4, which show the wiring and path of the current in various positions of the transmitter.

The transmitter in Fig. 5 is set in a position ready to transmit alarm signals.

The transmitter is operated by a spring motor which is wound up by a key not shown, inserted upon the arbor 82, the end of the key engaging a stop or cam 81 fixedly attached to the arbor. The spring motor causes the code wheel 80 to rotate at a given speed. The release of the transmitter is controlled by the electromagnetic coils 48 and 49 shown diagrammatically in the wiring diagrams and in Figs. 5, 7 and 9 of the drawings.

The number of rounds or rotations of the code wheel at the time of fire alarm signals is governed by the stop cam 81 shown in dotted lines in Fig. 5, which, as stated, is fixedly mounted upon the arbor 82 and moves with the same, engaging the stop pin 83 in its rotation. The stop pin 83 may be set to allow the code wheel to rotate two rounds or more. The increasing of the number of rotations is effected by moving the pin 83 into adjacent screw holes such as shown at 83a.

When the system is signaling trouble alarm the code wheel makes one round by reason of the stop lever 84 upon which is mounted a pin 85 shown in Fig. 9. The lever 84 is supported in substantially a horizontal position by means of the levers 90 which are set by the key through an engaging lever 86 and lever 84a. The pin 85 engages a contacting pin which is permanently mounted in the pinion wheel 88, thereby arresting rotation of the gear 88 after one revolution which constitutes trouble alarm. The pinion wheel is fixedly mounted on the main arbor 89 upon which is also mounted the code wheel, so that the code wheel 80 and pinion wheel 88 rotate in unison.

It should be understood in this connection that the lever 86 and levers 90 operate independently and that any one may hold the lever 84 in substantially a horizontal position as suggested. The lever 84a and lever 86 comprise a mechanism which is nothing more than a setting device for the levers 90. In fire alarm position, it will be noted that current flows through the coils 48 and 49, which causes the armatures 91 and 92 shown in Fig. 6, to be drawn to the coils 48 and 49, the armatures 91 and 92 being connected to the release arms 94 and 93 respectively, which are pivoted at 95 and serve when actuated by the circuit to raise the lock lever 96, also pivoted at 95. This frees the escapement lever 97 which contacts the end of the lock lever 96, releasing the escapement lever 97 and allowing the spring motor to rotate the code wheel 80. As the code wheel rotates, the notches 98 of the code wheel raise the code switch lever 99 shown in Fig. 5, in accordance with the number of notches on the code wheel, thus functioning with the passing of each notch, the code switches 21 and 36 shown in Figs. 5 and 9. This functioning of the code switch causes the signal to be recorded as previously described, it being understood that at the same time the shunt switches 77 and 78 shown in the wiring diagrams and in Fig. 7, are closed. It will be noted that the contacts of the shunt switches 77 will be closed as the armature 92 is drawn to the coil 49 which operation raises the release lever 94 sufficiently to allow the lever 100 to move forward under the pressure of the spring 101 which operation closes the contact shunt switch 77, allowing the current to flow as shown in Fig. 3. It will be understood that in fire alarm operation both levers 100 and 102 move forward due to spring action, closing the contacts of both shunt switches 77 and 78.

It can readily be seen that in the event either of the coils 48 or 49 are energized, its armature will cause the operation of the lever affected, closing the contact of the shunt switches for that position. It will also be seen that the release of the spring motor is controlled by raising the lock lever 96 (see Fig. 6) which lever is common to both release levers 93 and 94 by means of the cross bar 103. It will be understood that when coils 48 and 49 are de-energized by the shunts, that levers 100 and 102 having moved under the toe of the levers will prevent their moving to locking position set free by the winding operation hereinafter described.

In rewinding the transmitter the end of the key also contacts the end of the arm 86a which is fixedly mounted on the arbor 86b upon which is also mounted the lever 86. This latter lever 86, besides raising the lever 84 by contacting a transverse stud 84a extending from the end of the lever, also turns arbor 86b when raised by the key. Two arms 90, shown in Fig. 10, are fixed to said arbor and actuate the lever 100 and the other to lever 102, to move them from beneath levers 94 and 93 and to locking position. The lever 100 and lever 102 are functioned by the coils 48 and 49 through pivoted lever arms 93 and 94. When but a single coil is energized, one arm being functioned will trip the lever 96 by contact through the cross piece 103. This lever 96 trips the stop 97 pivoted at 97a (see Fig. 9) and releases the catch 97b. This permits rotation of the arbor 89 produced by the gear drive mechanism from the motor until the stop pin 87 on pinion 88 contacts the pin 85 on the arm 84. This constitutes one revolution of the code wheel 80, and during this rotation signals are transmitted due to the teeth 98 of the code wheel raising the lever 99 to function code switches 21 and 36.

When the remaining coil of the transmitter is energized, its arm will drop the other lever 90 which alone supports the lever 84, permitting the pin 87 to pass the pin 85, and the motor to continue to rotate the code wheel so that the code wheel will signal fire alarm through the code switches and main circuit to the receiving boards. The rotation of the code wheel is finally arrested when the stop cam 81 meets the stop pin 83 (see Fig. 5). The number of rotations of the code wheel is governed by the positioning of the stop pin.

The automatic drop which controls the minimum current requirement for the system comprises a support 104 shown in Fig. 11, upon which is mounted a secondary support member 105, and to this is attached the permanent resistance 9. Upon the support 104 is mounted the coil 7 and the double drop contact switch 8. One of these switches controls the resistance, the other the local circuit signals including the signal light 59 and buzzer 58. The support 104 is attached as shown to the panel 106 of the signal receiving board. The wiring of the drop is shown in the wiring diagram (Figs. 1 to 4) and is omitted from Fig. 11 and Fig. 12 in the interest of simplicity.

Pivoted at 107 is the armature drop 108 which is normally held in the position shown in Fig. 11 by the current passing through the coil 7. When the current diminishes beyond a certain predetermined amount, the weight of the drop 108 overcomes the attraction of the current in the coil and permits the drop to fall into a position shown in dotted lines in Fig. 11, at which time the numeral at the bottom of the drop shown in Fig. 12 is swung down so that it is exposed at the front of the panel through an aperture in the front of the panel. At the end of the pivoted armature 108 is an adjusting screw 110 which regulates the contact between the armature and the trouble contact switch 8. When the drop has been operated by failure of sufficient current passing through the main circuit or system and after the trouble has been repaired, the drop may be returned to position by means of a restoring button 111 shown in Fig. 11, and in detail in Fig. 13. The restoring button works against a spring 112 and has a parallel rod or bar 113 which contacts the front of the armature drop and swings it back into position as shown in Fig. 11, where the current in the coil holds it and keeps the double contact switch open so that the circuit passes continuously through the permanent resistance 9 until the drop falls and permits the switch to close. As heretofore suggested, the weighted armature or drop determines the minimum circuit requirement of the system until upon failure of this current it functions and thereby gives notice of failure of the current.

The transmitter and drop mechanism have been developed primarily for a closed circuit fire alarm system of the character herein described and each have features and novelty essential to the operation of this particular type of system. No attempt has been made to detail the entire mechanism of the receiving board, as a great part of this apparatus is standard electrical equipment. The system in four of its phases has been diagrammatically shown to bring out its functioning and disclose the passage of the current under different conditions. Supplementing the diagrammatic disclosure of the system are the details of the transmitter and drop mechanism which have been a development essential to the proper functioning of the system.

The one particular element of novelty in the transmitter is the fact that each transmitter has but two electromagnetic coils to function the shunt and code switches. By the use of but two coils in the transmitter a considerable amount of mechanism has been dispensed with, materially increasing the simplicity of the transmitter.

Another advantage of the transmitter mechanism is in the fact that in re-winding the transmitter it is impossible to reset it for operation as long as there is an open circuit either in the main circuits or in the secondary house line circuits. Also it is impossible to reset the transmitter mechanism without completely resetting it in a position for normal operation. In other words, it is impossible to reset the transmitter in trouble alarm position or any normal operating position if the key cannot be removed from the transmitter, and consequently the transmitter box cannot be closed. The system is capable of being enlarged to accommodate any desired number of thermostats by increasing the transmitter and receiving board units. Thus a central receiving station may have any desired number of receiving boards and the system may be increased as population or requirements are increased.

I claim as my invention:

1. A fire alarm system including in combination, a normally closed circuit comprising a source of potential, a first magnet, a second magnet; a shunt circuit containing a thermostat normally shunting said first magnet, a shunt circuit containing a thermostat normally shunting said second magnet, and means operated by one of said magnets for giving an indication when its respective shunt circuit is broken, and means for giving a different indication when both said shunt circuits are broken.

2. In a fire alarm system including in combination, a normally closed circuit comprising a source of potential, a code-transmitter having at least two electromagnets; a shunt circuit for each of said electromagnets, said shunt circuits comprising protection loops extending through an area to be protected, said loops being placed adjacent to each other and being provided with thermostats normally closing said shunt circuits, a means controlled by one of said magnets for giving a code trouble signal when its respective shunt is broken, means controlled by both of said magnets when energized by the opening of both said shunt circuits to give an alarm signal.

3. A protective alarm system comprising a normally closed circuit including a source of energy, a normally inoperative code transmitter included in said circuit and having means for transmitting an alarm code signal and a trouble code signal over said circuit, means for controlling the operation of the transmitter to transmit one or the other of said codes comprising at least two electromagnets included in said circuit, at least two closed protection loops extending through the area to be protected adjacent to each other, each loop being connected across a corresponding electromagnet to prevent its effective energization, circuit opening means adapted when actuated to open both protector loops, and means controlled by the effective energization of both magnets due to the operation of the circuit opening means in both loops to cause the transmitter to transmit the alarm code and controlled by the energization of one magnet only

due to a break in one of the loops only to transmit the trouble code.

4. A protective alarm system as claimed in the preceding claim wherein the transmitter is provided with means to transmit a single round of the code signal when one of said magnets is actuated, and a plurality of rounds upon the energization of both magnets.

5. A protective alarm system comprising, a normally closed circuit including a source of energy, a normally inoperative code transmitter included in said circuit and having means for transmitting an alarm code signal and a trouble code signal over said circuit, a pair of means for controlling the operation of the transmitter to transmit one or the other of said codes, said means being included in said circuit, at least two closed protective loops extending through the area to be protected, each loop being connected across one of said controlling means to prevent its effective energization, circuit closing means adapted when actuated to open both protective loops and means controlled by the effective energization of both controlling means due to the operation of the circuit closing means opening both loops to cause the transmitter to transmit the alarm code and controlled by the energization of one controlling means only due to a break in one of the loops only to transmit the trouble code.

6. A fire alarm system including in combination a normally closed circuit comprising a source of potential, a resistance, a first electromagnet, a second electromagnet, a shunt circuit containing a thermostat normally shunting said first magnet, a shunt circuit containing a thermostat normally shunting said second magnet, means operated by one of said magnets for transmitting an indication over said closed circuit when its respective shunt circuit is broken, means for transmitting a different indication over said closed circuit when both of said shunt circuits are broken and means to shunt said resistance when either of said magnets is effectively energized by the rupture of its respective shunt.

7. In combination a pair of main line wires; a transmitter interposed therebetween including a pair of normally deenergized electromagnets and means whereby a signal is sent when either magnet is energized and a different signal when both magnets are energized; a plurality of stations; circuits short circuiting the magnets respectively; and a switch in each station operable to break both short circuiting circuits.

8. In combination a pair of main line wires; a transmitter interposed therebetween including a pair of electromagnets normally approximately free of current and means whereby a signal is sent when current is increased in either magnet, and a different signal when the current is increased in both magnets; a plurality of stations; circuits short circuiting the magnets respectively; and a switch in each station operable to break both short circuiting circuits.

JOHN M. JOHNSON.